Final Report

Subcontractor information

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Key Milestones:

Earlier flowering has been successfully induced in different genotypes through extended photoperiod (red light district-RLD) and plant growth regulators (PGR). The incorporation of a new strategy based on the pruning of young branches adds power to the technologies validated during a second season of testing. Although pruning does not induce earlier flowering it allows fruit and seed set from the first flowering event which is usually sterile. It also increases the number of fruits and favors the feminization of male flowers resulting in complete (hermaphrodite) flowers. The impact of pruning does not seem to be genotype dependent.

General Progress:

Observations made during the first season of research regarding the effect of RLD and PGR were validated during a second evaluation season. RLD result in earlier branching (e.g. flowering) in most genotypes. Initially it was thought that light intensity was not relevant. However, during the second season night breaks illuminating plants for a brief period of time (ranging from 60 to 240 min) it became evident that a minimum amount of light energy has to be delivered to the plants to trigger flowering. Different types of LED sources of red light (620 to 640 nm) were evaluated. A 50W reflector was found to be the most convenient facilitating the logistics for large RLD “commercial” crossing nurseries. Combining the two PGR used (silver thiosulfate and benzyl adenine) provided, in general, better results than spraying them individually. Phyto-toxic effects of PGR was found to vary with seasons. Both RLD and PGR seem to be genotype-dependent and in some cases (e.g. “asparagus” cassava) responses were particularly favorable with one of the treatments. The new strategy of pruning young branches was tested during the last season of research. This approach is the contribution of earlier research conducted at GuangXi Subtropical Crops Research Institute (GSCRI) in China. Pruning young branches complements nicely with RLD and PGR. It does not seem to be genotype dependent. It requires, however, that flowering had already been induced.

Key Milestone Deviation:

All activities were conducted as planned and there was no deviation in any milestone.

Course Correction:

The only modification to previous plans was the addition of pruning of young branches as the team became aware of the critical issues around this strategy.

Plans for Next Reporting Period:

This is the final report of this project. A new project has been approved and the progress achieved so far will be the foundation of new research activities. In the new project key activities include the training of the pruning technique, validation of the experimental protocols in large "commercial" crossing nurseries and fine-tuning of the protocols so far developed. The production of hermaphrodite flowers after pruning requires a new approach for direct crosses because, for the first time, anther emasculation would be required.

Lessons Learned:

The key lesson learned is the value of collaboration among different institutions. RLD seem to work better in combination with cool nights, which are prevalent in the intermediate altitude of CIAT experimental station in Palmira (1000 meters above sea level). The advantage of RLD are not so clear in low altitude environments. Involving CIAT during the later stages of the project, by serendipity, allowed to prove the usefulness of RLD. However, the most striking lesson was the speed in which the pruning strategy was implemented and improved. Upon understanding the key features of the pruning of young branches in China (August 2017), CIAT shared that information with the team. We tested and validated the technology in the field (on the second branching event) for the first-time outside China. Colleagues from Cornell University quickly did the same under greenhouse conditions and further improved the protocol by testing the effect of combining the pruning with the application of BA when pruning took place. Within a year, therefore the project learned the technique, validated and quickly improved it.

Publications:

Ceballos, H., J.J. Jaramillo, S. Salazar, L.M. Pineda, F. Calle and T. Setter (2017). Induction of flowering in cassava through grafting. Journal of Plant Breeding and Crop Science 9:19-29.

The following posters were presented during the GCP21 conference (Cotonou, Benin. June, 2018):

1. L. Marcela Pineda, Nelson Morante, Sandra Salazar, Peter Hyde, Tim Setter, and Hernán Ceballos (2018). Induction of flowering I: photoperiod extension through a red lights district.
2. L. Marcela Pineda, Nelson Morante, Sandra Salazar, Peter Hyde, Tim Setter, and Hernán Ceballos (2018). Induction of flowering II: night breaks as an alternative for photoperiod extension
3. L. Marcela Pineda, Peter Hyde, Tim Setter, Nelson Morante, Sandra Salazar, and Hernán Ceballos (2018). Induction of flowering III: the potential of plant growth regulators
4. L.M Pineda, B. Yu, T. Yinong, N. Morante, S. Salazar, and H. Ceballos (2018). Induction of flowering IV: the potential of pruning young branches

A plenary presentation was also made during the GCP21 conference: H. Ceballos (2018). Progress and challenges in our understanding of cassava breeding and genetics. At least two manuscripts are under preparation for their publication in peer-reviewed journals.

Capacity Building:

The ongoing research on the pruning technique will be the subject of a M.Sc. thesis of a young female Colombian student. The pruning protocol requires field training, particularly to be able to detect as early as possible when flowering has been triggered. Digital training material (a 5 min video) has been prepared illustrating the power of the technology.

Feedback to the Foundation:

The Foundation and the NextGen project were flexible enough to involve CIAT and GuangXi Subtropical Crops Research Institute from China. This proved to be very beneficial for the project because the special environmental conditions of CIAT experimental station, perhaps special genotypes that are very responsive to RLD and/or PGR, and the very useful pruning technique originally developed in China.