

## DETERMINATION OF HORMONE EFFICIENCY FOR PROPAGATION OF COCOA (*Theobroma cacao* L.) BY TWIGS IN MICROTUNNELS

Alexander Altamirano-Salazar<sup>1</sup>; Mar A. Gárate-Navarro<sup>2</sup>; Jorge L. Paz-Urrelo<sup>3</sup>; Ayda K. Valles-Ramirez<sup>2</sup>; Henri Delgado-Haya<sup>2</sup>; Dina L. Gutiérrez-Reynoso<sup>2</sup>; Vicente Pocomuchu-Poma<sup>4\*</sup>

<sup>1</sup>Asociación Peruana de Productores de Cacao - APPCACAO; <sup>2</sup>Instituto Nacional de Innovación Agraria – INIA – Estación Experimental Agraria El Porvenir San Martín; <sup>3</sup>Instituto Nacional de Innovación Agraria (INIA) La Molina 15026, Lima 12, Perú; <sup>4</sup>Facultad de Recursos Naturales Renovables, Universidad Nacional Agraria de la Selva. E-mail: jparajina.gpb.pe

### Introduction

Peru is listed as one of the main producers and suppliers of fine and aroma cacao. Likewise, it is the second largest producer of organic cacao worldwide, added to the great existing biodiversity (genetic material) in our country. In this sense, ensuring the multiplication and production of these species, conserving their high genetic value through clonal techniques, is so important for agro-export and consequently for the economy of many producers linked to this crop. Therefore, it is required to have a fast and efficient propagation method that allows preserving the genetic characteristics of the material; and the twig rooting method constitutes an interesting option. The aim of this research focused on the establishment of a vegetative propagation system using twigs of superior cacao genotypes, based on the use of Naphthaleneacetic Acid (NAA) and Indolebutyric Acid (IBA).

### Methodology

Seven cacao genotypes were evaluated (IRC-3, BT, CJO-1, CCN-51, BIG, IRC-4, TSH-565), to determine the effect of 2 types of auxins, Naphthaleneacetic Acid (NAA) and Indolebutyric Acid (IBA). Plants of superior cacao genotypes were selected, as well as their branches, which became twigs donors. These were cut 0.30 m from the tip of the selected branch, then a bevel-shaped cut was made in the basal part, leaving 3 to 4 leaves, which were then cut in 2/3 parts to avoid dehydration. The final twig had an approximate length of 16 - 20 cm. Once ready, they were immersed in a fungicide solution for 10 minutes, allowing them to drain to dry, approximately 3 minutes. Then, 3 centimeters from the base of each twig were submerged in the hormonal solution of NAA and IBA for 5 seconds, to then go through an aeration process to eliminate the excess of hormonal solution. Next, they were plated at a depth of 3 to 5 cm, trying to ensure that they remain firm in the substrate. Finally, the microtunnels were irrigated and placed in pots with favorable conditions (80-90% relative humidity and average temperature of 29°C (± 3°C)). The internal irrigation system (fogging), as well as external (microirrigation) of the microtunnels, worked with an alternate frequency of 15 minutes for 1 minute, programmed for 24 hours a day. The twigs remained for 6 to 8 weeks in the microtunnels. After that time, rooting was concluded to start the process of pre-acclimatization and acclimatization of the rooted twigs.

### Results

With the application of the IBA hormone, a higher rooting percentage was observed (Table 1) compared to the genotypes where the NAA hormone was applied; considering also for the generation of the roots in the genotypes IRC-03, CCN-51, BT, CJO-1 with the application of IBA, roots were formed after 35 days; while in the IRC-3 and CCN-51 genotypes, when subjected to the hormone NAA, roots were formed at 42 and 56 days.

**Table 1.** Percentage of rooting in relation to the selected cacao genotypes in the experiment

Genotype	% Rooting	Mean Rank
BIG	0.0	245.0 a
CIR-4	0.0	266.0 a
TSH-565	100.0	332.5 b
BT	100.0	346.5 b
CJO-1	100.0	346.5 b
CCN-51	100.0	371.0 b
IRC-3	100.0	448.0 b

Mean rank with different letters within the same column differ significantly ( $p > 0.05$ ), according to Kruskall-Wallis.

**Table 2.** Percentage of rooting in relation to the type of hormone used.

Hormone	% Rooting	Mean Rank
NAA	100	318.5 a
IBA	100	354.5 b

Mean rank with different letters within the same column differ significantly ( $p > 0.05$ ), according to Kruskall-Wallis.

**Figure 1.** Plants obtained by rooting twigs suitable for planting in the field.



**Figure 2.** Plant obtained by rooting of twigs established in the field.



**Figure 3.** Cacao twig rooting process timeline.



### Conclusions and recommendations

IBA auxin was more efficient for genotypes IRC-03, CCN-51, BT, and CJO-1, which formed roots after 35 days of cultivation in the microtunnels. The microtunnels are an excellent option for rooting twigs, as they provide the ideal temperature and humidity for the twigs to express their rooting potential on their vascular tissue. The results show that vegetative propagation through twigs is a reliable and effective method for obtaining cacao plants and, offers the possibility of preserving the characters of interest of the selected genotypes.