

PURE CULTURE FERMENTATION OF GREEN OLIVES

Filed Oct. 10, 1966

4 Sheets-Sheet 1

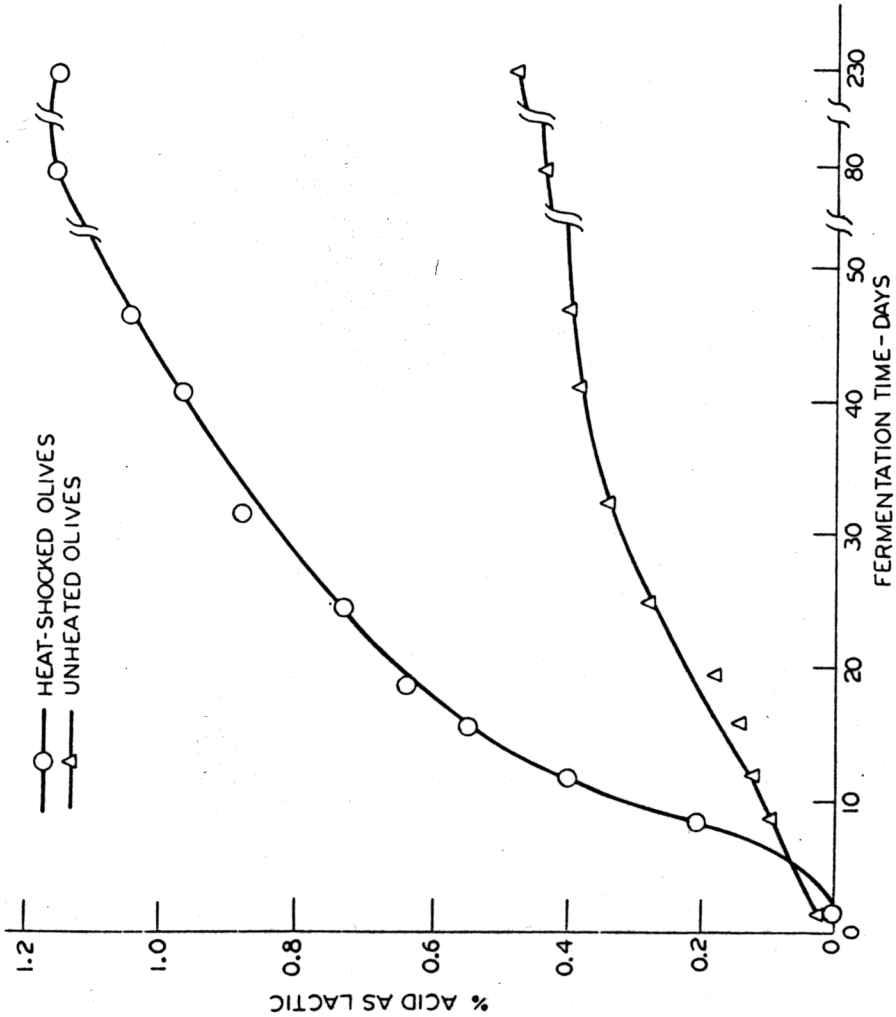


FIG. 1

INVENTORS  
JOHN L. ETHELLES  
THOMAS A. BELL  
IVAN D. KITTEL

BY

*R. Hoffman*  
*W. Beer*

ATTORNEYS

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4 Sheets-Sheet 2

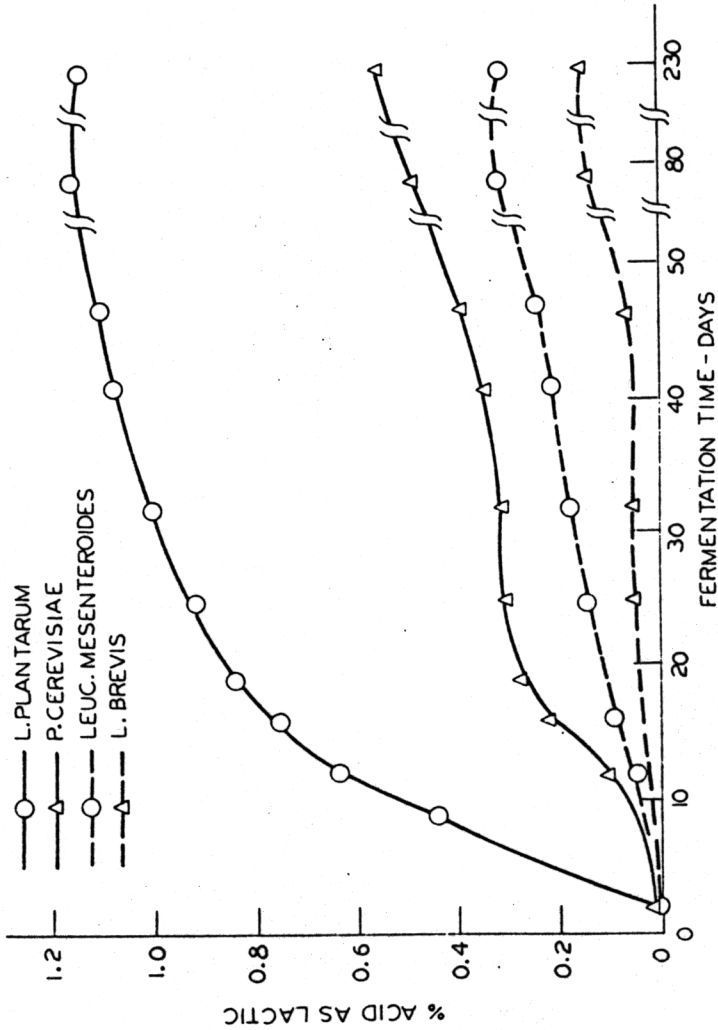


FIG. 2

INVENTORS  
JOHN L. ETHELLS  
THOMAS A. BELL  
IVAN D. KITTEL

BY

*R. Hoffman*  
*W. Bier*

ATTORNEYS

PURE CULTURE FERMENTATION OF GREEN OLIVES

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4 Sheets-Sheet 3

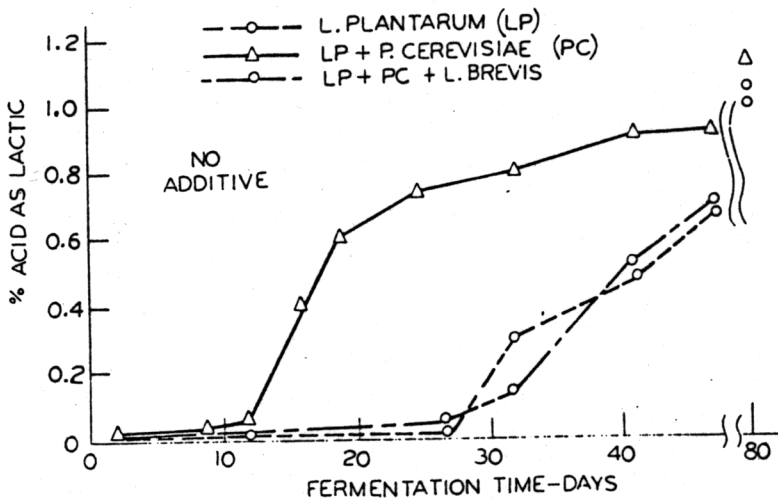


FIG. 3A

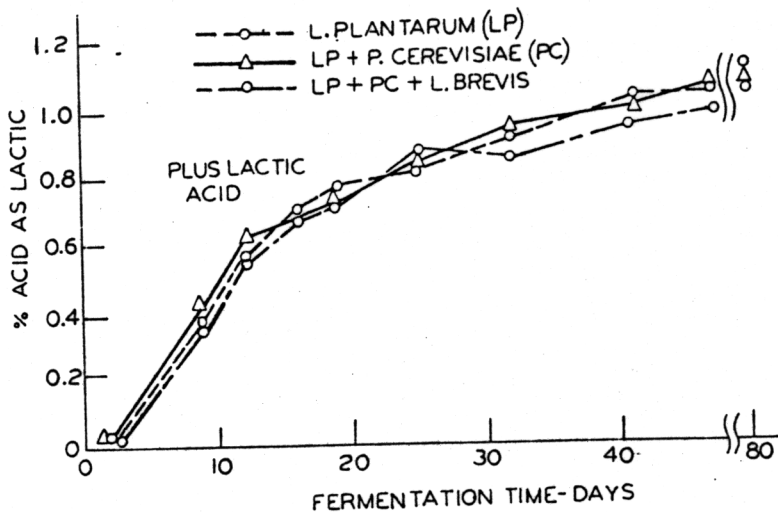


FIG. 3B

INVENTORS  
JOHN L. ETHELLS  
THOMAS A. BELL  
IVAN D. KITTEL

BY

*R. Hoffman*  
*W. Sier*

ATTORNEYS

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4 Sheets-Sheet 4

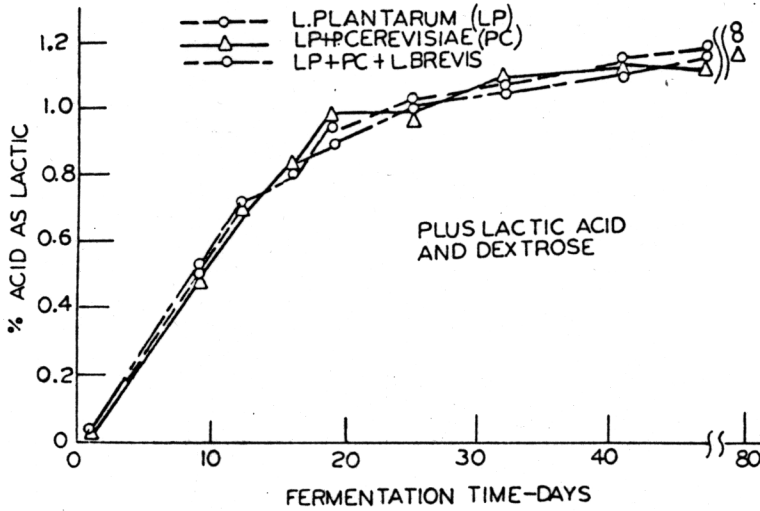


FIG. 3C

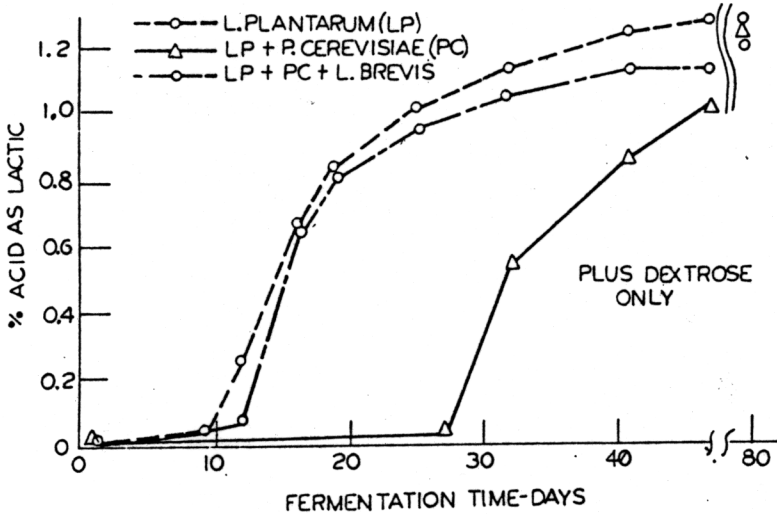


FIG. 3D

INVENTORS  
 JOHN LETCHHELLS  
 THOMAS A. BELL  
 IVAN D. KITTEL

BY

*R. Hoffman*  
*W. Bier*

ATTORNEYS

1

3,480,448

PURE CULTURE FERMENTATION OF  
GREEN OLIVES

John L. Etchells and Thomas A. Bell, Raleigh, N.C., and  
Ivan D. Kittel, Shakopee, Minn., assignors to the United  
States of America as represented by the Secretary of  
Agriculture

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6 Claims

2

## ABSTRACT OF THE DISCLOSURE

An improved brine-curing process for olives comprising fermentation controlled by selected microorganisms is provided. Introduction and growth of competing microorganisms is inhibited by the employment of aseptic processing conditions and by the use of a heat-shocking operation. The heat-shocking operation is performed on the olives after lye treatment for debittering but before introduction of the selected microorganisms.

A non-exclusive, irrevocable, royalty-free license in the invention herein described, throughout the world for all purposes of the United States Government, with the power to grant sublicenses for such purposes, is hereby granted to the Government of the United States of America.

This invention relates to an improved method for pickling green olives and to the product so produced. Specifically, it deals with a process for the pure-culture fermentation of green olives by selected pure cultures of non-gas producing lactic acid bacteria. More specifically, it deals with the use of such cultures in the pickling process without accompanying nutrient additives. Still more specifically, the process greatly enhances the fermentability of the olives by the pure culture inoculant. The resultant pickled fruit is not physically or chemically damaged, and has excellent commercial acceptability.

The term "fruit" as used herein includes commercial varieties of green olives such as Manzanillo, Barouni, Sevillano, Ascolano, and Mission. Because of the unusual problems of pickling (fermenting) the Manzanillo variety, the term "Manzanillo" will frequently be used below as "the fruit." However, the invention is not to be construed as limited to the Manzanillo variety.

The term "nutritive additives" relates to fermentable carbohydrates, particularly dextrose (corn sugar).

The conventional process for the brine curing of green olives for commercial use involves first sorting to remove trash, leaves, and defective fruit followed by a lye treatment to destroy most of the bitter factor (oleuropein) with subsequent leaching with water to remove the lye. The debittered fruit is then barreled and covered with a brine consisting of a sodium chloride (salt) solution of about 25° to 40° salometer. Subsequent fermentation is induced by micro-organisms normally extant on the fruit and transient micro-organisms introduced during and/by virtue of process operations. This limits the type and number of micro-organisms present in the brine only by the ability of each to survive the conditions of lye treatment and of brining. The success of this natural, mixed microbial flora fermentation process depends completely upon chance and the skills of those practicing the art of brine curing in establishing environmental conditions favorable for the growth of the lactic acid producing bacteria. A major and costly difficulty in the natural fermentation process is the frequent ascendancy of nonlactic acid producing bacteria, yeasts, molds and other fungi. This ascendancy results in a fermentation which is abnormal to the one desired, and usually gives rise to such kinds of deteriorative conditions as softening, gassy de-

terioration, butyric acid fermentation, putrefaction, and the other unpalatable and unappetizing changes.

W. V. Cruess was the first to suggest the possible use of pure cultures of lactic acid bacteria for starters in the fermentation of green olives. *Lactobacillus pentosus* (syn. *L. plantarum*) was considered to be worthy of commercial brining tests (Use of Starters for Green Olive Fermentations, Fruit Products Journal 17, (1) 12. 1937). Subsequently, Vaughn, Douglas, and Gilliland (Production of Spanish-type Green Olives, California Agricultural Experiment Station Bulletin No. 678. 1943) greatly expanded the pioneering studies of Professor Cruess and inquired further into the matter of pure culture starters for olive brines. Using one species of the genus *Lactobacillus*, namely *L. plantarum* (the same strain which W. V. Cruess had used) Vaughn et al. fermented debittered (lye treated) green olives of the Sevillano variety but were unable to get satisfactory fermentation results by similar means for Manzanillo fruit with simultaneous lactic acid formation using *L. plantarum* starters. As a result, they stated "It is readily seen that inoculation alone had little effect on acceleration of acid production. However, when corn sugar was made available, acid production increases significantly. This is further proof that inoculation alone is frequently not sufficient to accelerate acid production." They also concluded that, "None of the strains of *L. plantarum* differed significantly in their effect on the acceleration of the fermentation, nor was it possible to detect appreciable differences in quality of the olives pickled in brines which had been inoculated with the different cultures." Thus, it is seen that there is a need for a process for the pure-culture fermentation of green olives, particularly Manzanillo variety, without the addition of nutrient additives such as fermentable carbohydrates in the starting material.

The process should be simple and easily carried out; it should be applicable to the commercial varieties of green olive fruit; it should result in the production of lactic acid rapidly in equalized salt brines ranging about from 15° to 25° salometer (4.0 to 6.6 weight percent); the final acidity of the completely fermented olive brines should range about from 0.6 to 1.2 percent calculated as lactic acid on a weight/volume basis, i.e., gm. lactic acid in 100 ml. brine and referred to herein as w./v. basis or (w./v.) and should have brine pH's of about 3.8 to 4.1. Most important, the fermented fruit treated by the process should have good texture, color, flavor, and freedom from such defects as gassy deterioration, softening, and butyric acid fermentation which would make the fruit commercially unacceptable.

Herein is reported the invention of a new, novel, and practical process for the brine fermentation and curing of olives such Manzanillo variety which enables scientific control of the fermentation thereby decreasing the chances of brine-stock loss and giving rise to finished olive products of unusually high quality and controlled characteristics.

It is accordingly an object of this invention to provide a brine-curing process for olives in which the frequency of abnormal fermentations is reduced or eliminated by the attenuation, destruction, or removal of the naturally occurring mixed flora on the fruit and transient micro-organisms introduced during and/or by virtue of processing operation which give rise to abnormal fermentations. These undesirable microbial species are supplanted with a pure-culture or cultures of one or more bacterial species or strains selected from the genera *Lactobacillus* and *Pediococcus*.

Another object of this invention is to provide an olive brine curing process in which the desirable characteristics of the processed product may be predicted. This is accomplished by knowing the biochemical properties and

