PIMENTO

The Jamaican Allspice Story

JOHN R. GAYLE

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John R. Gayle

With Appendices by

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&
Ministry of Agriculture(Export Division)
Jamaica

IICA

This publication is also available in electronic (PDF) format from IICA´s Web site at http://www.iica.int

Editorial Coordination: Ignatius Jean

Editing: Shirley Thomas, Kenneth Magnus, Krystal Cameron

Cover Design: Krystal Cameron

Layout: Krystal Cameron

Cover Photos: Robert Lancashire | Pimento Dram: J. Wray & Nephew Ltd.

Printed: Phoenix Printery Limited

Gayle, John R.
Pimento: the Jamaican allspice story / John R. Gayle – Jamaica: IICA, 2013.
xxv, 78 p.; 15 cm x 23 cm

ISBN: 978-92-9248-497-2

1. Spices 2. Allspice 3. Spice crops 4. Pimenta dioica 5. History 6. Jamaica I. Title

AGRIS Q05 | DEWEY 633.83

Jamaica

2013

FIG. 1 GRAFTED PIMENTO TREE BEARING ABUNDANTLY AFTER THREE YEARS. A BREAKTHROUGH IN VEGETATIVE PROPAGATION

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Glossary
Of Terms

Anther	Part of stamen containing/carrying pollen
Callus	Thickened part of soft tissue
Dioecious	Having male and female flowers on separate plants
Graft	Piece of living tissue transplanted on to another plant
Hermaphrodite	A plant having pistils and stamen in the same plant
Inflorescence	The complete flowerhead of a plant
Internode	The portion of the stem between two nodes
Marcotting	Circumposing, cutting the bark of the stem and surrounding it with rooting medium
Monoecious	Having male and female flowers (maybe combined) on the same plant
Nodes	Points on stems where leaves and buds appear
Ovary	Part of the pistil containing the germ cells
Ovule	Unfertilised female germ cell

Pericarp	The part of a fruit formed from the wall of the ripened ovary
Pimento walk	Pimento grove or orchard
Pistil	Female organ of plant comprising stigma, style and ovary
Scion	A young shoot or twig that is cut off to create a new plant
Sport	Animal or plant deviating suddenly or strikingly from normal
Stamen	Male organ of flowering plants
Stock	A part of plant onto which a graft is inserted

Notes

1. **The English in this book is British**
2. **F.O.B. literally means Free On Board, it indicates the value at the point of export**
3. **The British Pound (£Sterling) was the currency in Jamaica until 1969. The value of the Jamaican Dollar has varied significantly over time with respect to both the US$ and the £ Sterling.**

2000	**(Dec)**	**US$1.00 = J$45.48**	**GBP£1.00 = 65.59**
2013	**(June)**	**US$1.00 = J$100.08**	**GBP£1.00 = 151.29**

4. **The Ministry of Agriculture has formally over the years had responsibility for Lands, Commerce or Fisheries. None of this is reflected in the text.**
5. **1 metric ton =1.1023 short tons = 2.204.6 pounds (lbs)**

MESSAGE

FROM THE MINISTER OF AGRICULTURE

Over the years, Jamaica has been known for producing many of the world's highest quality commodities. We have produced lime oil and juice, which were matchless, avocados which are top of the line, mangoes in varieties for many tastes, ginger which set the world standard, and coffee which is the best in the world.

Pimento, the unique Jamaican Allspice is in the category of "excellent" by world standards.

It is a great pleasure to introduce to you the research which more than anything else has brought out the best in an outstanding crop. The person who was at the pivot in bringing this about has now written his work. I must congratulate him on his achievement. As a visionary, I look to a future in which his work will gain international recognition.

John Gayle is to be congratulated for his achievements and given recogni-

tion for the unstinting way in which he has made his expertise available to any who asked. His contribution to the management of this crop cannot be overemphasized. I recommend this book to policy makers, pimento farmers as well as to those interested in agriculture in general as a model for the development of any crop.

In addition to its traditional use in cooking, Gayle also draws attention to its other uses. The ripe berries can make a tasty liqueur and an alcoholic tincture of the mature berries of pimento has long since been known in folk medicine for various digestive complaints. However modern medicine is showing that there are constituents of pimento that can contribute to the cure of much more serious conditions, such as cancer.

Nevertheless, it is in its traditional role in cooking that pimento plays its major role. It is the flavour of pimento that naturally combines that of other flavouring materials that helps to make "jerk flavour" so compelling. Even the leaves of the plant can provide added flavour to cooking.

I wish to congratulate John Gayle on drawing together so much original and general information on this crop.

The Honourable Roger Clarke, C.D., M.P.
Minister of Agriculture and Fisheries
2013

MESSAGE
FROM IICA

The Inter-American Institute for Cooperation on Agriculture (IICA) is the specialized agency of the Inter-American System for the promotion of agriculture and rural well-being. As a knowledge-based institution, IICA promotes the sharing of knowledge and experiences and is committed to providing technical and scientific advice on the major challenges and opportunities that face agriculture in the hemisphere.

In order to fulfil its mandate, the Institute must, among other things, link the experience existing in its member countries and cooperation networks efficiently and effectively. In fostering those linkages and networks, IICA strictly adheres to the recognition of intellectual property, while simultaneously promoting the sharing of the science within the public domain, with the ultimate economic, social and cultural objectives of abundant prosperity for all. It is said that science is public, not private knowledge. "Only by publishing their work can scientists make their contribution and only when it thus becomes part of the public domain of science can they truly lay claim to it as theirs." Merton, R.K. (1999)[1]

Accordingly, it is in this context that we have collaborated with the Ministry of Agriculture in supporting this seminal work by Mr. John Gayle:

"Pimento – The Jamaican Allspice Story".

Mr. John Gayle, O.D., is a retired agronomist who specialized in the production of pimento (*Pimenta dioica*), a popular Jamaican spice. Mr. Gayle has tremendous scientific and institutional knowledge on the subject, having worked in pimento research for over 40 years. The first bulletin on pimento in Jamaica was printed in 1961, and others in 1965, 1969 and 1981[2]. Much has changed over the decades, including losses of institutional memory and technical capacities. Mr Gayle has embarked on preserving this knowledge through authoring this book, which he hopes will be circulated to policy makers, libraries, educational institutions, farmers, agricultural and other commercial organizations.

It is hoped that this publication will develop into a powerful tool for revitalising a fast declining pimento industry. We congratulate Mr. John Gayle for sharing this work with the people of Jamaica and through IICA, the people of the hemisphere. Indeed, in tribute to Professor Merton's philosophy, even though inadvertently, Mr. Gayle has bequeathed this sterling scientific contribution not only to our Hemisphere, but to the entire international community of scientific and intellectual endeavour.

Ignatius Jean
IICA Representative in Jamaica
2013

[1] ***Foreword* to the book, Citation Indexing by *Robert K. Merton*, Columbia University. http://garfield.library.upenn.edu/ci/foreword.pdf**

[2] **Gayle, J. R. and Henry, D. D., 1981, The Culture of Grafted Pimento – A Spice Crop for Hilly Lands of Jamaica, Booklet, Ministry of Agriculture, Jamaica and Inter-American Institute for Co-operation on Agriculture, Jamaica.**

FOREWORD

Hugh T. Lyon

I deemed it an honour and privilege to have been asked in my capacity as a pimento farmer, a member of the Board of Management of the Jamaica Agricultural Society, and a former President of the Jamaica Pimento Association, to write the foreword to this book on pimento, whose author I have known and been closely associated with for many decades. It is therefore with immense pleasure that I have acceded to the request.

I first became acquainted with the author of this much needed publication during the 1970s when he was employed at the Crops and Soils Department of the Ministry of Agriculture and involved in conducting research on pimento, the Jamaican spice of high reputation.

He was a regular attendant at the annual meetings of the Jamaica Pimento Association, usually held at Drax Hall Polo Clubhouse in St. Ann, and during the period of studies, paid several visits to our Shawbury Estate located in St. Ann. These visits enabled us to develop a close relationship and provided the opportunity for me to receive some useful advice and acquire knowledge on many matters pertaining to pimento.

Over these years, I have from an agronomical perspective come to regard the author as probably the most knowledgeable individual that the pimento industry can identify at this time. He possesses the technical competence to offer advice to farmers engaged in the growing of pimento and those desirous of becoming involved.

For many years, he worked along with scientists attached to the Botany and Chemistry Departments of the University of the West Indies, senior agronomists in the Ministry of Agriculture, technocrats from the Tropical Products Institute of London, while research was being conducted on the vegetative propagation of plants, field husbandry practices, artificial drying of pimento, the floral biology of trees, and the chemical composition of pimento berries.

He is to be credited with fully developing the technique of vegetatively propagating pimento plants by means of approach graft, a process whereby the fertility of planting material is assured. His establishment of demonstration and experimental plots and plant nurseries throughout Jamaica to provide planting material for farmers, enabled him to gain practical knowledge on a wide range of matters relating to pimento, to the extent that he has been able through experience to convincingly refute some erroneous beliefs that once existed and substantiate many of the notions that prevailed about this native tree.

It was because of his experience and vast knowledge of agricultural practices gained from over 40 years involvement with pimento, having also during his career been in charge of the Beverley Pimento Research Station in St. Ann, why I was among those persistently advocating that he publish a book on pimento and use the medium to impart his knowledge for the benefit of the farming and student community, in particular, and other segments of the society.

After his retirement from the Ministry, the author was appointed Executive Director of the Jamaica Pimento Association, which he served for

14 years. He afterwards assumed duties at the Export Division of the Ministry of Agriculture as Project Co-ordinator and, later as Director of the Pimento Resuscitation and Replanting Programme, which was implemented to address the issue of the severe destruction of pimento trees by Hurricane Ivan in 2004.

Since the end of his assignment, he has been contacted on many occasions to provide information on pimento and to offer advice. He has often been invited to accompany visiting spice manufacturers to pimento estates as they were desirous of knowing the tree and observing the field conditions under which they exist.

I understand that his decision to write the book is not to earn any financial benefit from its publication. Unable to resist the constant inducement to publish a book on pimento, he finally decided to comply and approached the General Manager of the Export Division of the Ministry of Agriculture and Fisheries, where he was once employed and whose staff was among those inducing him to write the book, to inform him of his decision.

In view of this initiative on his part, conscious of the author's desire to make a further contribution to the industry, apparently realizing that such a publication would be in the interest of all stakeholders of the industry, and aware of the author's capability to write on such a subject, the Division, guardians of the industry, not only embraced the idea, but responded favourably to the initiative.

I commend the author for undertaking a task which will be a valuable literary contribution to the agricultural sector, and which will be his legacy to the industry which he served for 42 years.

The book covers all aspects of pimento, ranging from the ancient history of the tree to the marketing of its precious fruits and will be available at most libraries throughout Jamaica, where a book on this topic and of this

nature is unfortunately absent from their bookshelves, from the literary collection of agricultural institutions and unavailable in bookshops.

I am sure that readers will find the book most interesting and comprehensive and one that will serve as a valuable source of information about one of our indigenous trees.

Hugh T. Lyon
Shawbury Estate, St. Ann
2013

FIG. 2 PIMENTO FARMERS, PRODUCE DEALERS AND STAFF MEMBERS OF THE EXPORT DIVISION, MINISTRY OF AGRICULTURE, JAMAICA

Front row from left: John Gayle, Project Coordinator, Export Division; Hugh Lyon, Farmer; George Lopez, Farmer; Vin Carr, Produce Dealer; Oscar Chin Loy, Produce Dealer.

Back row: Melbourne Richardson, General Manager of Export Division, Ministry of Agriculture; Leslie Nathan, Farmer; Anthony Nathan, Farmer.

INTRODUCTION
& ACKNOWLEDGEMENTS

This book is on Pimento otherwise known to the spice world as Jamaican Allspice, one of Jamaica's oldest export commodities. It is the most informative and comprehensive book to be written on the subject and the most recent publication that readers will find on the agricultural shelf of any library.

Some of its contents are extracts from previous publications issued many decades ago by various scientific institutions and agricultural researchers including the Agricultural Planning Unit of the Ministry of Agriculture and Fisheries, the Botany and Chemistry Departments of the University of the West Indies, the then Tropical Products Institute of London, the Plant Protection Division of the Ministry of Agriculture, a Chief Agricultural Officer, a horticulturalist and a Miscellaneous Fruit Tree Specialist of the Crops and Soils Department of the Ministry.

These excerpts are quoted in this book simply because much of what is written about pimento in those publications is still relevant and applicable today, while some of their contents had to be reviewed and updated as a consequence of the enormous developments which have taken place within the industry since the issue of those early publications. This has created

a scenario where experiences in the field have made some of the ancient notions about pimento totally erroneous, some theoretical conclusions transformed into realities, while at the same time causing some notions to remain uncertain and debatable.

These developments which unfortunately were never given the wide publicity which they deserved, were as a result of the findings of extensive research conducted on both the botanical and chemical aspects of pimento, at an opportune time when the trees were then known by many farmers mainly for their existence in the wild and the commercial value of their fruits and leaves.

It was during the time between 1960 and 1968 that many scientific institutions in collaboration with the Ministry of Agriculture became involved in the studies, making that period the most progressive era in the life of the industry from a scientific standpoint.

It was necessary for farmers interested in growing pimento in a proper manner to be advised that if the trees are to give satisfactory yields consistently, apart from selecting suitable areas for their establishment, a wide range of cultural practices has to be applied. These include proper field establishment and field husbandry, proper reaping of fruit and control of pests and diseases. It was as a consequence of these studies on pimento that it became possible to offer the requisite advice on such agricultural practices, especially the reaping of berries which, regrettably, has not fully achieved the desired objective of getting farmers to discontinue that traditional but destructive manner of harvesting, to which bearing pimento trees have been subjected.

Many people are unaware of the invaluable scientific contribution made to the pimento industry by both local and foreign institutions and their teams of researchers as a result of the investigative work they conducted both in the field and in laboratories. It cannot be over-emphasized that their findings have been of immense benefit, not only to those who grow

the crop, but to the industry and to the Export Division of the Ministry of Agriculture and Fisheries, which to its credit funded many of the development programmes which emerged from the investigations during the administration of the late General Manager, Melbourne A. Richardson.

Being an employee of the Crops and Soils Department of the Ministry, I was a privileged participant and was fortunate to have worked with most of these institutions and technocrats involved in the studies and to have supervised field operations on the property which was acquired specifically for conducting research on pimento. Having gained a wealth of knowledge as a result of this level of exposure, I was in a position to impart a range of valuable information and to advise the farmers in particular about the cultural practices of pimento. There was a reluctance on the part of many farmers to accept advice about new ways to replace certain traditional practices, to which they had become accustomed. Local sale of the crop in many instances was their main interest. It is of some satisfaction to know that many have been responsive to much of the information and advice imparted not only by way of verbal contact, but through the more effective avenue of pamphlets which were however limited to basic information.

Because of my long and at one time exclusive acquaintance with pimento, I was constantly being persuaded by interested parties, some of whom were my office colleagues, to document and share with the present generation and for posterity, the knowledge and experience which I was fortunate to have acquired. With such motivation from them, I began to contemplate that by responding favourably to their inducement, writing a book on pimento apart from serving as a literary composition for reference would also provide an opportunity not offered before to recognize the contribution of all those Researchers and Heads of Departments who participated in the research programme. No longer will their identity remain obscured from full public awareness, but they will be widely exposed as pioneers in the scientific transformation of the pimento industry into the well-established, sustainable and viable commercial enterprise that it has become.

Being cognizant of the fact that a debt of gratitude is also owed to several

farmers whose co-operation with the Ministry was essential in ensuring the success of the programme, producing a book would also present an opportunity to acknowledge the contribution offered by them.

I also gave serious consideration to the fact that among those directly involved in the studies, I am fortunate to be among the few still alive, and therefore the onus rests on me to compile and narrate the information which I have in my possession to the general public. It was this realization that finally impelled me to come to the conclusion that it was incumbent on me to produce a book on a subject with which I was familiar, having been associated with pimento for the greater portion of my professional career, and no longer able to resist the persistence of those persevering advocates. In doing so, libraries which are easily accessible centres of knowledge will be provided with copies from which tertiary students in particular, who have always been in search of information on the subject, will be able to acquire the requisite knowledge.

It is not my intention to receive any monetary compensation from writing this book. It is a service which I freely offer to the wide community, with the expectation and hope that the publication will assist the industry, and generate interest among a wide circle of readers.

It is therefore with pleasure that I undertake this task in conveying this knowledge and in relating my experiences through this medium, with the anticipation that the book will serve as an educational source of information and play a significant role in the further development of an industry which is listed among Jamaica's oldest and which provides economic benefit to thousands of growers, employees and the country. Often referred to as the "Cinderella" of Jamaica's agricultural industries, pimento is frequently regarded as a "Manna" crop.

I believe that students in particular, many of whom have never seen a pimento tree, and the general public will be interested in learning not only about the origin, the characteristics and the value of this aromatic com-

mercial commodity, but also about its reproductive and dissemination processes which originally are attributed to the creative ability of nature, and more recently to the introduction of scientific human initiatives.

"There is no doubt that the pimento tree is one of the most elegant productions of nature and there is not perhaps a tree of greater beauty", wrote one Kenny many decades ago in his "Civil and Natural History of Jamaica, 1756". Patrick Browne the writer noted that "nothing can be more delicious than the odour of these pimento walks when the trees are in bloom as well as at other times, the friction of the leaves and the small branches even in a gentle breeze diffusing a most fragrant and exhilarating scent". Indeed, the pimento tree has an ancient and indigenous relationship with Jamaica. The aromatic odour of its leaves, flowers and fruits, its ability to thrive abundantly throughout most areas of the island and its economic importance to Jamaica and its farmers must have offered a strong challenge for it to be considered as Jamaica's national tree.

The pages of this book contain a wide range of information covering all the biological phases of the pimento tree from its ancient origin to the commercialization of its precious fruits and leaves. I hope all its readers will find it not only informative, but interesting and beneficial.

I wish formally to acknowledge the contributions made to the development of the pimento industry by the research activities directed by, conducted by or allowed by the following persons:

John Haughton - Director, Crops and Soils Department
-Ministry of Agriculture, Jamaica

W. B. Dixon - Plant Protection Officer
-Ministry of Agriculture, Jamaica

S. K. Glasgow - Miscellaneous Fruit Tree Specialist
-Ministry of Agriculture, Jamaica

C.W. Hewitt - Crops and Soils Department
-Ministry of Agriculture, Jamaica

R. I. Leather - Director, Plant Protection Division
-Ministry of Agriculture, Jamaica

W.K. Mitchell - Chief Agricultural Officer - Crops and Soils Department
-Ministry of Agriculture, Jamaica

A. G. Naylor - Chief Plant Protection Officer
-Ministry of Agriculture, Jamaica

D.W. Rodriques - Agricultural Planning Unit
-Ministry of Agriculture, Jamaica

J. R. Suah - Entomologist, Plant Protection Division
-Ministry of Agriculture, Jamaica

J.F. Ward - Horticulturalist - Crops and Soils Department
-Ministry of Agriculture, Jamaica

G.P. Chapman - Botany Department
-University of the West Indies, Mona, Jamaica

Ingolf Duphorn - Chemistry Department
-University of the West Indies, Mona, Jamaica

Kenneth Magnus - Chemistry Department
-University of the West Indies, Mona, Jamaica

Shirley Thomas - Chemistry Department
-University of the West Indies, Mona, Jamaica

P.R. Ashurst - **Scientific Research Council, Jamaica**

A.R. Firth - **Scientific Research Council, Jamaica**

G. Breag - Industrial Technology Department
-Tropical Products Institute, London, England

E. Brown - **Tropical Products Institute, London, England**

J.D. MacLachlan - **Harvard University, U.S.A**

I also wish to acknowledge the following farmers and institution for permitting their bearing trees to be used in the Plant Production Programme, making lands available for establishment of demonstration plots and a propagation nursery, and facilitating experimental trials on the artificial drying of pimento:

John Collier: St. Ann

Martin Hopwood: St. Ann

Leslie Nathan: St. Ann

Gordon Lewis: St. Ann

Hugh Lyon: St. Ann

Robin Crum Ewin: St. Mary

Gerry Brinsley: Portland

Val Parnell: Trelawny

Sydney Aguilar: Westmoreland

Pimento Farmers from St. Thomas

College of Agriculture, Science and Education, Passley Gardens, Portland

I wish to extend my gratitude to Theralee Wright-Kelly and to Janet Gayle for typing the manuscript, also to Ken Magnus and Shirley Thomas for the assistance they have given in the final preparation of this book for publication.

I also wish to thank Robert Lancashire, Maurice Chung and the Export Division, Ministry of Agriculture for the use of their photographs, and Waterworks Ltd for adding colour to some black and white photographs, Figs. 7, 8, 9, 10, and 11.

John R. Gayle, O.D.
2013

Pimento

History of Pimento

Pimento is commonly known as "Allspice". This name indicates that the berry contains the characteristic flavour and aroma of four other well-known spices – cloves, nutmeg, cinnamon and pepper. Naturally, this alone would imply that the spice is a most valuable commodity and of great economic importance.

The pimento tree was named *Pimenta officinalis* Lindl. in 1821, renamed *Pimenta dioica* (L) Merr. in 1947. It is a species of the family Myrtaceae and in the same genus as *Pimenta racemosa,* the leaves of which are used to make Bay Rum. The tree from which cloves are obtained, *Syzygium aromaticum,* is in the same family. The bay leaves used in cooking come from *Laurus nobilis (*Family Lauraceae*).* Neither *Syzygium aromaticum* nor *Laurus nobilis* grow in Jamaica.

Pimento is the dried green berry of *P. dioica* and is found in the Caribbean Islands and Central America, but of all the locations in which it exists, it does so most abundantly in Jamaica. This abundance can be attributed to critical environmental factors such as soil and climate which do not exist in most of the areas into which it was introduced such as India, Sri Lanka (formerly Ceylon), Costa Rica, Haiti, Panama and Grenada. The tree was seen growing in Cuba, the seed being apparently disseminated there by migratory birds which feed on the ripe berries in Jamaica to supplement their diet. Several trees in the thick vegetative areas of Bermuda were observed by this writer and were in the process of flowering in the month

of June, usually the normal time in Jamaica when the blossoms begin to open. Most of the Bermudans are not interested in the commercial value of the berries that are produced by these evergreen trees, but this is not strange as it is well known that tourism and not agriculture is Bermuda's dominant industry. Of course, there is no certainty that those flowering trees will produce fruits since the pimento tree oftentimes exhibits unpredictable biological behaviour during its life-span. From a biological point of view, the only thing that is most certain about the tree is that both fertile and infertile trees exist, but with the significance of the barren trees still in dispute. Even in favourable climatic conditions the fertile tree will flower profusely, but yet produce a disappointing crop. The tree will bear inconsistently even when the proper reaping method is applied, and the first crop of a tree can be delayed, whereas if planted in a more suitable habitat, it can take a much shorter time to produce its initial crop.

To further illustrate its unpredictability, it is reported that in the botanical gardens of Brisbane in Australia, in Sri Lanka, and in Singapore, the tree flowers profusely but never seems to produce berries, while in Madras in India, it is understood that it seldom flowers and never bears.

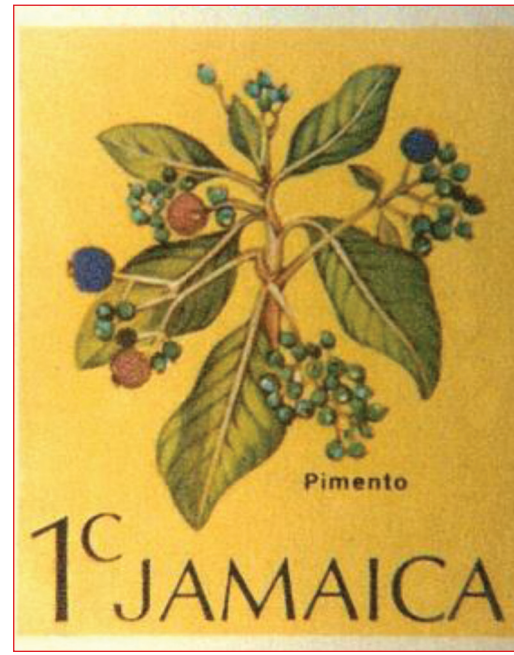


FIG. 3 EARLY JAMAICAN STAMP SHOWING THE IMPORTANCE OF PIMENTO

Various names have been given to the tree and the name "pimento" is the one which is ascribed to it by English speaking people. It originated from early explorers who called it "pimienta". In Spanish it is still called "la pimienta de Jamaica". The earliest reference to pimento use was in London, England in 1601 when Garret, a druggist, prepared medicine containing dried pimento berries which he used to treat the disease with which one Clusius was affected. This was the earliest recorded medical use of pimento.

The pimento tree also exists and produces fruit in Guatemala, Honduras and

Mexico which are our main export competitors. Jamaica however, produces the best quality pimento in terms of oil content and composition, aroma, colour and size and extols these intrinsic qualities to promote sales and justify the higher price which it commands for its product.

The early history of pimento dates as far back as about 1509 when it was identified and found growing in Jamaica by Spanish explorers who were very impressed with the taste and aroma of both the berries and the leaves. In 1532 Filipe IV of Spain was informed that the berries then known as pepper bore on trees which grew in a wild fashion, and taking into consideration the economic benefits to be derived and the Spanish interest in obtaining spices as much as they were in finding gold, issued instructions to the Santa Domingo Council to carry out investigations into the berries and the relationship with Jamaica. Samples were sent to him with a report substantiating the fact that the trees grew all over Jamaica in a wild manner and that no cultural practices were needed to maintain them. It is reasonable to presume therefore that all early exports of pimento were made directly to Spain.

The pimento tree is reproduced from ripe seeds when new trees spring up by natural regeneration from seedlings when the ripe fruit falls to the ground. In general, the process is also started by birds, bats, and insects which are attracted to the sweet pulp of the ripe berries which they consume, and this is what has attributed to the fallacious belief once held by many farmers that the propagation of the plant depended solely on the passage of the seeds through the intestines of birds, - the main disseminators. During the process of digestion, the fleshy pulp of the ripe berries known as the pericarp is removed and the undigested seeds are excreted by these agents which then germinate and grow into trees resulting in a population existing in an irregular manner, along fences, under various types of trees, and under electric wires where birds usually perch. Under such circumstances, it is not unusual to see as many as 6 to 8 trees growing in a small area where birds roost at night, which under proper spacing conditions, should only be accommodating a third of such a population. Naturally, such a congestion of trees can only result in low production and in the development of slender trunks as they strive to get sufficient sunlight, many attaining heights of 30 to 40 feet, thus making any reaping of their fruits an extremely risky and laborious exercise.

This process of propagation by seeds is very undesirable in that approximately 50% of such trees will emerge as barren trees or "male" trees as

they are commonly called and will be frequently referred to as such in this publication.

In addition to this disadvantage, there is no way of determining the sex of these plants until they flower and this is generally 6 to 8 years after establishment. This is a long time to wait for a tree to be identified as to its sex, and furthermore not everyone is capable of distinguishing female blossoms from male ones. Only farmers experienced in cultivating pimento and those engaged in studying its science can safely determine the sex of a flowering tree. Researchers and farmers were well aware of early comments made regarding sexual reproduction in pimento. The comment that the male trees flowered but did not bear fruit was irrefutable. The remarks relating to the wide-spread notion that they are necessary for the fruiting of female trees through the process of pollination was disputable. There was also a wider range of necessary information about pimento which was unavailable and necessitated research and documentation.

Spices have played an important role in the development of methods of food preparation. They convert tasteless and unpalatable foods into delicious flavours and therefore satisfy human needs. In this regard and in light of the popular notion that the pimento berries contain the characteristic flavours and aromas of four other spices, pimento has a high rating on the list of the world's popular spices.

FIG. 4 SANGSTER'S PIMENTO DRAM (LIQUEUR MADE FROM PIMENTO BERRIES)

All parts of the pimento tree including the berries, the leaves and the wood are used for various purposes. Countries which import the berries use the spice for flavouring beef, fish, chicken, sausages, pork and soups. It is also used in the ground form by spice mixers who blend it with other ingredients for baking and other industrial uses. A liqueur is made locally from the ripe berries and the wood is used extensively in the jerk pork trade since those who prepare and market the prod-

uct are explicit in confirming that it contributes to the flavour of the processed meat.

The liqueur, blended with alcohol and known for its pungent flavour and stimulating effect was first brewed by the Spaniards who claimed that it was more beneficial than brandy as mentioned in History of Jamaica, by Clinton Black, 1958.

It is recorded that many years ago the wood was used in the United Kingdom and the United States to make walking and umbrella sticks and thousands of saplings were exported for those purposes between 1876 and 1930, a trade which nearly ruined the industry. In 1881, a huge shipment of over 521,000 suitable young trees, uprooted from pimento walks established for the purpose and with a value of £3,125.00, was exported. Due to its durability the wood was used for making fence posts and uprights in dwelling houses. The demand for the wood for use in the preparation of jerk pork is so great that one processor in the United States some years ago made inquiries about the prospect of importing wood from Jamaica. The idea was not entertained on the logical grounds that such a business venture would extensively diminish the tree population and severely damage the industry, in that bearing trees would not escape depletion.

The leaves are used to produce leaf oil which is also exported. Berry oil is distilled from the dried green berries, either locally or overseas. In view of the decline in the number of leaf oil factories that once existed, the Jamaica Agricultural Development Foundation in collaboration with the Scientific Research Council has conducted research on how to make use of discarded leaves by utilizing them to construct briquettes of compressed leaves that may be useful as fuel for grilling meats. Several medicinal preparations are made from dried pimento, such as, "Oil of Pimento" and "Spirit of Pimento" extracts which are said to relieve flatulence and promote digestion. Minott et al, 1998, researched the effects of pimento extracts on ticks. Tea bags featuring pimento as an ingredient are a new product on the market. Pimento is also an ingredient in the preparation of pain relievers and insecticides which can be seen on the shelves of supermarkets in Jamaica.

Benefits of pimento are documented on the internet and studies have been conducted in Jamaica at the UWI, Mona, by Campbell-Shelly, 2007.

Varieties

D.W. Rodriques of the Agricultural Planning Unit of the Ministry of Agriculture, in his book, "Pimento – A Short Economic History", 1969, makes mention of variations in the several varieties of pimento identified in Jamaica. Unfortunately, though the book was one of those intended to provide information about a particular commodity and published by the Agricultural Information Service, it did not enjoy a sufficiently wide circulation for the general public to acquire or to read. A so-called "dwarf" strain which he mentioned is just biologically speaking, a "sport" which unusually sprouted from the trunk of a normal pimento tree which was numbered B508 among the population at the Beverley Research Station in St. Ann, (a 31 acre pimento property which was acquired by the Ministry of Agriculture for research purposes in 1960). Several seedlings were propagated from this plant whose characteristics deviated noticeably from the normal pimento tree. They were planted on the Beverley Station and later at Braco in Trelawny and New Hall in Manchester for observation purposes. The berries of the tree are very small, and when tested were found to be low in oil content and proved to be unsuitable for export. It was the stature of the trees that caused the name 'dwarf' to be applied. If planted at close proximity to each other, these trees could serve as an attractive hedge, but because of the undesirable qualities this clone was never included for reproduction in the plant production programme.

Admittedly, there are several variations in pimento trees growing in Jamaica. Some produce large berries, some small, some are heavier bearers than others, and some leaves tend to be larger on some trees, although environmental factors can contribute to these variations. Rare strains and related species (identified in "Flowering Plants of Jamaica" by C. D. Adams) have been found in the Cockpit mountains in Trelawny and in the John Crow mountains of Portland. A lemon-scented strain was discovered growing at Williamsfield in Manchester, seedlings with narrow leaf blades aptly named "pepper leaf" have been seen, and a branch with pale variegated leaves totally devoid of chlorophyll was observed on a tree at Upton in St. Ann. These miscellaneous strains were of no commercial value, but could serve as fascinating exhibits in museum plots, and so the species *Pimenta dioica* as described by Merril remains the only one of commercial importance. In addition, it has been found that within the population of trees used in commerce, variations are observed (See Appendix).

Research and Extension

Pimento is of major economic importance, because of its characteristic flavour and aroma. Authoritative and scientific knowledge of the agronomy and chemistry of this crop was not available either locally or from foreign sources in the early 20th century. For the industry to develop, it became incumbent on the part of the Ministry of Agriculture, through its Crops and Soils Department under the direction of John Haughton, to see that a precise system of pimento culture and a study of its various aspects were undertaken and a programme of research planned, implemented, and developed.

In 1960, a programme of investigation was initiated jointly by the Crops and Soils Department and the Botany and Chemistry Departments of the University of the West Indies, Mona. Part of the work was sponsored initially by the Scientific Research Council and later was taken over and expanded by the Ministry of Trade and Industry to which portfolio the pimento industry was then assigned. The programme got fully underway when the Ministry of Agriculture and Lands assumed responsibility for pimento, and in 1962 accelerated the project when it acquired land, a portion of the Beverley Land Settlement Reserve area in the parish of St. Ann, an area where the pimento tree both grew and produced substantially. It was allotted to the Crops and Soils Department for exclusive research work on pimento. In 1963 this writer joined the staff of this Department at Hope as an Agricultural Research Assistant to the Miscellaneous Fruit Tree Specialist, Stanley Glasgow.

G. P. Chapman of the Botany Department of the University of the West Indies, Mona, agreed to conduct research into the floral aspect of pimento and, in particular, into the existence of the high percentage of sterile trees in the field and their effect, since this condition was felt to be a deterrent to progressive agriculture. The Chemistry Department team headed by Ken Magnus became involved in the chemical analysis of berries of certain trees selected for the Plant Production Programme in respect of their oil content and composition, while the Soils Section in the Ministry of Agriculture under the leadership of C.W. Hewitt was entrusted with the selection of soils considered suitable for the planting of pimento. The production of planting material was the responsibility of the Crops Section of the Ministry.

The matter of the floral biology of pimento was considered an interesting

and obscure aspect of pimento and one which required clarity since different opinions existed among botanists on the effect of infertile trees on the productivity of fertile ones. It was therefore found necessary to investigate in some detail the flowers of pimento and the curious way in which they function. G.P. Chapman of the Botany Department, UWI, Mona, embarked on this important task, but this work is still not complete.

The findings of his study were published in the 1965 Caribbean Quarterly Journal, which is not easily available. He observed that plants such as the tomato are monoecious and have hermaphrodite flowers, which means that anthers, which carry pollen and are part of the stamen (the male organ of flowering plants) and the pistil (the female organ of a flower, carrying the ovule) are both often present. When this is so, this allows for pollination and seed-setting to be easily accomplished. On the other hand he realized that the nutmeg tree was dioecious, in that there are male trees whose flowers have only stamens, and female trees whose flowers contain a pistil and carry ovules (which are female germ cells). Therefore, in the case of nutmeg, both types of trees must be established to ensure a crop.

Chapman interestingly concluded that pimento is about half way between the tomato and the nutmeg, that small but consistent differences between fertile and infertile trees exist. All flowers contain stamens and pistils, "female" flowers having about fifty anthers per flower, "male" flowers possessing about twice that amount. Furthermore, in the "female" flower pollen is produced but does not germinate. In the "male" flower, pollen which is described as a dust-like mass of grains found on the anthers of seed plants, is produced and when deposited on mature ovules, germination takes place readily. Another difference which was noticeable and well-known was that "female" flowers normally set to produce fruit, while "male" flowers drop off after shedding pollen. When the fruit of the "female" flower forms it usually has two seeds while the rare fruit which is formed on the "male" tree is usually one-seeded and mal-shaped. It is therefore not scientifically correct to say that "male" trees do not bear fruit. They rarely do so, but when they do, the fruit is ill-shaped and is of no commercial or reproductive value.

This matter of the significance of "male" trees has generated much debate over the years and despite Chapman's findings uncertainty still exists over the real purpose of their existence. Farmers however, have always in the past been advised to allow a certain proportion of male trees to exist in the population, but that their heavy proliferation among female trees of

approximately 50% is not necessary and should be reduced to about 10%. This has the advantage of the increased productivity that usually occurs when the trees are properly spaced.

While Chapman's findings give credibility to his opinion that barren ("male") trees are necessary, that both types of trees must be present to ensure a crop and that maximum productivity from an orchard will occur where the proportion of barren trees are just sufficient to ensure adequate pollination of fertile trees, these findings now appear to be questionable based on what has since occurred in the field which is an appropriate place to test for verification of some scientific conclusions.

There is credible evidence to confirm that pimento trees exist which are self-fertilizing, and this was conceded by Chapman. They are categorized as hermaphrodites in that the same flower has both stamens and pistils and can bear heavily and consistently in the absence of male trees. He also recommends the utilization of bees to ensure maximum spread of pollen as occurs in apple-growing countries, and suggests that it is advisable to put hives in pimento orchards while flowering is in progress, but this appears not to be necessary.

This advice is refutable as hives of bees in orchards do not seem to produce any beneficial influence on production, as bees are conspicuous by their absence in a pimento grove when the trees are flowering. The aversion of these insects to pimento blossoms is also stated by horticulturalist, J.F Ward in his booklet on pimento written in 1961, which is another of the scarce publications. It is mystifying however, that as agents of cross- pollination, bees and other insects avoid visiting the flowers of pimento trees despite the fragrance and beauty of their blooms.

To further support the claim that bees do not play any significant role in the pollination of pimento blossoms, a visit to a property near Manchioneal in Portland some years ago confirmed this assertion and provided factual evidence. Attention was drawn to 2 trees in close proximity to each other undergoing their flowering process. One was a tree commonly known as sweet-wood with its inflorescence swarmed with bees while the other, a pimento tree with the pleasant aroma of its blossoms penetrating the atmosphere, offered no attraction to the bees. This was not an unusual observation as only once during lengthy hours of traversing pimento fields and observing the trees was a single bee seen on a pimento blossom. On Chapman's recommendation that hives should be placed in pimento walks

when flowering is in progress, an apiary was established at the Beverley Research Station, but employees, despite their vigilance, were unable to confirm the presence of bees while the trees were passing through that important phase of their lives.

It may be of interest to mention that a few grafted trees planted on the premises of the Export Division of the Ministry on Marcus Garvey Drive in lower Kingston, an area where other pimento trees are non-existent, have borne in the absence of male trees. When observed at the time of writing, one of the trees was blooming and fruit setting appeared to be imminent, an interesting observation relative to the male and female tree debate.

Bees are not attracted to the white blossoms of the pimento trees, and there is no available scientific explanation for this. One wonders whether this unusual observation can be attributed to the notion that bee pollinated flowers are usually blue or yellow and often have markings that display the location of nectar, or, that the pungency of the flowers, as are other parts of the tree, is a likely deterrent.

The experience at the Orange River Research Station in St. Mary appears to support the view that male trees are not necessary for the fruiting process of fertile trees to be accomplished. In 1998, a nursery originally consisting of 327 grafted plants originating from Yallahs in St. Thomas and Upton in St. Ann was established on the Station, and then later expanded. The trees were planted 6 feet apart along the rows which were 10 feet between rows. This is a nursery spacing which allows a tractor driven mower to operate efficiently in order to control grass and weeds. The plot was established to facilitate the resumption of the production of grafted plants for farmers as earlier established plots were inoperative. The plan was to utilize all available areas on the property for any agricultural project considered feasible and important.

It is a certainty that no male trees were included in the population, neither were there any seen in near proximity, and despite it being said that bees are necessary for cross pollination in pimento, flowering trees were not visited by these agents. The effectiveness of wind in the pollination process was not very pronounced either, since the location of the plot did not expose the trees to abnormal wind disturbance. The trees in this plot engaged the interest of all those involved with the project and all were amazed not only by their exceptional ability to bear, but their frequency,

which has provided substantial evidence that there are indeed pimento trees that will produce abundantly and regularly without the input of male trees. In 2001, **3 years** after planting, 170 of the Orange River population **bore**, followed in the year after by **prolific fruiting**, when more trees came into bearing. Their ability to produce continued until 2003 when, on attaining the appropriate growth for propagation, some of the trees were themselves used to produce grafted plants, and berries from some of those trees that bore were allowed to ripen in order to produce a target of 25,000 seedlings for distribution. Finally many were pruned so as to stimulate new growth in preparation for the full resumption of grafting operations.

Readers are reminded that the Orange River Plot was established specifically for the multiplication of grafted plants, and that in 2003 due to a shift in policy, the ripe berries were used to propagate seedlings when the Plant Production Programme was rejuvenated. It appears that the Jamaican pimento tree is diverse in character and a test plot was established which was intended to clarify whether or not seeds from a self-fertilized hermaphrodite plant will produce fertile trees as progeny. The plot consisting of 300 of these seedlings was established in 2004 on adjoining lands to ascertain how many would eventually become bearing trees, as it was reported that at a grove in Grenada all the plants which were produced from seeds developed into fruiting trees. Seeds of ripe fruit sent from Grenada germinated and one of the seedlings was planted in apparent isolation at Hope. Another was planted at 65 Hope Boulevard and both bore fruit. The results from the plot at Orange River should prove interesting when their fertility or barrenness is determined. It is important therefore and advisable in the interest of the industry, that the authorities ensure that the Orange River plot is properly maintained despite a report that this is not the case. The results of the Orange River experiment were intended to determine if plants from seeds of self-fertilised trees were also self-fertilising.

With further reference to the role of barren ("male") trees in the pollination process, it is interesting to mention that as early as 1755, Patrick Browne the writer referred to the presence of such trees in the property but dissociated them from any function in the fruiting process of the bearing tree. Botanist Macfadyen suggested later that the flowers of fruiting pimento trees are hermaphrodite in nature.

The view held by the botanist, Chapman is not conclusive, since he ended his 1965 article titled "A New Development in the Agronomy of Pimento" with special reference to its floral biology by cautiously saying that " ideas

put forward concerning the floral biology of pimento have been tested on a limited scale, but no matter how reasonable a theory seems it must justify itself in the field, and it would be a task of enormous proportions and could provide a life's work and a very interesting and worthwhile one for an agronomist".

It is difficult not to conclude that the search for hermaphrodite trees (to replace "male" trees that do not produce marketable fruit) has accidentally met with success, since such strains in the Orange River plot are among the hermaphrodite group of plants where the flowers have both male and female organs, and so have the ability to fertilize themselves resulting in seed formation. It is expected that their heavy producing capacity should be transmitted to their progeny through the process of vegetative propagation and if planted in suitable areas, farmers in particular and the industry in general will benefit tremendously from what is undoubtedly a remarkable discovery and a significant development in that heavy bearing plants whose flowers are capable of fertilizing themselves can be vegetatively propagated. Unfortunately, after many years of use this plot is now neglected.

FIG. 5 SELF-FERTILISING TREE FROM GRENADA SEED AT 65 HOPE BOULEVARD

ILLISTRATION OF A BOTTE GRAFT.

TREE GRAFT TECHNIQUE APPLIED ON A MATURE TREE.

Seed Propagation

Prior to 1968, the propagation and large-scale production of plants relied exclusively on the germination of seeds from ripe fruits which is not an intricate process. During the period between 1955 and 1966 and 1994 to 2005, a total of 405,094 seedlings were produced by the Ministry and distributed free of cost to farmers. This was an effort to increase the tree population which was being gradually depleted by the ravages of hurricanes, mining operations, charcoal burning, clearing of lands for housing construction, improper care and constant mutilation of trees when being harvested.

It is interesting to learn that in 1814, John Lunan published an article on pimento, and in his reference to propagation says that "not one attempt in fifty to propagate the young plant, or to raise plants from seed in parts of the country where the tree is not found growing spontaneously had succeeded, and that new trees arise by natural regeneration from seedlings which spring up where the fruit is allowed to ripen and fall to the ground". While it cannot be denied that seedlings are produced from ripe seeds when they fall from the trees, this system of dissemination is somewhat confined, and it is surprising that no mention was made in his article of the vast and more effective dissemination process attributable from time immemorial to birds.

In the production of seedlings only ripe fruits must be selected as green berries are useless for propagation. The seeds which are kept in water after collection are extracted by removing the fleshy covering already described as the pericarp, then squeezing out the seeds taking care that in the process they are not crushed. The seeds along with the pericarp are then passed through a mesh which will allow mostly the seeds to pass through while the rubbing and squeezing process continues. J.F. Ward, horticulturalist once employed by the Ministry recommended in his booklet on pimento that the seeds should be dried in the shade before they are sown. It is advisable not to expose the seeds to the sun or warm temperature, otherwise their powers of germination will be reduced considerably. In the event that the ripe berries have to be kept for a day or two, keep them in water and store in cool surroundings. Seeds should be sown immediately after extraction by scattering them over the seed-bed making use of all available space thus avoiding congestion when germination commences. If kept in incongenial surroundings for a few hours before sowing they

may lose their viability. To illustrate how important it is to ensure that the seeds are not exposed to warm temperatures, processed seeds transported to Caenwood Agricultural Station at Hope Bay in Portland a distance of 50 miles failed to germinate. This was quite likely due to the fact that although packaged in wet material the parcel was inadvertently placed on the floor of the vehicle, thus exposed to the heat developed while the engine was in motion, causing the package to lose its saturation and exposing the seeds to an unfavourable environment. It was also unwise for the seeds to have been extracted from the ripe berries before being dispatched to their destination.

Seed-beds made up with sandy soil or preferably river mud should be located under 50% shade as a protection against intense sunlight. Cover seeds with some of the sowing medium and spread bagging or newspaper over the surface which will retain moisture and hasten germination, then water lightly with a mist nozzle or watering can, making sure that whatever is used as covering is kept moist at all times. The covering should be kept in place by pieces of wood or board, otherwise wind will dismantle and blow it away.

Within a period of fourteen days after sowing, when the first set of seedlings will appear, remove the covering. Germination will spread over a period of weeks and care should be taken not to water too frequently as a condition known as "Damping Off" which is caused by various soil-borne fungi, (for example species of *Rhizoctonia, Fusarium* and *Pythium)* will develop, causing a rapid death of seedlings. This can be avoided by watering the bed with a fungicide before sowing or at intervals of 2 to 3 weeks thereafter, if necessary.

Pimento seedlings are more susceptible to rust disease (*Puccinia psidii)* than mature trees, and one should be on the alert for the appearance of a tiny, bright orange-coloured powder-like substance on the young leaves which is the symptom of rust attack and is promoted by low temperatures and cool damp weather. As soon as this symptom is observed, spray at two week intervals with Dithane M45 fungicide or Manzate D, at the rate of two table spoons of chemical to one gallon of water using a knapsack spray pump.

When the seedlings are about 2" – 2½" in height, by which time they will develop two leaves, they should be carefully lifted from the seed-bed with a small hand shovel, care being taken not to damage the tender roots. They

should be potted immediately into diathene bags, placed under shade-cloth which will allow about 50% sunlight and watered as needed. Avoid keeping the seedlings in the seed-bed beyond the two-leaf stage, otherwise they will develop too lengthy a root system to fit comfortably into the container, requiring clipping or bending of the main root which is undesirable.

Potting bags should be filled beforehand with suitable potting soil mixed with some coarse river sand (*ca* 3:1) to provide drainage. In about 10 to 12 months after potting, seedlings should be ready for planting in the field at which time they should be about 12 to 15 inches in height.

The propagation of pimento plants in the early years relied exclusively on the germination of ripe seeds, thus discrediting that old fictitious and common belief that the propagation of the plant depended solely on

FIG. 6 PRODUCING PIMENTO SEEDLINGS FOR THE GRAFTING PROGRAMME AND FOR DISTRIBUTION TO FARMERS

birds. Since it is not possible to distinguish the barren from the bearing plants until they flower in about 6 to 8 years after planting, and then since only someone with the requisite expertise can distinguish the female from the male flowers, any attempt to establish pimento in a properly designed manner using seedlings of unknown sex would prove futile and undesirable. However, in the early part of the 20th century, in the absence of any proven successful alternative method of propagation, this system had to be

adopted, especially since hurricanes, in particular, as well as other occurrences had caused the destruction of trees and impacted the population adversely. The Pimento Tree Replanting Programme was implemented later by the Export Division of the Ministry, a programme which was intended to compensate for the disastrous effects of Hurricanes Gilbert and Ivan.

However prudent this may have been at the time, this mass production and distribution of seedlings would ultimately prove disadvantageous to the farmer in many ways. Commencement of bearings would be delayed, a degree of variability would be manifested in the field, early identification of the sex of plants would be impossible, and orchard style plantings (which is recommended) would be unachievable since a considerable proportion of the plants would become unnecessary male trees, thus interfering with proper spacing of trees which is one of the main features of a fruit tree orchard.

Vegetative Propagation

In the efforts to employ vegetative propagation as a means of producing plants, various trials were conducted. The first major attempt was directed towards CHIP BUDDING at Hope under glass-house conditions. This involved the selection of well developed seedlings as root-stock and careful selection of scion material at a certain stage of development from known bearing trees. An axillary bud with a leaf attached and a small shield of bark was tried. The shield was inserted into a space accurately cut in the bark of the seedling and secured with plastic tape. To avoid excessive transpiration, the bud and leaf were covered with plastic sheet. In most cases the survival period of the bud was limited and there were also a significant number of buds that remained dormant. Survival was erratic, ranging from 12 to 72%, and averaging 38%. These results, despite the practicability of such a method, discouraged intentions to use this technique as one means of mass reproduction. Dormant but live buds took 12 weeks to shoot.

FIG. 7 FEMALE PIMENTO PLANT PRODUCED BY PATCH GRAFT

In 1968, the PATCH GRAFT technique was introduced on potted seedlings on the premise that the use of mature patch grafts with at least three nodes would considerably increase the survival of this type of scion and induce the likelihood of even one node activating a bud. The basic requirements were that the scion should be in an air-tight and water-tight connection with dim light being available to the union. The 3 to 4 inches length of graft was covered with wraps of translucent tape. After a period of 6 weeks when callusing should have been in progress, the wrappings

were removed but retied at the internode as a precaution against any slight accidental bending of the stock which would release the delicate union being formed. On removal of the taping, the stock was ring-barked just above the region of the graft in order to stimulate bud-growth. Gradual reduction of the height of the stock was then done and the most vigorous shoot selected for development in the event that more than one had emerged.

It was established that a period of about 8 to 10 months was needed before a plant propagated in this manner became ready for planting out in the field. The average of 15% success was not considered satisfactory to ensure production of these plants on a large scale, and even when hormones in various concentrations were applied, there was no indication that any of the treatments were beneficial in activating buds.

Due to the lengthy development period of patch grafts and their delicacy, thought was given to the idea that if this method was applied on seedlings previously planted in a nursery under suitable shade conditions (using *Gliricidia sepium* Jacq. trees, which can be easily pruned as circumstances demanded) the maturity period could be greatly reduced and the delicacy of such grafts avoided. However, when this operation was tried, the process of digging up and potting plants with successful grafts, presented a new problem because of the difficulty in getting them to survive.

In 1978, a process using ROOTED CUTTINGS was investigated by the Botany Department of the University of the West Indies, Mona, Jamaica, in collaboration with the Crop Agronomy Division of the Ministry of Agriculture. The rooting of stem cuttings was conducted under mist conditions at the Botany Department's green house on the UWI, Mona campus and marcotting at the Lawrencefield nursery. To stimulate the emergence of roots, three concentrations of different auxins were used – indole butyric acid, indoleacetic acid and naphthylacetic acid.

Results from this trial with stem cuttings revealed (Kenneth Tucker, 1984) that although most of the shoots retained their leaves for the 12 week period the experiment lasted, there was no appearance of roots, nor even signs of callus which is an emergence of the thickened part of the bark or soft tissues of the branch. On the average, the lower 4 leaves of the shoots became detached and about 1 inch of the treated portion of the shoots developed a dark brown to black colouration. These observations were noticeable on both the treated and untreated shoots which indicate that

the hormones used were not the cause for this strange symptom.

In the case of the MARCOTTING where coir dust was used as the rooting media, it was observed after a period of 12 weeks that there were no signs of rooting. All the leaves were retained, terminal growth continued but not vigorously, and callus appeared on the marcots which of course does not necessarily mean that roots will emerge even if given a period beyond the standard time. Sidrak et al., 1978, claim that the loss of leaves from some of the cuttings may have been attributed to the loss of nutrients since the leaves were shaded and received less water from the mist system. The results of these trials were not convincing, and the conclusion was reached that to embark on such a method of propagation for pimento would not be viable.

All attempts to propagate plants by the rooting process have shown that pimento cuttings do not possess the ability to produce roots as easily as cuttings from other fruit trees. This is probably due to the hard, close-grained characteristics of its interior wood. Furthermore, in the event that pimento branches were to produce roots, any emergence of roots on individual branches is not likely to be abundant, and with an inadequate root system the chance of survival when transferred to a container pot would be extremely limited.

However, if this method was to prove successful at some future date, rooted cuttings would be the most practical, convenient, and least complex of the trials done to produce plants vegetatively. Such a system would only require a properly erected propagating unit fitted with mist sprinklers, a suitable rooting medium, a hardening-shed supplying the appropriate light, and most importantly, a regular supply of suitable branches from bearing pimento trees which in the absence of a nursery to provide cuttings would necessitate negotiations with farmers.

These unsuccessful attempts to discover a method of vegetative propagation which would replace the standard seed production process did not thwart the effort to find other appropriate techniques, and so the APPROACH GRAFT method was applied in two ways, the BOTTLE GRAFT and the TREE GRAFT.

A BOTTLE GRAFT starts with the collection of scion material in the form of a branch of about 8 to 10 inches in length which would naturally have several nodes, and many dormant buds. The leaves are cut in half and

the scion grafted to a planted seedling stock with the base of the scion immersed in a dark bottle with water, hence the name given to it. This is simply a device employed to prolong the life-span of the scion while both layers of cells are in the process of forming a union, since keeping the scion alive is of such great importance. This technique conducted under shaded conditions represented a simple substitute for the tree graft in that it was directed towards reducing labour. The trials gave moderate success averaging about 40%. The majority of the scions remained green and healthy up to a period of 8 weeks. This was 4 weeks short of the time required for a complete union to be formed, but the scion faded despite regular replenishment of water in the bottle which was continuously being absorbed.

To produce a Tree Graft, take a potted seedling (about 15-18 months old with an internode circumference of ¾ inch) and graft it to a lateral or terminal branch (smaller circumference than the seedling) of a bearing tree. The height of the seedling is reduced at the end of a 12 week period when a union of both cambiums would have developed. It is actually an operation opposite to the bottle-graft in that in the bottle-graft the branch from the mother tree is taken to the seedling planted in the ground, whereas in the tree graft the seedling in a plastic pot, is taken into the parent tree.

FIG. 8 ILLUSTRATION OF A BOTTLE GRAFT

In the tree graft technique, if the downward 3 inch incision in the branch (which has to be made) is properly done, its survival for the required 12 week period will be assured. The development of the branch will not be restricted, while still attached to its parent tree, while the growth of the seedling will be negligible. This is why it cannot be over emphasized that the scion should be lesser in girth than the seedling, otherwise you will produce a top-heavy grafted pimento plant which would be unstable and would have to be staked when planted or the height of the scion reduced.

FIG. 9 TREE GRAFT TECHNIQUE APPLIED ON A MATURE TREE

When this system was introduced at the Beverley Research Station, the procedure involved climbing the parent tree, selecting a suitable branch within reach, and positioning the seedling as close as possible to the branch. Using a sharp knife to make a 3 inch incision downwards on both stock and scion, care is taken not to cut too deeply into the wood, to connect both slits together with precision using budding tape, making sure that the seedling pot is fastened to a convenient branch or limb. This is an operation of a demanding nature, since it is a requirement that the seed-

ling be watered at least twice weekly for a period of 12 weeks. A secateur is then used to sever the scion from the parent tree just below the region of the graft. A reduction of the height of the seedling stock is carried out to enable the scion to adequately receive the nutrients it requires to develop.

While this procedure may appear to be somewhat cumbersome, the excellent results obtained from the initial use of the approach graft technique at the Research Station exceeded in importance the tedious nature of the operation, as results ranged from 80 to 90% success. With such encouraging results from what was the first attempt at producing grafted plants on a large scale under field conditions, it was apparent that better results could be obtained if seedlings and scions were more carefully selected, the operation more carefully executed, and most importantly, the moisture content of the seedlings kept at a high level even in the event of light rain. There is a tendency for matured leaves to fall from the parent tree and lodge in the plastic container impeding the free entry of water to the seedling, and this will inhibit the formation of callus and hamper the cohesion of both incisions which are the two vital processes that should not be impeded. When grafting operations were extended to private properties and later at the established nurseries and procedural guidelines fully observed, results improved substantially to an average of 96% success.

Owners of estates, who participated in this programme, by making their most prolific bearing trees available, were compensated with a proportion of the plants propagated from their own trees. It is plausible to mention that one farmer having acquainted himself with the technique produced his own plants and John Collier's orchard located at Upton in St. Ann was the second most populated field of grafted plants established in Jamaica, with William Scheckler's orchard at Beecher Town having the highest number at the time.

This successful method of propagation is unquestionably regarded as one of the most significant agronomic discoveries ever made with pimento by the team of researchers involved in the research programme over the years. It resulted in the establishment of nurseries at the Beverley Research Station in 1965, at the Lawrencefield Station at Grange Lane in St. Catherine in 1966, at the College of Agriculture, Science and Education nursery at Passley Garden in Portland in 1998, and finally at the Orange River Research Station at Highgate in St. Mary in the same year. These nurseries provided planting material not only for expansion purposes, but thousands of fertile plants for farmers whose heavy demand for such plants

could not be satisfied.

This agronomic achievement has facilitated the distribution of high yielding progeny with berries high in eugenol content (which is a desired constituent in the berries) and also contain an appropriate range of other constituents. This has been made possible since the parent trees were selected not only for their bearing ability, but also for their capacity to produce berries of high quality, a criterion on which Jamaica's pimento export price is fixed. To determine the trees suitable for production, the Chemistry Department of the University of the West Indies, Mona, provided the necessary information by testing samples of their berries for oil content and suitability of composition. The industry has benefited since the population of bearing trees has been increased since production started in 1966, with approximately 150,000 grafted plants being produced for sale to farmers and for expansion of nurseries. It has provided for the future establishment of pimento on a uniform and pre-determined design facilitating orchard style establishment. This will simplify to a considerable extent the cultural practices of spacing, spraying, fertilizing, irrigation and most importantly harvesting. It has also made feasible, the possibilities of inter-cropping during the early stages of establishment, and has offered the advantage of reducing the time-limit factor involved in initial crop yield from 6 or 7 years to 3 years. In addition, it has made possible the distribution of plants of high yielding strains potentially more consistent in bearing, and clones that are suitable in oil content and composition, and plants less susceptible to attacks by rust disease. Finally, it allows for the multiplication of progeny that exhibit

FIG. 10 TREE GRAFTS ON FEMALE NURSERY TREES

desirable shorter growth habits, and are unlikely to attain heights of more than 15 feet when they reach the age of maturity.

However, grafted plants have the disadvantage that they are not considered as drought resistant as ungrafted seedlings and during the first 3 years of planting they do not thrive as well as ungrafted seedlings under the same conditions. In this respect they are not highly recommended for planting in areas constantly deficient in rainfall, particularly where bauxitic soil exists and unless watering can be done until they establish themselves. These plants are not recommended for areas which do not allow for adequate drainage.

It is unfortunate that in 1977 when grafted plants were in demand and production was at its highest peak, the Lawrence Field nursery which was producing these plants had to cease operations as a result of an unreliable water supply, intrusion of illegal sand-mining operations, damage to canals and illegal dumping of garbage. Approval was granted to establish a new nursery, and this accounted for the nursery which was located at the College of Agriculture, Science and Education (CASE). This also was later abandoned when the supervisory staff of the Jamaica Pimento Association which was given responsibility for its operation demitted office on

The successful method of Approach Grafting of pimento trees has provided substantial benefits to both the farmer and the industry in many ways. It has solved the problem that the sex identification of pimento seedlings presented in that the farmer is aware from the outset that he is planting a bearing tree which produces oil with the blend of constituents acceptable to the market.

the impending demise of the Association. Some of the plants produced at the CASE nursery were also used to establish a new nursery at the Orange River Research Station, but because of a shift in policy, emphasis was again placed on the quicker system of seedling production to satisfy a growing demand for planting material which could not be satisfied by grafted plants. This nursery has now fallen into disrepair. It is apparent that the Orange River nursery, which provided grafted plants, is no longer in operation and the production of fertile plants which are so highly in demand, has been terminated. This results in a total reversal to propagation by seeds which is a retrograde step and most unfortunate.

It was inadvisable to terminate the propagation of these plants since both methods of production could have operated simultaneously as a supply of seedlings is one of the prerequisites for the production of grafted plants. However, the decision to cease operations should not have been made since other arrangements could have been considered. Supervision of staff for grafting, by experienced personnel, was still available.

It is noteworthy that a plot, established at Beecher Town in St. Ann with grafted pimento plants, purchased from the Ministry of Agriculture, exemplified the desirable features of a pimento orchard embracing proper spacing of trees, plants free from encroaching vines and other encumbrances, and with undergrowth kept under control. The plot which was established by William Scheckler, contained the highest population of grafted pimento plants in Jamaica and hopefully the new owners will not allow the care of this plot to decline to a state of neglect.

FIG. 11 AN ORCHARD OF GRAFTED PIMENTO PLANTS

The advantages of planting grafted trees have naturally intensified the demand for such plants. Unfortunately, their production has been suspended and I suggest that a proportion of any future production should be used for nursery expansion. The main factors which have always contributed to the unavailability of grafted plants are the time that it takes to produce them and the inadequacy in the number of parent trees.

Due to the slow growth of a pimento seedling, it normally takes about 1 year and 3 months before it has developed to the stage where it is ready to

be grafted. The time required for the cambiums of both stock and scion to form a firm union, is 3 months. After the grafted scion is severed from the parent tree, it requires about 2 months before the union is united enough for the plant to be transplanted in the field. It therefore takes a total period of approximately 20 months to produce a grafted plant, from the germination of the seed to the stage when the young grafted plant is ready for planting in the field.

In order to have a reasonable number constantly available for supply to farmers, the establishment of a nursery with the design and the capacity of the plot that existed many years ago at the Lawrencefield Research Station in St. Catherine, (which accommodated 600 parent trees) would be desirable. In order to do this, three fundamental requirements have to be met. These are the establishment of a new propagation nursery with a reliable water supply; the resuscitation of the trees which exist and the expansion of the existing plot to provide a regular supply of seedlings and mother trees, and the provision of trained staff to undertake field operations.

Pimento has a preference for free draining soils derived from limestone. Some desirable soil types recommended by the Soils Division of the Ministry of Agriculture are Killancholly Clay, St. Ann Clay Loam, Bellefield Clay, Agualta Vale Clay, Bonny Gate Loam, Cave Valley Clay Loam, Llandewey Clay Loam, Chudleigh Clay, and Lucky Hill Loam. Soils such as Rhymesbury Clay, Four Paths Clay and Sydenham Clay should be avoided. Pimento can be grown successfully on red bauxitic soils which are free-draining, but depends to a large extent on the consistency of rainfall. It thrives most abundantly on the coarse soils of the limestone areas which are noted for their free-draining capacity, and it is not unusual to see trees growing in shallow soils with their roots embedded in the crevices of rocks where abundant amount of plant food is not expected to exist.

Interestingly, a plant observed growing in a rock at the Beverley Research Station in St. Ann confirmed this tendency, arousing much curiosity as to its source of nutrients. Temperature in pimento areas varies from 26°C to 30°C with occasional short periods in which it rises to 36°C in the summer months and falls to 16°C in the winter. It is therefore evident that the pimento tree has a wide range of tolerance for rainfall, temperature, altitude, and other environmental factors, while being somewhat selective in soil type. But throughout Jamaica environmental factors along with suitable types of soil seem to be so conducive to the growing of pimento, that there are approximately 75 specific areas where the tree population is abundant.

These areas include:-

St. Elizabeth - New Market, Harmony Hall, Elgin, Mulgrave, Retirement, Cotterwood, Malvern, Balaclava, Jointwood, Brompton,

Manchester - Craighead, Cross Keys, Pratville, Spice Grove, May-field, Devon, Walderston,

Westmoreland - Bethel Town, Cave, Bluefields, Beeston Spring, Auchindown,

St. James - Adelphi, Catadupa, Anchovy,

Hanover - Chester Castle, Ramble, Askenish,

Clarendon - Mocho, Bellas Gate, Crooked River,

St. Catherine - Linstead, Kitson Town, Bartons, Browns Hall, Mount Rosser,

St. Mary - Islington, Long Road, Prospect, Robin's Bay, Hampstead, Oracabessa, Gayle,

Portland - Buff Bay, Windsor Castle, St. Margaret's Bay, Belvedere, Priestman's River, Manchioneal, Passley Gardens, Boston,

St. Ann - Breadnut Hill, Lime Hall, Drax Hall, Beverley, Steer Town, Seville, Alexandria, Queen Hythe, Bengal, Sturge Town, Home Castle, Upton, Brown's Town,

St. Thomas - Cedar Valley, Goat Ridge, Yallahs, Rowlandsfield, Amity Hall,

St. Andrew - Gordon Town, Mavis Bank, Golden Spring.

Trelawny - Braco, Duncans, Jackson Town, Brampton, Rock Spring, Clarke's Town.

There are about thirteen areas in Jamaica where pimento trees are almost non-existent. These include the Golden Grove, Duckenfield and Bowden areas of Eastern St. Thomas, Port Royal and Kingston, Hellshire, Portmore and Bushy Park in Southern St. Catherine, the Race Course and Lionel Town areas of South Clarendon, the Pedro Plains of South St. Elizabeth, and Mount Airy and Broughton in Southern Westmoreland.

When planting pimento plants for commercial operations, spacing is very important and a pure stand 25 by 25 feet is considered adequate. It must be borne in mind that a high density of trees will have a deleterious effect on productivity, as closer spacing tends to produce tall timber-like trees with a limited number of bearing branches rather than trees with prolific foliage which is what a farmer should desire. Tall trees in a dense population cause bearing to be confined mainly to the top sections (where branches are more exposed to sunlight) and where the reaping of berries is more difficult. Large planting holes are not necessary and should be a little larger than the diathene bag which contains the plant and should be about 18 by 18 inches. The site should be prepared before the rainy season commences and sites located in valleys should be avoided as such sites often have high humidity which will encourage the attack by the rust disease.

In selecting an area to grow pimento, consideration should be given to elevation, rainfall and humidity. At elevations above 1,000 feet plants will be more susceptible to attacks of the rust disease. However, pimento is a versatile crop and flourishes where the annual rainfall varies from 40 inches as in Trelawny and St. Ann, to 100 inches as in Portland.

Where the land is arable, intercropping with 'catch' crops such as peas and beans, pumpkin, vegetables and potatoes can be practiced. This can provide an additional source of income and the pimento plants will benefit from the care of such crops.

It is unfortunate that many farmers still do not care their pimento trees despite the fact that they do respond to care. They allow bush and all types of vines to over-run the plot and entangle the trees. They reap the trees when they bear in a very injudicious manner, and when they do not produce a crop the branches are broken off and sold to leaf-oil factories. They also neglect to treat black ants and termites which infest the trees. It is inconceivable that a tree which contributed so much in the past to the profitability of many estates, (in that the procurement of farm trucks, tractors, and other essential farm-equipment was made possible through earnings from the sale of its produce) is today still subjected to these deplorable forms of field husbandry.

In establishing pimento, goats and cows can be a nuisance and will have to be kept away from the young plants. While they may not relish the flavour of the leaves, their natural habit is to bite off a couple leaves occasionally leaving the plant devoid of foliage over a period of time, retarding their growth. Goats have a mischievous tendency to use their horns to break the young branches and cows will trample the young trees. Large trees can also be adversely affected if cows are tethered with chains to the pimento trees since damage to the bark is a set-back to their development.

When planting pimento (15 to 18 inches tall) it is not necessary to shade the plants. With regard to the fertilizing of pimento plants there is an absence of precise information as it affects bearing. Experimental work done on the related Bay Rum Tree in fertilizing with nitrogen, phosphate, and potash showed a response, by producing a heavier proliferation of leaves. In 1968, in collaboration with the Crops and Soils Department of the Ministry of Agriculture, a major fertilizer statistical experiment was conducted at the Beverley Research Station, to test the response to fertilizer application on young trees. The severe drought conditions in 1971,

during the summer months, resulted in many deaths, so that no result of any consequence was obtained from that trial. There is therefore a need for investigations into this aspect of field husbandry of this crop.

It is highly unlikely that farmers at the present time are applying fertilizer to their pimento trees, and at the prevailing price they will find such a practice prohibitive, and as stated, there is as yet no concrete evidence that trees will produce heavier yield if fertilizer is applied. Naturally, nitrogen should produce a higher proliferation of young foliage which would be expected to attract the rust disease, thus affecting production. The belief that the application of potash encourages bearing has not yet been substantiated.

In the absence of more precise information regarding fertilizer, advice on inorganic treatment of pimento must be directed mainly towards correcting any known deficiencies of the particular soil type. This is by following the general fertilizer recommendations for orchard crops on that type of soil. Nevertheless, a balanced mixture of NPK such as 12-12-20, 12-10-18, 10-10-20 and 15-15-15 may be applied during spring and autumn months.

There is no need to apply fertilizer until the young plants have established themselves. If it is decided to use fertilizer, this should be a few months after planting, and at the rate of one pound per tree in two applications, which can be increased gradually as the tree grows older. One should be cautious however in applying fertilizer during periods of severe drought, as pimento is susceptible to concentrations of soluble salts as evidenced by the situation experienced at the Beverley Research Station. It has been observed that seedlings respond favourably to application of liquid fertilizer by the development of more abundant and larger leaves.

Many years ago, Sydney Aguilar an enterprising pimento farmer in Westmoreland, in demonstrating his usual curiosity about the cultivation of pimento, experimentally injected his trees with a hormone with the intention of influencing bearing, but when some of the berries were inspected they had an abnormal shape, raising suspicion that the unique practice may have been responsible. So protective and caring was this farmer of his pimento trees, that it was revealed that they were all financially protected from hurricane damage by being insured with a reputable foreign insurance company. When this estate later operated under new management, it was a blow to production since the tree population, noted for its ability to produce berries in substantial quantities, was subjected to intense reaping

of leaves to assist in providing the supply needed for operating what was then the most sophisticated leaf-oil factory in existence, which was located on the property. Later like other factories, it ceased operations. It is quite likely that the justification for such a diversion from harvesting berries, when the crop is poor, to reaping leaves was that leaf oil manufacturing at the time was considered a more lucrative enterprise.

Many farmers will not find it practical to practice all the various forms of field husbandry, but one would be pleasantly surprised to see how beneficial it will be to apply the basic cultural practices where the trees are growing. These practices include: (i) clearing the area of any existing bush, (ii) destroying entangling vines, (iii) treating any infestation of black ants, (iv) getting rid of unnecessary competing trees, and (v) reaping the berries in the proper manner.

Pimento trees can grow to heights of 30 to 40 feet which naturally makes reaping a difficult task. In 1968, trials were conducted at Beverley to determine the effectiveness of not only resuscitating derelict pimento trees but to reduce the size of tall trees to reasonable heights so as to facilitate reaping. Trees which were reduced in height to a low of 10 to 15 feet showed vigorous response in terms of producing new shoots, but these shoots were attacked by the rust disease, more so since the cut-back period coincided with the rainy season.

It is suggested that in the event of too numerous shoots developing, some of the less vigorous ones should be removed to allow for a quicker growth of those selected to remain on the branches. It is further recommended that if there is any intention to carry out top-working of pimento trees, all the limbs should not be reduced simultaneously. If this is done, it will take a long time for the trees to recover sufficiently to restart their fruiting process, and the possibility of the fire-blight disease appearing as a consequence of any extensive reduction does exist. It is also advisable to use a saw when cutting back the trees and to paint the cut surfaces.

During the early stage of establishing pimento orchards, the fields should be cleared of bush, weeds, vines, and shrubs. Farmers may wish to use chemicals to control these types of vegetation, since they compete with the trees for available nutrients. But care should be taken to avoid herbicides such as 2.4.D to which pimento plants are very susceptible, especially since fumes from this chemical are spread by the wind. The symptoms include curling and defoliation of leaves, and trees take a long time to recuperate.

Many years ago a plot which was established at Braco Estate in Trelawny suffered extensively from the use of this herbicide which was used to eradicate bush in cattle pastures adjacent to the plot.

In the event that weed control is to be practiced, it is advisable to use Gramoxone, Round-up or Glyphosate at the rate of 2 tablespoons to 1 gallon of water. These herbicides were effectively used at the Orange River Agricultural Station to control grass in the pimento nursery. No damage was observed but spraying operations should be confined to the early morning hours to avoid the fumes being blown about by the wind which tends to develop later in the day.

There are a number of diseases and pests which occasionally attack pimento trees resulting in reduced productivity, but they are not devastating to an extent which would cause alarm.

The most damaging disease and one well known to farmers is the Pimento Leaf Rust – *Puccinia psidii*. It was first detected in 1932 in Manchester and recognized generally in 1934 when the island recorded heavy rainfall accompanied by high winds. This disease attacks the young foliage, the inflorescences, the stems, and the berries and results in defoliation and scarred berries. It is influenced primarily by a relative abundance of new growth, and the occurrence of long periods of inclement weather aided by fogs and late dew, and also by high humidity. In the late 1990's seedlings produced at the Orange River Agricultural Station in St. Mary had to be transferred to the Export Division in down-town Kingston to escape attacks of the disease despite regular treatment. At this new location, different environmental conditions exist and they quickly rejuvenated themselves, flourishing without any further signs of infection.

Applying fungicide is one method of combating the disease. Dithane M45, or Manzate D (at the rate of 1 tablespoon to 1 gallon of water, using a knapsack spray – high volume application, or 3 pounds (lbs) to 25 gallons of water if a mist-blower – low volume application is used) can control the infection. Add 1 teaspoon of a suitable sticker such as Triton B to the mixture.

Copper based fungicides such as New Dithane or Cupravit can also control the disease, but should not be used at fruiting time, as they will leave a higher residue of copper on the berries than permissible under health regulations; and importers of pimento are very stringent in applying these

regulations. If spraying to guard against attacks is contemplated, this should be done at the commencement of flushing, which is usually from February to March, before the appearance of the disease, and should terminate when flowering and knitting of berries are about to take place in May and June as spraying could blow away the inflorescence.

The disease is a serious threat to production if the trees are established in areas of elevation above 1,000 ft. and high humidity. It is doubtful if there is any farmer at present who is engaged in spraying his trees for rust disease, compared with earlier years when airplanes were used on large estates. Reduction of male trees has had a positive impact on the spread of the infection since there is a less dense population, congestion being one of the factors which encourages attacks by the disease.

Plant pathologist J. D. Maclachlan of Harvard University, in a 1936 report on the disease after a visit to Jamaica to investigate the 1934 out-break, stated that: "The rust is a parasitic fungus which can grow only in the green-living tissues of a host plant such as the pimento. It can be distinguished by a yellowish pollen-like powder which is composed of thousands of tiny spores of the rust which are blown about by the wind which usually falls on a young leaf and is capable of starting a new infection. It takes approximately 14 hours for the spores to begin to germinate until the germ tube grows to form a mass of mycelium which gets nourishment from the tiny cells in the leaf. Within 10 to 12 days, the mycelium breaks through the surface of the leaf to form thousands of new spores causing the rust to spread rapidly. When all the spores have blown away, the remaining spot on the leaf appears brown to black in colour which is the end of the infection, and now harmless as far as the spread of the rust is concerned. The disease can only attack the young tender and green parts of the tree and the infection causes the leaves, flowers and berries to be deprived of their biological stages of development and to fall to the ground. The defoliation stimulates the trees to send out new growth which is immediately infected by the abundance of spores present setting up a vicious cycle"

The pimento tree is also affected by the disease known as pimento die-back or fire-blight. This disease is caused by the entry of organisms into the wounds created by severe breaking of the limbs and branches, resulting in these sections of the trees displaying symptoms of dying and appearing as if scorched by fire.

For many years black ants have been a constant nuisance to those engaged in reaping the crop and many trees have remained unreaped during the season because of these insects. They are not directly parasitic to pimento, but their activities are somewhat damaging since they also build nests on broken limbs thus encouraging the entry of moisture which causes wood-rot, retarding the growth of the tree and giving it an unhealthy looking appearance as if wilting from lack of moisture. They are also disseminators of scale insects which attack the foliage and twigs of the pimento tree, sucking the sap. They also produce a dark powdery substance infesting the top surface of the leaves that encourages the growth of sooty mould. This substance is the excreta of the insects on the foliage which reduces the process of photosynthesis.

In 2001, the Export Division of the Ministry of Agriculture was fully aware of the nuisance caused by black ants, when the tree had to be climbed for reaping which disturbed their nests. The Black Ants Control Project under the Pimento Rehabilitation Programme was implemented after conducting a pilot test at Shawbury Estate in St. Ann. This programme was designed to facilitate reaping and control the rapid spread of infestation and was successful in several parishes where it was conducted, as thousands of ants were eliminated in the process.

The operation involved destruction of the nests by spraying with diazinon insecticide at the rate of 1 tablespoon to 1 gallon of water. The areas surrounding the roots of the trees were also sprayed with diazinon. Bands of plastic impregnated with Dursban insecticide, (available from the Banana Board) were wrapped around the trunk of the tree, so as to kill the insects, that normally crawl downwards and back to their nests after their search for food.

However, unless such a programme is sustained, there is every possibility that these pests will reappear, multiply, and continue to infest pimento trees, and be a deterrent to the reaping of berries.

Other insects that cause damage to young pimento trees, although to a lesser degree, include the worm-like grub of the fiddler beetle which thrives underground and usually ring-barks the roots cutting off the nourishment required for growth. Thrips, scale insects, and termites also cause damage. Sevin insecticide or Malathion has been used to control thrips and scale insects, while termites are easily eradicated by plugging holes in their nests and tunnels and applying a powdery stomach insecticide such

as Sevin. Being cannibalistic in nature they usually destroy themselves by feeding on their own species after they fall victim to the treatment.

Population and Identification of Trees

At present there is no recent record of the number of pimento trees growing in the Island. Various figures have been issued in the past, on the plant population, and also on the number of farmers and acreages per parish which have only been estimated. In view of the wild manner in which the trees exist and being clustered among a wide range of diverse vegetation, it is not possible to enumerate and so give any realistic assessment of the extent of the population. But it has to be conceded that the population has been depleted significantly when compared with that of earlier years, despite the heavy replacement with plants over the years.

The population of trees from the time of their discovery has always consisted of almost equal numbers of fertile and infertile trees, but some uncertainty still surrounds the significance of the existence of sterile trees and the part they play in the fruiting process of the bearing trees. Acting on advice however, many farmers have reduced the barren population of their farms.

Barren trees can be easily identified in the field by farmers simply because they have not borne since being established. However, it will prove difficult for anyone without knowledge of the pimento tree to correctly identify sterile trees without being informed of their different characteristics. It is already mentioned that it is not possible to determine the sex of the tree at the seedling stage, and that only when they flower later can their identity be known. Male (infertile) trees can be differentiated in the field by their tall and slender stature, by abundance of wood and less foliage, by their profuse inflorescence and by earlier and extended period of flowering. Since they are allowed to grow unmolested, if their branches are not torn off for leaf oil production, this accounts for their different morphological structure. A popular notion exists that in leaves from sterile trees, the percentage of oil is higher than that in those of bearing trees. If this is true, it may be due to the absence of fruiting in the male tree, which makes it possible for more oil to be stored in the leaves. Minott-Kates and Brown, 2007, have found the opposite to be the case.

Censuses undertaken by the Ministry of Agriculture Data Bank Unit in 1943 and 1996, (which provided the latest dated record available) are presented below. A careful analysis of the figures will divulge the wide dispar-

ity in the data presented, taking into consideration the period of years that elapsed and the harmful events, such as hurricanes, which have occurred between the years when the censuses were taken.

Census results for 1943 and 1996 comparing numbers of pimento trees with acreages within parishes and numbers of farmers in different parishes.

PARISH	NO. OF TREES	NO. OF FARMERS
St. Andrew	25,110	993
St. Catherine	52,890	2,116
Clarendon	18,750	1,801
Manchester	332,050	3,811
St. Elizabeth	694,300	3,904
Westmoreland	167,230	2,151
Hanover	66,440	964
St. James	39,930	864
Trelawny	308,230	740
St. Ann	463,490	4,022
St. Mary	113,500	1,553
Portland	35,340	746
St. Thomas	28,150	1,200
Total	2,345,410	24,865

Table 1A *(1943 Census)*

PARISH	ACREAGE	NO. OF FARMERS
St. Andrew	132.8	363
St. Catherine	500.3	1,622
Clarendon	164.5	1,041
Manchester	338	1,281
St. Elizabeth	834.5	1,246
Westmoreland	608.8	1,698
Hanover	1,071.30	908
St. James	103.9	346
Trelawny	555.7	153
St. Ann	4,036	1,277
St. Mary	2,594	1,439
Portland	1,153.30	526
St. Thomas	343.3	610
Total	12,436.40	12,510

Table 1B *(1996 Census)*

An examination of the various surveys will indicate that the pimento tree exists throughout all parishes of the island, but some sections are naturally much more densely populated than others. If the question was asked to identify any specific areas where the population of trees exceeds that of any other area, the answer would be that the areas of Spice Grove in Manchester, appropriately named and located on the outskirts of Spur Tree, and Lime Hall in St. Ann would be seen as the two most densely populated areas of the Island. Both of these localities have the free-draining limestone soil formation and climatic conditions which are among the factors which contribute to the proper sustenance of the pimento tree. However, an analysis of the 1943 survey disclosed that 694,300 trees were recorded for the parish of St. Elizabeth and this number surpassed that of other parishes, representing almost 30% of the island's total population of 2,345,410 trees.

As far as the island's production of berries is concerned, since 2003, St. Elizabeth's production has exceeded that of St. Ann and indeed all other parishes. St. Ann in 1943 recorded a population of 463,490 pimento trees

and 4,022 farmers. Its decrease in production may not have been due to a decline in the yield per tree, but rather to a reduction in the population of trees as a result of development in the Housing and Mining sectors over the years, destruction by hurricanes and the establishment of commercial enterprises on some of the large plantations.

During the 1970 to 1985 period, when supplies from the parish of St. Ann were still in excess of that of other parishes, properties such as Drax Hall, Sussex, Roaring River, Shawbury, Seville, Endeavour, Southfield and Cranbrook, all within close proximity of each other were large suppliers of the commodity, each having suitable soil composition, a favourable elevation, and enjoying climatic conditions favourable for pimento farming. So substantial were their supplies to the trade that the cleaning of their cured produce, a requirement under the Agrcultural Produce Act, and an operation of a costly and time consuming nature when done manually, had to be assigned to an exporting company. Transfirma Ltd. had the proper mechanically operated equipment to facilitate and expedite the removal of such extraneous substances as leaves and twigs that are unavoidably plucked with the berries (while being removed from their branches) and particles of dirt, grit and stones which usually contaminate the berries during the curing process, (which were swept up together on the concrete barbecues for collection and storage at night). If such a service is provided, a fee will be charged, calculated on the basis of a percentage of the total value of the clean product after each estate supply is bagged, labeled and weighed. The payment to the farmer should then be made.

In many areas, there is an abundance of towering trees, of both sexes, averaging about 70 to 80 trees per acre, all competing for their share of scarce sunlight. Proper field husbandry would dictate that the population should be decreased thereby increasing the bearing capability of fertile trees. While some farmers may respond to the idea of removing sterile trees and of eliminating other miscellaneous trees from the population, as many have done, no farmer will embrace the idea of reducing fertile trees because of their abundance. Only when hurricanes strike and create havoc on the vegetation will any reduction of bearing pimento trees from the population occur.

Reaping and Curing of Berries

Pimento berries attain maturity 3 to 4 months after flowering. The period and extent of the flowering season are greatly influenced by the local climate and so varies considerably from year to year and from area to area. It is known that pimento trees begin to flower earlier in the western sections of the Island during the months of February to March, resulting in harvesting commencing earlier in those areas. Generally, reaping takes place from July to October.

Farmers often consider themselves fortunate when they reap a good harvest, since a good crop depends so extensively on weather conditions. Heavy continuous rains at flowering time accompanied by wind, is not welcomed since this will cause the blossoms to fall off. Severe drought after berries are formed causes wilting of trees resulting in premature maturity and fruit- dropping. A period with the occasional shower of rain sufficient to keep the soil moist during flowering, and adequate rainfall to develop the young berries until they mature is the ideal condition required for a successful crop, provided that there is no attack of the rust disease.

Berries are ready for reaping when they are fully matured but still green. If not reaped at this stage they will soon begin to ripen, especially if there is constant rainfall, and the trade does not accept ripe berries which take a longer time to cure and have a different flavour. The method usually employed in harvesting pimento by breaking branches is primitive and is injurious to the trees. Consequently, over the years the industry has suffered from this antiquated system.

The traditional method is to climb the trees, and to break off the twigs and branches to which berries are attached, using hook-sticks to bring distant branches within reach. The branches are dropped to the ground where other workers mainly women and boys collect them, and pick off the berries from the branches. So established is this method of reaping pimento, that growers do not speak in terms of reaping pimento but rather say that they are going to 'bruck' pimento.

This method is injudicious because when the branches are torn off in this manner, the pimento wood being very brittle, it leads to serious damage to the trees since excessively large branches and too much foliage are often broken off. It is not uncommon to see a recently harvested tree in which 80 to 90 percent of the foliage has been removed so severely that the tree

may take 3 or more years to recover sufficiently to produce another crop. It is also because of this poor reaping habit that pimento trees tend to show fluctuation in their production however good a bearer the tree may be. Furthermore, another damage that is usually caused by breaking off the limbs and branches is that the ragged wounds left by breaking permits the entry of organisms which lead to the disease pimento "die-back" which is always observed in some pimento "walks".

As an alternative method of reaping, clipping of the branches with clippers or tree pruners has always been recommended to the farmer despite being more time-consuming, since there is a smooth detachment of the branch and defoliation is greatly reduced. But reapers are not yet fully converted to the use of clippers, as they maintain that it is too slow a process. Besides, there are many farmers who still harbour the mythical belief that branches produce quicker shoots when broken than when clipped. Under a programme known as the Pimento Rejuvenation Project, the Ministry some years ago purchased a supply of clippers for free distribution to qualified farmers so as to improve the reaping process, but farmers in general have not shown any preference for the use of clippers.

FIG. 12 IMPROPER REAPING SHOWING SEVERE BREAKING OF PIMENTO BRANCHES

From as early as the 1940s, it was found necessary to put into effect certain regulations governing the curing of pimento so as to ensure that only the highest quality was exported. These regulations are embodied in the Agricultural Produce Regulations, Pimento, made under the Agricultural Produce Act published in the Jamaica Gazette Supplement of August 1988.

FIG. 13 REAPING WITH CLIPPERS SHOWING REDUCED LOSS OF BRANCHES

Regulation 3 - Sale of Pimento states that no person shall for the purposes of export offer for sale or purchase:

(a) green pimento, berries, or pimento which has not been properly cured,

(b) pimento containing ripes, sticks, stones, trash or other foreign matter, and

(c) pimento that has been dried upon the ground

Breaches of this will result in the rejection of your produce. One can therefore realize the importance attached to the quality of pimento to be offered for sale.

When berries are reaped they are usually taken to concrete structures known as barbecues or to other appropriate surfaces, spread out thinly, and benefitting from the degree of the brilliancy and duration of Jamaica's

sunshine, allowed to dry in the intense heat. This usually takes about 6 to 8 days. During the process the berries are turned regularly with a board rake to allow for uniform drying, taken up at nights or covered with a suitable material as a protection against rain or heavy dew. If allowed to get wet, the drying period will be extended, and the berries having been exposed to the moist warm air may be attacked by fungus, inducing the development of "mould". This is indicated by the appearance of a grayish-white mass of fungal growth on the berries, making them unsuitable for sale.

When the berries are dried sufficiently, it is common practice to shake them, when they will rattle as this provides some evidence that they have reached a stage acceptable to the trade. However, it is not unusual for pimento to rattle with up to 18% moisture content which is excessively high, but experienced farmers know when the product will require at least an extra day of full sunlight. Berries that are either over-cured or under-cured face rejection when offered for sale. When pimento is over-cured, they will crush when squeezed within the palm of the hands, and if not cured sufficiently will still show signs of greenness and when squeezed they have a moist feel. When drying is completed, the berries will have a dark brown colour, and should then be collected and stored usually in jute sacks which will not cause them to dissipate their aromatic essential oils. The use of plastic bags is to be avoided.

Berries properly cured contain about 11 to 12% moisture which is the standard set for export. This percentage is attained through the curing process, a reduction from about 63%, which is the moisture content of matured green berries.

Since various forms of inappropriate equipment were being used to dry the product, the Ministry of Agriculture Export Division, in an effort to improve quality and ensure that proper curing of pimento was done, implemented the Barbecue Building Project in 1988. Financial assistance was offered to qualified farmers not only to erect barbecues but also to restore the condition of those in disrepair. The project facilitated the building of 1,988 barbecues at a cost of J$1,335,121, with the parishes of Manchester, St. Elizabeth, and St. Catherine erecting the greatest number. Later, the distribution of canvas drying units was another programme launched by the Ministry to maintain and improve the quality of pimento offered for sale.

FIG 14. DRIED BERRIES READY FOR CLEANING

The successful world-wide drying of other farm products by artificial means provided an incentive to investigate the possibilities of drying pimento artificially, and so in 1969 the Ministry of Agriculture submitted a request to the Tropical Products Institute in London seeking their assistance. It was an initiative aimed at reducing the time required for drying pimento and the inconvenience suffered if weather conditions are unfavourable, and also to ascertain if this system of drying would have an adverse effect on the quality of pimento to be exported, especially with regards to the retention of essential oils.

In 1969, a portable drier, a Nu-Way Benson Portable Heater – Indirect Zeta Type 1 – Z set to maintain$70^0C \pm 20^0C$, was secured, a gift from the Tropical Products Institute, London, and suitable drying compartments to store the berries were constructed. Drying trials resulted in several samples of the cured product passing tests as they related to appearance, contamination, cleanliness, resistance to crush, moisture content, oil content and composition. It was found that the drying temperature was critical if the pimento is to lose its green colour and at the same time retain its essential oils, while rapid drying would result in brittleness of the product.

It was also found that a short period of fermentation in a cool storage area before drying would assist in ensuring the production of a spice with good colour, while prolonged fermentation would result in a mouldy product.

These successful trials resulted in the delivery from London of suitable mobile driers of later models, (II, III, and IV) which were ordered on behalf of some special farmers who displayed interest in the modern system of drying pimento. The Department of Chemistry, UWI, Mona, played a vital role in these experiments, devising frames on which pimento could be dried and conducting determinations of the chemical effect of this form of drying (See Appendix 1).

The Ministry of Agriculture also obtained one of the units for demonstration purposes and this was first staged at a Denbigh Agricultural Show and later on some pimento estates. Experiments proved that the unit was capable of drying between 600 and 700 pounds (lbs) of pimento to an acceptable colour, uniformity in drying and a moisture content retention of 11 to 12% in approximately 8 hours at a temperature of 70^0C without any serious loss of oil or any significant change in composition. It is unfortunate that the increasing price of oil which was used as fuel for these machines prohibited the prolonged use of these units for drying pimento, and farmers had to resort to the traditional system of sun-drying.

A trial was also conducted at Drax Hall estate using an E.H. Bentall & Company drier considered more appropriate for large estates. The unit was loaded with 4,084 pounds (lbs) of pimento averaging moisture content of 65%, but this test was hampered by a defective photocell in the burner, necessitating adjustments to the moisture control unit. However, the test was not considered unsuccessful, as the cured product was accepted by a produce dealer who was satisfied with the colour and drying uniformity of the produce.

In view of the possibilities which exist as a result of satisfactory experiments with artificial drying of pimento, it should be regarded as an idea with merit that in this modern age of technology, consideration should be given to the establishment of pimento curing centres equipped with suitable drying and cleaning units in an endeavour to improve efficiency in this commercial enterprise. Arrangements could be made for farmers' produce to be collected and delivered to these centres, quick-dried and then cleaned as occurs in other local agricultural industries, thereby making the lengthy and tedious process of sun-drying obsolete. This enter-

prise could be operated by private entrepreneurs as a business venture or by a Government appointed Board, but this process would necessitate an amendment to the existing Agricultural Produce Act. It is felt that farmers would be interested in such a development which would relieve them of the various problems associated with sun-drying as long as a reasonable price is paid for green pimento. It would also serve as deterrent to praedial larceny which is not only prevalent in the field but also during the storage period of the curing/cured product.

It is difficult to realize, and it is unacceptable in this modern age, that both the reaping and curing processes, which are the two most significant operations involved in the field husbandry of pimento, remain today in the same traditional and primitive form that was employed when pimento became an industry in about the year 1737. In that year, 146,600 pounds (lbs) of pimento (approximately 73 short tons) were exported from Jamaica, thus establishing a trade which despite various forms of setbacks, still exists.

It is common practice and sensible for farmers interested in growing pimento to make enquiries about the productivity of trees. The recorded production of individual trees is, however, almost non-existent, is known to be very inconsistent and varies significantly from tree to tree. Young trees 20 to 25 years old may produce up to 60 pounds (lbs) of green berries in a crop year and fail to bear in the following two or more years. Yields depend to a considerably extent on the manner in which the trees are harvested and on prevailing environmental conditions. Dry weight of pimento varies between 37 to 40% of green weight.

At the Beverley Research Station in St. Ann, this inconsistency and unpredictability in bearing was well confirmed. A large matured tree labeled B931 yielded 154 pounds (lbs) of green pimento in 1965, produced much less in 1966 and 1968, did not bear in 1967 nor between 1969 and 1973 at which time the tree began to exhibit symptoms of apparent impending death, but after cut-back of infected branches, surprisingly recovered. A diagnosis revealed that it suffered an attack of the pimento disease referred to as fire-blight.

It was reported by a property owner in Westmoreland when discussing yield, that one of his trees once produced 300 pounds (lbs) of pimento in a single crop, a yield which is considered exceptional, and that the tree despite minimal defoliation when being reaped was never able in the years

after to produce to an extent that he would regard as reasonable. This is likely to have been caused by weather conditions or just a manifestation of the natural bearing capability and inconsistency of some pimento trees.

The most reliable and comprehensive data available on yield in pounds (lbs) of 35 individual trees at the Beverly Research Station over a 9 year period from 1965-1973 is tabulated below. The ages of these trees ranged from about 50 to 60 years, and they had already passed their most productive period but, they were still considered sufficiently productive for many of them to be selected for the propagation programme.

'Reaping & Curing of Berries' continued on page 49.

Individual yields of 35 pimento trees at Beverley over a nine year period.

Tree #	1965	'66	'67	'68	'69	'70	'71	'72	'73	Total (lbs)
B508	-	35	65	15	28	47	67	-	-	257
B511	66	22	80	-	19	38	5	-	-	230
B513	27	15	16	-	-	33	24	-	7	122
B515	20	24	20	25	14	46		51	3	203
B516	21	18	14	-	3	-	2	18	3	79
B521	45	11	20	36	-	10	-	-	-	122
B530	96	36	16		-	22	-	14	-	184
B603	65	42	9	32	-	22	-	14	-	184
B612	70	72	30	52	-	43	13	-	-	280
B623	117	93	10	80	-	22	-	-	-	322
B665	60	22	50	46	-	28	17	54	5	282
B718*	87	76	104	31	39	70	-	73	38	518
B730*	89	50	94	-	6	52	15	46	29	381
B736	60	75	20	26	-	-	-	-	-	181
B749	110	57	28	61	11	2	3	18	20	310
B754*	40	47	46	62	-	60	-	93	31	379
B766	-	-	20	75	-	-	10	30	4	139
B767*	112	45	79	98	-	26	49	78	18	505
B769*	40	20	44	34	8	71	5	75	48	345
B774	76	51	18	34	-	68	dying	dying	dying	247
B781	60	14	9	34	-	-	9	23	8	157
B784*	47	33	95	63	38	52	59	48	44	479
B790*	81	37	43	44	-	43	2	74	21	345
B797	60	38	-	40	-	23	-	37	-	198
B818*	73	35	80	72	-	-	13	57	-	330
B828	-	-	92	29	-	32	-	15	44	212
B829	-	-	17	-	-	-			10	27
B831	120	-	70	-	4	8	10	54	-	266
B931	154	70	-	92	-	-	-	-	-	316
B955	69	70	35	64	-	-	-	30	-	268
B958	150	33	44	-	-	27	3	19	14	290

B975*	105	56	68	111	7	-	-	-	-	347
B988	106	52	19	80	-	-	-	-	-	257
B1037	-	74	-	-	-	18	4	33	-	129
B1049	-	110	-	-	-	-	28	25	-	163
35 trees	2226	1433	1355	1336	177	898	338	965	352	9080

Table 2

Note: - the dash symbol means that the tree did not bear

When these figures are analysed one can arrive at a reasonable conclusion regarding the fruiting ability of pimento trees after they have passed their most prolific years. It can be observed that the nine most prolific bearers (indicated by *) produced 3,629 pounds (lbs) of pimento at an average rate of 403 pounds (lbs) per tree over the 9 year period. On an annual basis this amounts to nearly 45 pounds (lbs) per tree which when cured would be reduced, after 40% loss of moisture, to approximately 18 pounds (lbs). B718 which was the most productive tree, produced at an annual rate of nearly 58 pounds (lbs) which is accepted as satisfactory. Also noticeable, is the gradual decline in production in the latter years as the trees get older, while in 1965 to 1968 yields were impressive with 1965 regarded as outstanding and only 6 trees out of 35 failing to bear.

It is reasonably safe to conclude that at the age of 25 to 30 years, (at which time they would have attained their peak period of productivity) the average yield of many of these trees over the period of the experiment would range from 60 to 70 pounds (lbs) of green pimento, per tree. This can be the expectation of yield per tree, assuming that weather conditions are favourable and a proper reaping process adhered to. However, it is not unusual for trees up to the age of 80 years and beyond to possess the ability to produce up to 70 pounds (lbs) of green pimento in a single crop.

Marketing

In the early history of the industry, its economical value to the country ranked fourth among agricultural exports in terms of gross export earnings, and the United Kingdom and the United States of America were the principal importers. Later, (1959) Russia became one of our heaviest importers, and it was not surprising when Jamaican pimento berries were observed in tinned sardines imported to Jamaica from the European exporter.

Over the years internal marketing of pimento followed the traditional pattern of most crops grown in Jamaica. Production was harvested, cured and sold by individuals. In the early years there were some twenty produce dealers, who were licensed to deal in agricultural produce. Many of these dealers sold a part of their purchases in the internal trade to the large exporters who prepared their pimento for export to overseas markets.
Many of the large farmers sold directly to the exporters, and years ago some of the larger producers even exported directly to special oversea purchasers, thus being able to obtain higher prices, a practice which still exists, but now regulated by Government.

During World War II it became necessary for Government to assist farmers in marketing their crop. Under Defence Regulations the function of exporters was greatly modified and they were no longer permitted to export pimento. Consequently, a Pimento Clearing House was established in 1942 under the Ministry of Trade and Industry, and was made the sole Jamaican exporter of pimento. A part of the Clearing House function was to recommend a farm gate price at the beginning of each crop, which was then fixed by the Ministry. Later, there were further modifications to the marketing of pimento when the Ministry of Agriculture assumed responsibility for marketing. Under the Agricultural Produce (Pimento) Regulation Act, a concession was made for those engaged in the business of growing pimento trees, to apply for exporter status if, in the crop year immedi-

Pimento is one of the earliest agriculture commodities to be exported from Jamaica, and it appears that all early exports were to Spain. There are reports of pimento being imported into Europe as early as 1601 and in 1693 it was marketed as "sweet-scented Jamaican pepper or allspice" (American Spice Trade Association, 1979). The earliest available record of export dates back to 1737 when 146,600 pounds (lbs) was exported.

ately preceding the application, the grower's trees produced at least 50 bags of pimento each weighing not less than 143 pounds (lbs). This represented the minimum quota to become approved exporters. The Jamaica Pimento Association, a farmer's organization, acting on behalf of the Ministry was authorised to inspect applicants' properties, to assess possible future yields, to verify past production, and to recommend such farmers to the Ministry for them to be declared approved exporters.

FIG. 15 CLEANING BERRIES FOR EXPORT

The pimento Clearing House was later renamed Export Division, Ministry of Agriculture and is located on Marcus Garvey Drive in Kingston. The Division is committed to the purchase of all pimento delivered to its warehouse by farmers, or collected from produce dealers and agents, after inspection by Produce Inspectors, who certify the product as meeting the approved standard for export. The farm-gate price is calculated by using the obtainable export price, and deducting operational expenses and is approved by the Ministry. The Export Division appoints a number of agents who purchase pimento and sell it to the Ministry on a commission basis. It is also responsible for final cleaning, re-bagging, and storing the produce. Fumigation is done by the Food Storage and Prevention of Infestation Division of the Ministry of Industry, Investment and Commerce. The Export Division finally carries out the sale and exportation of the product.

Historically, the United Kingdom and the United States of America were the principal importers of Jamaica's pimento, but towards the end of the last century, Canada became an important market. In 1964, Germany and Russia were also purchasers of large quantities and over the years the number of countries importing Jamaica's pimento increased substantially.

At the present time, the pimento trade chiefly involves the United States, the United Kingdom, Japan and some European countries including Poland, Sweden, Holland and Germany. The marketing arrangement for the Ministry of Agriculture, whereby sales were once finalized through the Jamaica Export Trading Company (JETCO) which collected a sales percentage for its services, no longer exists. These sales are now carried out by the Export Division of The Ministry of Agriculture. Export of pimento is experiencing a decline perhaps because of the price of our product. Produce from Mexico, our main competitor is being sold on the world market at a much lower price than the Jamaican pimento, which makes it more attractive to importers despite its inferiority in quality.

It therefore seems as if price and not quality is now a more significant factor as far as the trade is concerned, resulting in a reduction in the farm-gate price paid to farmers since 2005. This will surely be a disincentive to them, inducing a disinclination to reap the crop especially in the event of a poor harvest. This will diminish the interest that was developing in the growing of pimento when the farm-gate price increased to J$110 per pound (lb) in 2005. It was reported that one local spice manufacturer offered as much as J$150 per pound (lb) fearing that in the event of low future production and depleted stock in government storage, the price could escalate. This manufacturer was making sure that his Company had ample supplies in storage and basing its action on the fact that the product can be stored for a considerable period of time without any deterioration in quality.

The following table in which the numbers given under countries refers to pounds (lbs) (as given in *Pimento, A Short Economic History*, by D.W. Rodriquez, 1969) will indicate the extent to which Jamaica's pimento was exported to the United States of America during the period 1954- 1969 compared with exports from other producing countries. Data for the missing years are not available.

Export of pimento to the USA from Jamaica compared with that from other countries.

YEAR	JAMAICA	MEXICO	GUATEMALA	HONDURAS
1954	1,200,834	298,720	31,444	22,460
1955	437,187	411,020	62,888	78,610
1956	1,177,080	NA	NA	NA
1957	831,949	363,852	53,00	7,130
1958	1,323,644	291,980	103,320	40,428
1959	722,640	NA	NA	NA
1960	867,020	NA	NA	NA
1961	804,440	NA	NA	NA
1962	1,098,440	NA	NA	NA
1963	780,280	80,000	155,000	108,000
1964	651,840	77,000	176,000	145,000
1965	430,460	148,000	93,000	212,000
1966	863,840	NA	42,000	299,000
1967	646,660	NA	NA	NA
1968	643,440	NA	NA	NA
1969	832,160	NA	NA	NA
TOTAL	13,311,911	1,670,572	717,552	912,628

Table 3

In addition, according to Rodriquez, 35,936 pounds (lbs) were exported from the Leeward Islands, during the period 1954 to 1968, while other producing countries exported 173,000 pounds (lbs), during that period.

Rodriquez also stated that, export prices increased from an average price of £3.15 (F.O.B.) per 100 pounds (lbs) (F.O.B.) in 1761 to £31.25 per 100 pounds (lbs) (F.O.B.) in 1967[1]. Not only had the price increased but the volume also increased from 1,062,200 pounds (lbs) in 1761 to 4,266,800 pounds (lbs) in 1967. This pimento was exported to various countries with the farm-gate price to growers averaging £25 per 100 pounds (lbs).

Rodriquez quotes statistics that further disclose that the volume of pi-

[1]**Jamaica used British currency (£) until 1969.**

mento, 24,575,100 pounds (lbs), exported in 1908 valued at £143,624, the average price being £0.6 / 100 lb, remains to date the largest weight ever to be exported. He states that in 1969 exports totaled 7,225,120 pounds (lbs) valued at £2,120,650 (F.O.B.) with an average price of £29.3 per 100 pounds (lbs) with the percentage of total domestic use amounting to 2.3 %, and gives interesting figures in respect of early export recorded as follows: sales to two major importers Russia and Germany during the years 1964, 1966 and 1968, amounted to a total of 3,331,701 pounds (lbs) valued at £970,623 and 3,385,011 pounds (lbs) with a value of £990,076, respectively. Total exports to the twenty-nine countries importing Jamaica's pimento during the same period were 15,349,283 pounds (lbs) at a value of £4,477,589.

Statistics for the more recent years disclose some useful information. For the period 2004 to 2008 total exports, exclusive of private approved exporters totaled 4,268,106 pounds (lbs) *i.e.* 1,936 metric tons. As far as prices are concerned, the average export price for 2005 to 2008 was US$5,692 per metric ton, while the farm gate price averagedJ$89.00 per pound (lb). For the period 2009 to2012 the export price averaged US$4313 per metric ton while the price paid to the farmer averaged J$97.00 per pound (lb). The fluctuation in price which occurs from time to time in the local and external trading of pimento is clearly a function of the local crop production in relation to that of other pimento producing countries and on the demand that exists for the product.

Generally speaking, export markets are procured, maintained and improved largely based on the quality of the product and the ability to meet the demand of the market, in terms of constant supply. The spice market is very sensitive to quality, consistency in appearance, flavour and form. These are regarded as the major factors that sell the product. It is well established that Jamaica's pimento quality wise exceeds those from other producing countries. According to the American Spice Trade Association, New Jersey, the essential oil content of pimento from all sources ranges from 2 to 4.5 %. They also report that the Jamaican pimento averages 4% and this is the dominant factor that sells the Jamaican product. Researchers at the Chemistry Department, UWI, Mona have found oil content as high as 7.0% in a sample of Jamaican pimento.

Historically, in the United Kingdom, market intelligence agents once kept the Jamaican authorities informed from time to time as to the state of the market and received a commission for providing such a service. In a paper

presented on behalf of the Export Division of the Ministry of Agriculture on "The Marketing of Spices" at an international spice group meeting held 18-23 November, 1991, it was stated that agents/buyers are obliged to: a) keep in contact with spice dealers, manufacturers and consumers regarding their immediate and future requirements; b) book orders for shipment; c) supply information in meeting the custom and tariff requirements which may have effect on sales; d) disseminate information about the various uses of pimento to manufacturers and consumers; e) assist in finding new uses of pimento; f) develop new markets. However, current information pertaining to external marketing of pimento remains an elusive matter, devoid of transparency. It does seem obvious however that the demand and the volume of production from other countries are the main factors taken into consideration when determining the export price, which is then fixed by the Ministry of Agriculture and which has been usually higher than that of other countries, but occasionally subjected to variation. Private exporters determine their export price and make their own arrangements for delivery. Shipping of the product purchased by Government is the responsibility of the Export Division of the Ministry. For several years the Jamaica Export Trading Company (JETCO) performed the role as marketing agent for Jamaican pimento, on behalf of the Ministry of Agriculture, for which it received a percentage commission based on the value of the sale. As mentioned earlier, this arrangement no longer exists and JETCO was eventually privatized about five years ago. All orders received from overseas by the Export Division are dealt with promptly. A final cleaning of the berries is done and certification from the Bureau of Standards, Scientific Research Council and the Plant Quarantine and Inspection Unit of the Ministry of Agriculture, ensures that the supplies adhere strictly to the standard laid down by the importing country as it relates to spices. Information for public knowledge on specific aspects of pimento trading is difficult to obtain. This difficulty may be attributed to the competitive nature associated with export trading.

However one of the realities which cannot be obscured from public awareness, nor can it be denied or disregarded, is that both internal and external marketing of Jamaica's allspice in terms of volume have declined significantly over the last 2 decades. There is a necessity for the industry to be revitalised and maintained, because its potential economic benefit remains a matter of paramount importance. It is imperative that the matter receives the attention it demands and deserves from the guardians of the industry.


SANGSTER'S
OLD JAMAICA
SPIRITS


Esso
ESSOLUBE

Leaf Oil and Berry Oil Production

Leaves of *Pimenta dioica* were and are still steam distilled to produce a leaf oil which is exported. In 1920, E. A. Campbell, a chemist employed to the then Department of Science and Agriculture discovered that an oil could be extracted economically from pimento leaves. His experiment was designed to find a way to make use of the vast amount of leaves which were gathered annually by harvesting, thereby providing an additional source of income to farmers. Unfortunately, when farmers do not expect a crop of pimento, both male and some female trees are defoliated for the extraction of oil. The injudicious manner in which this is done inflicts severe damage on the trees, and as in the case of indiscreet reaping of the berries has a harmful effect on the future productivity of bearing trees since their recovery is sometimes of long duration.

The first leaf oil distillery to be established in Jamaica was in Manchester in 1920, and this industry developed till there were about 8 to 10 distilleries in Jamaica. This number has now been reduced, one of the reasons being that more farmers have wisely come to realize that stripping the trees of their leaves in such a deplorable manner for the leaf-oil trade (in years with a poor crop so as to earn a few dollars), is absurd. The practice of stripping trees of their leaves as now practiced, should be condemned. It is considered a much wiser proposition if farmers, who wish to participate in the leaf oil trade, and possess available land suitable for planting pimento such as stony hillsides, establish trees at close spacing and become suppliers of foliage to the distilleries. However, the price paid for the material at present would probably not make this venture a profitable investment at this time.

Some years ago the search for suitable leaves was so desperate that the Ministry of Agriculture found it necessary to issue a release imploring leaf oil manufacturers to desist from purchasing leaves when the crop is out of season. At present manufacturers of leaf oil are in the process of seeking supplies of material when the reaping season begins.

Today, the largest factory engaged in the manufacturing of leaf oil, is located at Hodges in St. Elizabeth. The proprietor has sensibly planted trees on his property to later assist in providing the factory with material, thereby reducing the cost involved in hiring trucks to collect foliage from other and more distant sources.

The yield of the leaf-oil is said to show considerable variation with both the season of the year and the source from which the leaves are reaped. It is well confirmed that material collected from such areas as the parishes of St. Elizabeth, Westmoreland and Manchester possess higher phenol content, and produce a higher yield of oil. It was not unusual therefore to see purchasers of leaves in stiff competition for the material from such preferred sources. It is estimated that it takes 250 pounds (lbs) of fresh green leaves to produce ½ pound (lb) of oil. In 1966, it is recorded that 145,524 pounds (lbs) of leaf oil valued at £139,839 was exported from Jamaica. It is used as a substitute for berry oil which is more pungent and expensive and it is used in anaesthetics and antioxidants. Local spice manufacturers sometimes use it in their products.

There was a time when both berry and leaf oil were purchased and exported by the Ministry's Export Division under the product development segment of its operations. The Ministry no longer deals in the export of leaf oil.

In 1974, 622,931 pounds (lbs) of berry oil were exported from Jamaica. It is not certain if there is at present any extraction of pimento berry oil; hence it is likely that export of this product has been suspended. George McFarlane, former Director of Spices, estimated in 1976, that 300 to 400 pounds (lbs) of green berries is required to produce 3 ½ to 4½ pounds (lbs) of oil.

Farmers' Organizations

Apart from the Jamaica Agricultural Society, an organization which was formed in 1895 and represents farmers island wide, there is unfortunately at present no organization in existence which promotes the interest of pimento growers exclusively, as did the one that existed some years ago (the Jamaica Pimento Association) which became defunct in 1998.

In 1970, a pimento farmers' organization known as the St. Ann Pimento Growers' Association was conceived, so named as the parish of St. Ann was then the heaviest producer of pimento. This concept never developed. Later, in January 16, 1973, Leon Marantz, a United States citizen and owner of Sussex Estates in St. Ann, another of the large producers of pimento was instrumental in assembling a group of growers and representatives of various scientific institutions at his St. Ann residence. Arising from this, an inaugural meeting to form an island wide Association was held at Drax Hall estate in St. Ann on April 3, 1973. Don Hopwood of Bengal Farm in St. Ann, a large pimento producing estate, was elected Chairman with Leslie Nathan of Drax Hall, another of the heavy producing properties, as Secretary. Later, in 1973, a Constitution for the Pimento Growers Association was drawn up and a formal meeting was held on March 28, 1974 when both Hopwood and Nathan were formally elected President and Secretary respectively.

It was incorporated as a Limited Company in 1977 when it became known as the Jamaica Pimento Association Limited so that it could transact business, but the Association never reached the stage where it operated as a business enterprise. It was renamed the Jamaica Pimento Association.

In 1984, so as to fulfill the mission of the Association, this author was appointed Executive Director after retiring from the Ministry of Agriculture, having then completed 36 years of service, the majority of which were associated with the agronomical aspects of pimento. Later Maurice Denton, a retiree from the Kaiser Bauxite Company and also a graduate of the Jamaica School of Agriculture, was appointed Assistant Executive Director.

The primary objectives of the Association were to protect the welfare of the pimento industry, to promote the economic interest of its members particularly with regard to the creation and the maintenance of high standards of field husbandry, and to the marketing of the crop which never developed. The Association served as an advisory body to the growers is-

land-wide and provided the only extension service then available to pimento growers. It operated in close collaboration with the Export Division of the Ministry of Agriculture in many matters concerning pimento with the exception of external marketing.

It was closely connected with the planning and implementation of useful projects initiated by the Export Division including the Barbecue Building Project, the Black Ants Control Project, and the Plant Production and Pimento Resuscitation Project after the devastating damage to pimento trees caused by Hurricane Gilbert in 1988. The organization was funded by an annual subsidy provided by the Ministry of Agriculture on the presentation and approval of a budget. Private exporters, numbering three at the time, were requested to assist in funding, but only two were able to provide such assistance and only for one year as they reported that due to a decline in export sales their continued assistance was beyond their financial capabilities.

The Association, lasting for 24 years, was served by nine Presidents recruited from the farming community and agricultural bodies, and in 1998, funding for the organization was unfortunately no longer available from the Ministry of Agriculture. Consequently, the Association which had its office located on the Hope compound was disbanded and both technical employees demitted office. At this stage the author of this publication assumed duties as Project Co-ordinator with the Export Division of the Ministry of Agriculture.

Conclusion

Economically, the pimento tree has to be regarded as one of Nature's biological gifts. Jamaica cannot afford to allow the trade in pimento to become an endangered industry, since so many small farmers, in particular, rely on its existence to supplement their other agricultural pursuits, a factor of which Government is fully aware.

Destruction of trees by hurricanes, a recurring disaster over the years has often resulted in farmers losing their crop since harvesting coincides with the hurricane season, resulting in substantial loss of earnings to farmers and harm to the economy. In the event of such disasters however, the Ministry of Agriculture has often times responded by offering assistance to growers so as to minimize their losses; thereby maintaining their interest in the industry. When Hurricane Ivan struck in 2004, uprooting and damaging thousands of pimento trees severely reducing the crop, the Ministry through its Export Division quickly responded by providing financial assistance to the extent of J$37,000,000 plus a free supply of planting material to 5,200 farmers as compensation for the loss of and damage to 248,000 pimento trees island wide. Perhaps an insurance scheme could be developed.

Trading of pimento in terms of volume and regularity has been experiencing a downward trend when compared with former years. This is due not only to the availability of a cheaper product, though of lesser quality, from other sources such as Mexico and Guatemala, but in general because of external factors. Consequently, the marketing of Jamaica's pimento despite the established reputation of the spice is one of the major concerns facing the industry at present. The situation has forced exporters to be continuously and unavoidably reducing the export price in order to compete with the cheaper prices that other suppliers offer, thereby causing the price to the farmer to fluctuate. Such a scenario has somewhat reduced their interest in cultivating pimento. It has also created a reluctance mostly on the part of large estates, to harvest the crop especially when production is poor. A severe shortage of labour to perform this task (which is no longer done by family members, causing the cost of reaping to increase), is creating a serious problem for farmers and the Industry.

It is apparent that the pimento trade should be reorganized with a governmental/private enterprise body providing the driving force to publicise our product overseas and to expand our sales by expanding existing mar-

kets and attracting new ones. Such initiatives would be jeopardized by the adoption of a complacent approach towards marketing with the belief and hope that it would inevitably make an automatic recovery.

With promotional initiatives, it is possible for the market to rebound, especially if it is bolstered by shortages of supplies from the other producing countries. We are reminded of those prosperous days when the Jamaican product was in great demand and commanded a high price. All stakeholders in the Industry are optimistic and anticipating that such a recovery will occur and will be of long duration as this would pave the way for Pimento Allspice to again experience the commercial boom it once enjoyed. Such resurgence would be the stimulus that would allow the commodity to regain, in terms of economic value, its high ranking among Jamaica's agricultural exports which it once held, and to retain the reputation and value which it enjoyed for decades as an indispensable ingredient in the meat processing, canning, baking, pharmaceutical and confectionery industries of the world.

As an indication of its intention to safeguard the permanent existence of these historical trees, the Ministry of Agriculture should continue to prop-

FIG. 16 PIMENTO TREE WITH YOUNG BERRIES, PARISH OF ST. ANN

agate seedlings and to produce grafted plants to meet farmers' needs and to replace trees lost by natural causes or by human development.

It was a famous historian, Renny, who many decades ago aptly described the pimento trees as "one of the most elegant productions of nature", adding that "there is not perhaps in the whole vegetable creation a tree of greater beauty."

Indeed, the pimento tree bearer of the renowned aromatic spice, native of Jamaica, is one of nature's botanical gifts to the island's luxuriant vegetation and to its farming community.

The recovery of the Pimento trade demands that we maintain the high quality of Jamaican pimento, while at the same time getting the highest yield per tree. To command the highest possible price on the world market, Jamaica must continue to produce pimento of the highest quality. To maximize our financial gains, Jamaica must have trees that produce substantial yields of berries, which have the highest oil content with Fair Average Quality type oil. Pimento trees that produce berries of such quality can only be the result of selection and asexual propagation processes.

Despite the present decline in world demand, but in view of the contribution of pimento to Jamaica's economy, of the financial benefits it provides to thousands of pimento farmers, (the majority being small farmers) and because of the beauty of these evergreen trees which produce these precious fruits, this industry must be maintained. Jamaica cannot allow this prominent member of the tree population, which adorns its picturesque landscape, to disappear from its original abode and conducive habitat and we must assist Mother Nature to ensure that pimento trees will not become endangered or extinct.

APPENDIX 1

ARTIFICIAL DRYING AND VARIETIES OF PIMENTO AS INDICATED BY GAS CHROMATOGRAPHY **(Shirley Thomas)**

Artificial Drying

A Nu-Way Benson Portable Heater – Indirect Zeta Type 1-Z was used and the heater was controlled by a Sunvic Controls Ltd. Type TS 3N6 Thermostat (Range ± 20° C) set to maintain 70° C (165° F) in the drying pimento in drying experiments.

Drying is carried out in a mesh tray, which slides into place on the main frame. Pimento may be stirred during drying by a wooden rake.

The drying process, done correctly, will bring 600 pounds (lbs) of green pimento to an acceptable brown colour and a moisture content of about 11%, in about 6 hours without loss of oil or significant change in oil composition (as tested by gas chromatography - GC).

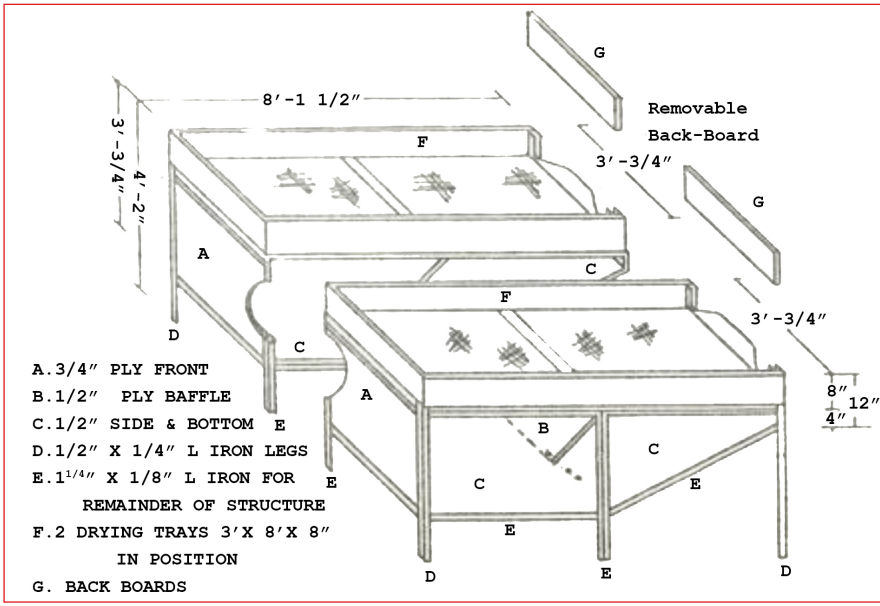


FIG. 17 PORTABLE EQUIPMENT FOR PIMENTO DRYING

Pimento Berry Oil Content

Trees producing berries having oil content below 4.0% were in general excluded from the grafting programme. Berry oils from some selected trees were found to have exceptionally high oil content from 5 – 7% dry weight with acceptable composition.

Pimento Berry Oil Quality

Gas Chromatograms (GC) of Pimento berry oils from different sources were run over a period from 1970 – 1975. Chromatograms were run on a Varian 1527B instrument, with a 5' x ⅛" column of 10% FFAP on 60/80 Chromosorb W with argon carrier gas and temperature programming (initial temperature 70^0, 30 min. 6^o/min).

The purpose of the gas chromatograms was to correlate berry oil quality with composition. Typical pimento is the term used to describe the commercial mixture called Fair Average Quality (FAQ) in the market. Comparisons were therefore made between the oils from these berries and oils from berries of individual trees for the purpose of propagating the "best" trees.

Variation was significant among the individual plants, so it was important to determine the features that influenced the quality. The basic compo-

nents appear to be present qualitatively in all the berry oils. The entire mixture of over 40 components was examined and most were identified at the then Tropical Products Institute by J. Nabney and F. V. Robinson, as published in 1972.

The berry oils from individual trees were examined by comparing their gas chromatography traces and the quantitative differences of specific components. The most outstanding quantitative feature in the oils of pimento berries is the eugenol content. The majority of pimento trees in Jamaica produce high eugenol oils as seen from the samples examined. The methyl eugenol is also an important variant, so oils were basically classified as high or low eugenol and high or low methyl eugenol.

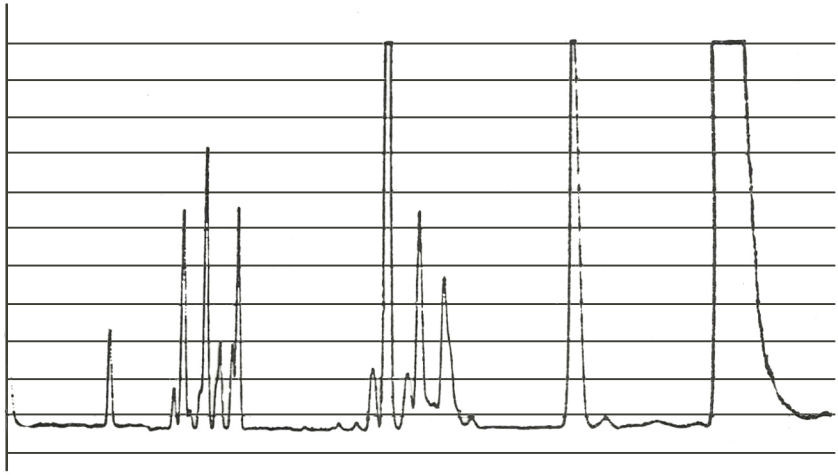
Further variation was then based on the monoterpene/sesquiterpene areas. In general, looking at individual trees, there is practically a continuum of variation, but broad divisions can be made. So the distinctions were made from the relative quantities of the components, eugenol, methyl eugenol, sesquiterpenes and monoterpenes.

This led to the proposed four varieties where two were high eugenol and two were low eugenol. The monoterpene/sesquiterpene ratio then distinguished between the two in each case. This does not preclude the possibility of other variants, for example where eugenol and methyl eugenol are close to equal. Most trees produced berry oil that fell into one of those four categories. However in individual trees, comparisons showed further quantitative variation in the components of monterpenes and sesquiterpenes.

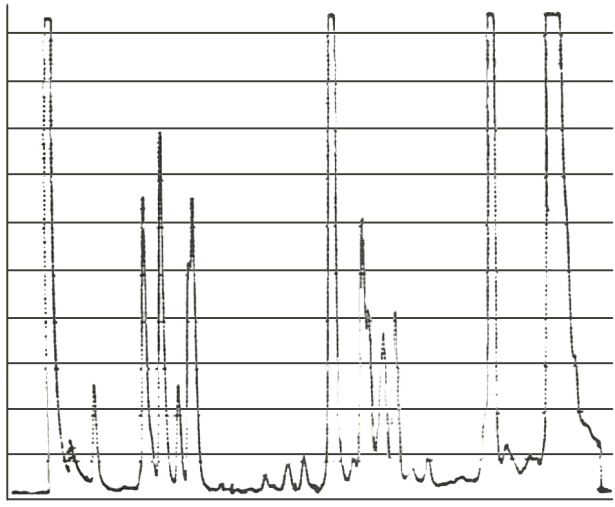
The results of these studies would allow for the selection of trees with specific composition blends for planting. Modern studies would be even more exact and with the option of producing trees that bear in a shorter time, the industry can be tailored to fit the available markets and to expand into new ones.

A GC pattern of a sample of "English Distilled Oil" berry oil is compared with one from a sample of "Fair Average Quality" pimento berry oil. "Fair Average Quality" pimento is the standard for export quality pimento berries.

The areas of the chromatogram labeled A, B, C, and D, refer to the following groups of components**:** A – Monoterpenes; B – Sesquiterpenes; C – Methyl Eugenol; D – Eugenol



(a) "English Distilled" Pimento Berry Oil



(b) Fair Average Quality Pimento Berry Oil

FIG. 18 GAS CHROMATOGRAMS OF THE OILS FROM HIGH QUALITY PIMENTO BERRIES

Classification of Pimento Varieties by Gas Chromatograms of berry oils showing different component patterns

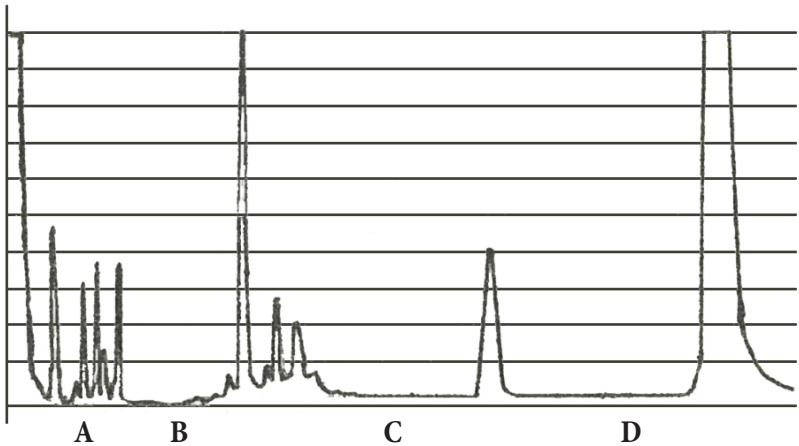


FIG. 19 CHROMATOGRAM OF VARIETY 1 PIMENTO BERRY OIL

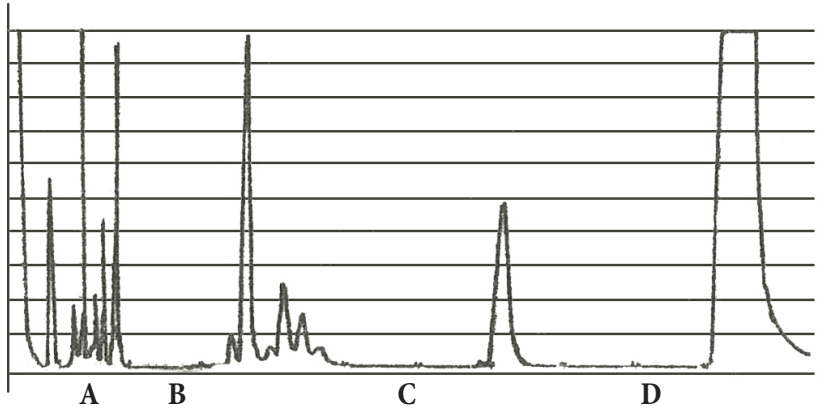


FIG. 20 CHROMATOGRAM OF VARIETY 2 PIMENTO BERRY OIL

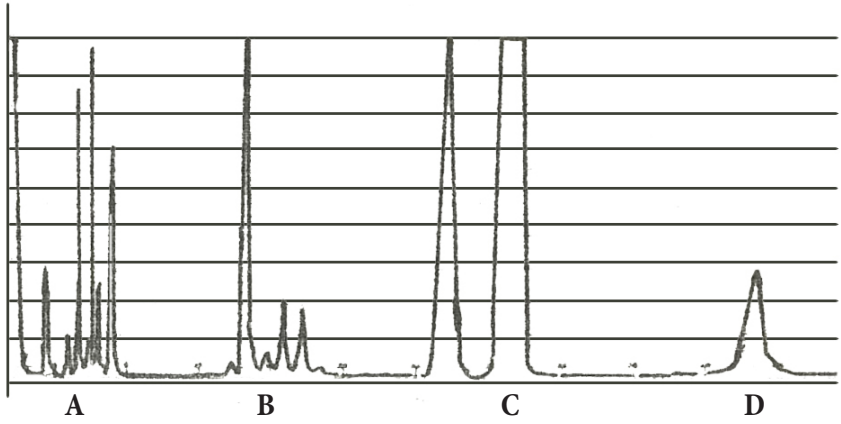


FIG. 21 CHROMATOGRAM OF VARIETY 3 PIMENTO BERRY OIL

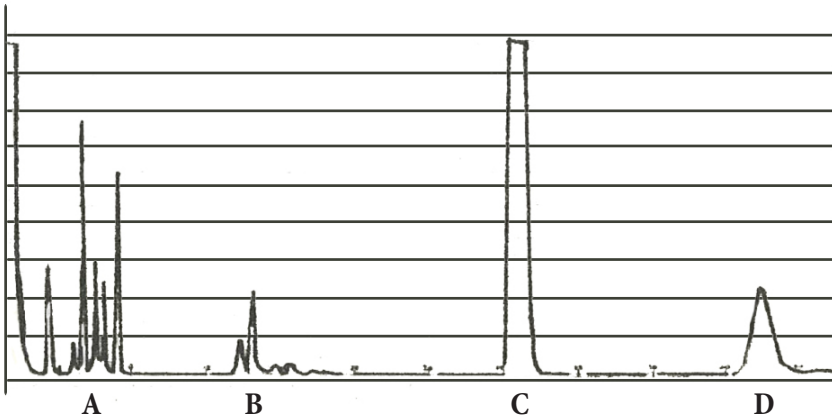


FIG. 22 CHROMATOGRAM OF VARIETY 4 PIMENTO BERRY OIL

The pimento varieties were classified according to the ratios of the components A, B, C, D to each other in the berry oil as shown in Table 4 below.

Varieties of pimento based on proportions of the components of the berry oil

Variety	A+B		C+D	Comments
	%A	%B	%C	
Variety 1	32	68	0 – 50	High Eugenol, high sesquiterpenes
Variety 2	68	32	0 – 50	High Eugenol, high monoterpenes
Variety 3	32	68	50 – 100	Low Eugenol, low monoterpenes
Variety 4	68	32	50 – 100	Low Eugenol, low sesquiterpenes

Table 4

Appendix 2

On September 19, 1978, the Ministry of Agriculture and the Jamaica Pimento Association launched the Jamaica Pimento "Allspice" Uses and Recipes booklet which was distributed to guests. Acknowledgement was made to Grace Kitchens and Consumer Services for testing and approving the recipes.

Those recipes are reproduced here by courtesy of the Ministry of Agriculture and Fisheries, Jamaica (Export Division).

FIG. 23 GRILLED CHICKEN BREASTS WITH ALLSPICE LEMON SAUCE

Ingredients

6 Chicken breasts

Salt and blackpepper to taste

Sauce

½ cup olive oil

8 tablespoons lemon juice

2 tablespoons finely chopped onions

1 teaspoon freshly ground ***Allspice***

2 teaspoons finely chopped parsley

A dash of Tabasco sauce

Method

Sprinkle chicken with salt, blackpepper and Allspice and marinate in sauce for at least 4 hours. When ready to grill, drain chicken breasts reserving marinated juices, and place on grill about 6 inches from heat. Brush with marinated juices and cook slowly until tender, about 1½ hours turning chicken constantly and basting from time to time.

FIG. 24 FILLET OF SOLE IN VERMOUTH AND ALLSPICE

INGREDIENTS

2 fillet of sole (about 1½ pound each)

6 tablespoons dry vermouth

6 tablespoons melted butter

2 teaspoons tomato paste

Salt to taste

Freshly ground ***Allspice***

6 tablespoons heavy cream

2 tablespoons finely chopped parsley

METHOD

Place fillet of sole in a small buttered flameproof dish or shallow casserole. Blend vermouth, melted butter and tomato paste and pour over fillets. Season to taste with salt and pepper and freshly ground Allspice. Cook over high heat until flesh flakes easily with a fork. Add cream and simmer gently for 2 minutes, shaking the pan continuously so that the sauce will thicken gradually. To serve, place fish fillet on a heated serving dish and pour sauce over fish. Sprinkle with freshly chopped parsley. Serve immediately.

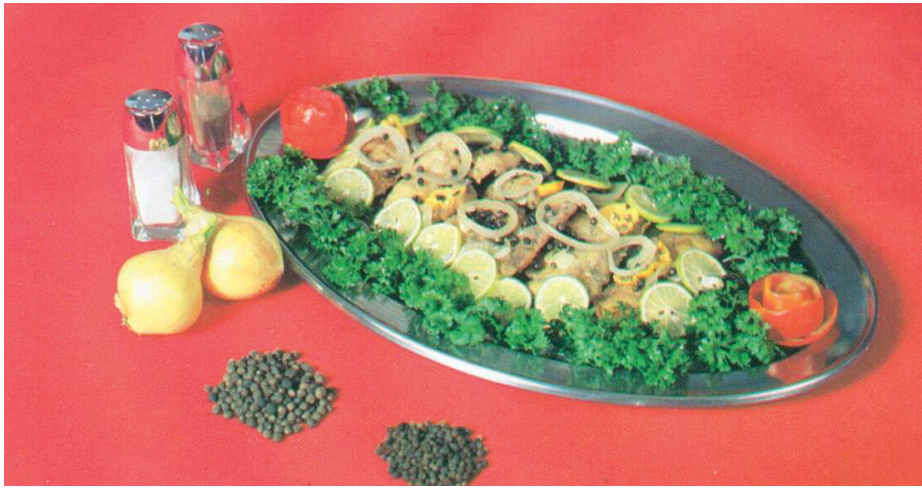


FIG. 25 ALLSPICE ESCOVEITCHED FISH

Ingredients

1 lb fish fillet (flounder or sole)

1 teaspoon blackpepper

Salt to taste

Corn oil for frying (about ¼ cup)

1 cup vinegar

1 large onion sliced

1 whole hot pepper sliced

1 teaspoon ***Allspice*** grains

½ teaspoon whole blackpepper grains

Method

Clean fish with lime juice or vinegar. Dry thoroughly and coat both sides of the fish with salt and blackpepper. Heat oil in skillet and fry fish on both sides. In another pan, mix together sliced onion, vinegar and Allspice grains, whole blackpepper grains and bring to a boil. Simmer for about 10 minutes then remove spices. Place the fish and allow to steep overnight. Refrigerate and serve as a first course.

FIG. 26 BAKED HAM WITH ALLSPICE

INGREDIENTS

3 – 5 lb ham

1 quart wine (any type)

1 pint water

1 cup brown sugar

1 teaspoon cinnamon

1 teaspoon ground ***Allspice***

1 teaspoon cloves

1 teaspoon nutmeg

1 cup molasses

METHOD

Soak ham overnight. For a 5 lb ham, bake in a slow oven for about 2½ hours. Baste often with wine and 1 pint water. Ham should be baked until somewhat loose from the bone. Remove from oven and allow to cool. Skin then cover ham with the following mixture: 1 cup brown sugar, 1 teaspoon each of cinnamon, Allspice, cloves and nutmeg. Put back in oven, basting with molasses, brown sugar and wine. Bake until brown.

FIG. 27 ALLSPICE CHRISTMAS CAKE

Ingredients

½ lb. butter
½ lb. margarine
1 lb. brown sugar
8 or 10 eggs (depending on size)
¾ lb. all purpose flour
¼ lb. fresh white bread crumbs
1 level teaspoon baking powder
1 lb. raisins chopped
2 lb. currants chopped
1 lb. prunes chopped
½ lb. glace cherries chopped
¼ cup or more browning
1 teaspoon vanilla
1 small nutmeg, grated
½ teaspoon mixed spice
1 teaspoon ground ***Allspice***
1 cup chopped nuts
3 ½ pints wine (to soak fruits)
½ pint rum (to soak fruits)

Method

Put fruit to soak some weeks before cake, add more rum, if necessary. Cream fat and sugar. Beat eggs well and pour into creamed mixture. Sift flour, baking powder and dry spices. Fold into mixture. Drain fruits and mix in with nuts, vanilla and browning. Fold in bread crumbs using a little wine if necessary. A wooden spoon should just be able to stand in the mixture. Put into greased and double lined baking tins. Bake at 300^0F until done, that is, when cake shrinks away from the sides of the pan and a cake tester comes out clean. Mixture may also be steamed in greased and covered containers. Test as stated above.

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Notes

Notes

John Gayle, O.D., received his training at the Jamaica School of Agriculture which was then at a site now occupied by the University of Technology, Jamaica. There he was taught by lecturers of a high standard, including Thomas Lecky. John Gayle's training was of University standard and it was not long before he began his work on the crop pimento. He worked at and later managed the Beverley Research Station in St. Ann and used this station as a major focus for this work.

He spent the major part of his working life in the Ministry of Agriculture and this book is a reflection of how he changed the agronomy of pimento and the improvements he made in the farming practices of this particular Jamaican crop. After his retirement, he became Executive Director of the Jamaica Pimento Association and after success in this position became Project Coordinator, Export Division, Ministry of Agriculture.

Kenneth Magnus, C.D., Ph.D., Professor Emeritus, University of the West Indies, Mona, says: Johnny Gayle is a retired expert in the tree crop pimento, one of Jamaica's **"best in the world"** products. His agronomic expertise and experience with this crop leaves us with a blueprint on how to proceed with its agricultural future.

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