Evaluation of the bean qualities of cocoa clones after propagated from somatic embryogenesis culture

G. ENTUNI*[1], H. NORI[1], R. EDWARD[1], M.J. AHMAD KAMIL[2] AND RAHMAN N.A.

[1]Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia, [2]Malaysian Cocoa Board, Cocoa Research and Development Centre, Lot 248, Blok 14, Biotechnology Park, 94300, Kota Samarahan, Sarawak.

**(e-mail: gib5181@gmail.com)*

ABSTRACT

A series of field experiments were conducted to assess the bean qualities of elite cocoa clones (KKM4, KKM22, MCBC1, and PBC230) after regenerated through somatic embryogenesis culture and grafting. The bean of all clones was morphologically and physically evaluated before quantified for the physiochemical changes after the fermentation and drying processes. No abnormalities were found in the morphological characteristics of beans for all treatments. However, the KKM4 clone of immature zygotic embryo culture yielded distinctly different lightest individual seed fresh weight (4.13 g), shortest seed length (21.2 mm), and seed width (11.5 mm) compared with those from the staminode culture and grafting. From this study, some clones such as KKM4 exhibited variation after propagated from different types of explants during somatic embryogenesis culture. Nevertheless, the dried bean moisture content (7.31%) and cut test score (685.0), which fall within the standard range, validated that the bean quality is not affected after the somatic embryogenesis culture process.

Keywords: Cocoa, Bean, Fermentation, Drying, Somatic embryogenesis culture

1. Introduction

Theobroma cacao L. or commonly known as cocoa, is a tropical crop tree species highly valued as a main raw material for the confectionery and cosmetic making industries. Cocoa, which belongs to the family of Sterculiaceae, is one of the major agricultural export products for several producing countries in Africa, Latin America, and Asia [1,2]. The raw cocoa seed is bitter and has an unpleasant taste, thus, need to be fermented and dried to generate essential flavor precursors for a better quality of cocoa bean products [3]. Various biochemical reactions occurred during fermentation and these induced chemical precursors that developed the specific flavour, aroma, and colour of beans. During fermentation, the microorganisms such as yeast, lactic and acetic bacteria convert the organic acid and sugars from cocoa pulps to ethanol and organic acids, i.e., lactic and acetic acid [4]. These organic acids then penetrate the seed and induce high temperatures through an aerobic process that leads to the embryo death and tissue acidification. After seed death, numerous compounds and enzymes react to form bean flavour. According to Kyi et al. [5], the cocoa beans are dried to a moisture content of 6 to 8% after the fermentation process to prevent mould infestation during subsequent bean storage and improve the flavours formation further.

The genotype of clones and handling procedures during fermentation and drying have been reported as the main factors that influence the quality of cocoa bean final products [6]. Studies by Efraim et al. [7] and Kongor et al. [3] showed that cocoa clones with different seed physical characteristics induced different bean physiochemical changes during both fermentation and drying processes. In cocoa, physiochemical changes in temperature, pH, moisture content, total soluble solid (TSS), and cut test score (CTS) are monitored to achieve the maximum fermentation and drying processes. Thus, for somatic embryogenesis cultured plants, which are usually observed with the occurrence of variation [8], it is imperative to carry out a rigorous evaluation of the quality standard of the cocoa bean before it is distributed for consumption. There is minimal research [9,10] conducted on the performance of cocoa plant following somatic embryogenesis culture and these are only focused on-field performance. To our knowledge, the present study is the first study that combines field performance and fermented bean quality among somatic embryogenesis-cultured clones. Hence, this study was