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ISPC Commentary on the CGIAR Research Program (CRP) 3.4, *Roots, Tubers and Bananas for Food Security and Income*

Summary

CRP 3.4 on Roots, Tubers and Bananas (RTB) combines research of four CGIAR Centers working on bananas, plantains, cassava, potato, sweet potato, yams and several other tropical and Andean root and tuber crops. As stated in the proposal, these crops are important for food security and income for target populations of the CGIAR and have several common features: – they are (i) vegetatively propagated; (ii) bulky and easily perishable; and in many cases, they have (iii) a narrow genetic base among varieties grown. The proposal is, in general, well-written and clear and has been developed with substantial input from stakeholders. Due attention is given to gender and capacity-building, which are embedded in each of the research themes.

The central premise of the proposal is that these vegetatively propagated crops are sufficiently similar to justify a common research approach through a CRP. The complexity of establishing a CRP on a number of crops is, however, evident in the proposal. Despite the similarities among these crops, both regarding characteristics and research challenges, there are important differences which should be more clearly analysed and reflected. For instance, the use of these crops ranges from almost pure subsistence level for the poor to relatively intensive commercial cultivation, and from human food to animal feed. This diversity in production systems and utilisation may apply even within the same crop species. Thus, the importance of researchable topics - for instance on post-harvest issues and the constraints to availability of high quality planting material - will also vary according to crop and context. Hence, it is difficult to make generic statements and simultaneously provide an accurate description of the work proposed for these crops in aggregate.

The proposal comprehensively describes the work of the four Centers, but it is not clear how synergies and complementarities between Centers would be effectively harnessed. Negotiation of where to concentrate critical mass between Centers will be one of the biggest challenges in establishing an efficient CRP, given the existing strengths, experience, and capacity. Development of critical mass should respond to priorities and it would be helpful if the proposal could be more explicit in how this will be handled. If efforts are well-coordinated, it is clear that the breeding capacities of the four Centers, working together with partner institutions around the world, can make a significant, positive difference to poor farmers growing RTB crops. Currently, however, the proposal does not make a sufficiently strong case for the advantages of a CRP on RTB over individual Center programs as they now exist.

Although the importance of RTB for food security, income and nutrition makes research on them relevant for the System-level outcomes (SLOs) defined in the Strategy and Results Framework (SRF), reference to the SRF is limited. This makes it difficult to see how the research agenda will be prioritised consistent with the SLOs. Information on production and importance of these crops in relation to prevalence of poverty would be needed and prioritization in relation to expected outcomes would be facilitated by expression of global importance of RTBs in caloric content or value instead of fresh weight. It would also help inform the prioritisation process, relative to outcomes, if more information was given on the CGIAR's success in generating impacts with some RTB crops but not others, and the reasons why substantial productivity gains have been achieved for some RTB crops, but not others. Such information and analysis is important considering that the largest share of the work and budget is (appropriately) focussed on yield-increasing technologies. A key ISPC concern with this proposal, similar to other CRPs evaluated to date, is lack of clarity about which activities are current and continuing, what is new, and how the transition to a new strategic agenda will be made in the initial phase of the program.

Although the Centers bring to the CRP their experience of research and their development partners and partnerships, the proposal is vague in articulating how a partnership strategy will be developed, integrated, managed, evaluated and improved. The partnership strategy should account for the need to develop partnerships with organisations that are not traditional CGIAR partners. Rather than including partnerships as a research topic in Theme 7, the program should give emphasis to partnerships as an important cross-cutting activity across all Themes.

The management and oversight functions are straightforward and authority is delegated appropriately. The Science Advisory Committee provides a sound mechanism for incorporating independent advice. However, providing each of the Centers with the right to appoint a leader to at least one of the research themes sends the wrong signal about which criteria matter most when identifying research leaders for a given theme. The lines of authority, allegiance and accountability within the CRP as a whole would be clearer if these appointments were made by the CRP management on the basis of scientific leadership capabilities alone. The proposal emphasises the need to raise additional resources. While the Centers are likely to pursue fund raising through their own donor contacts, the CRP should develop a resource-mobilization strategy for the program as a single coordinated initiative.

Recommendation

The ISPC recommends that CRP 3.4 be approved subject to substantial revisions and resubmission, taking into account the detailed commentary that follows, with emphasis on:

- Stronger justification for a CRP on RTB crops that provides details on how the proposed themes and work plans will leverage the assets of the four Centers involved, and harness synergies and complementarities to deliver greater efficiencies and impact, compared with individual Center programs as they now exist.
- Better description and analysis of data and key information required for effective prioritization of research activities. This includes crop-specific information on areas of

cultivation relative to prevalence of poverty, utilization (subsistence vs. commercial; food vs. feed) and value chains, gaps in research knowledge, and reasons for success, or lack thereof, from prior research in terms of impact, including reasons underpinning substantial productivity gains made in some RTB crops, and not in others.

- The rationale for the research objectives on specific RTB crops needs to be strengthened; the underlying assumptions on returns to research investments in the development of RTB technologies (Table 2.2) needs greater transparency. Ranking of global importance of RTB crops should be based on caloric content or value, rather than fresh weight.
- Critically assess the comparative advantage of this CRP for a number of product line activities proposed within Themes 3, 5, and 7; deemphasize or omit unless a stronger case can be made for their inclusion.
- The proposal should specify which activities are continuing, what is new, and how a transition will be made to a new agenda based on a prioritization process during the initial years. More substantive evaluation of the lessons learnt, particularly regarding success in terms of adoption of technologies and impact, would help support this discussion.
- The proposal would be strengthened by detail as to how the four Centers will set priorities and negotiate the process of where to concentrate critical mass, taking into account the relative capacities of the Centers involved.
- The CRP management team should play a leadership role in developing the program partnership strategy; communications and knowledge-management should be part of management functions.
- Specification of Research Theme Leaders on the basis of a “Center quota” is not appropriate.

1. Strategic coherence and clarity of Program objectives

The CRP 3.4 proposal is well written and well organized. It reflects the long term experience of the participating Centers in working with RTB crops, and the substantial consultation with stakeholders that has occurred in proposal preparation. The similarity among RTB crops is given as strong justification for having a global program for these crops. However, the proposal does not give many specific examples of where synergies, efficiencies, and improved effectiveness will be captured by the CRP. Presumably most of the synergies are in the genetic enhancement, breeding and seed systems, but more detail on how synergies will be pursued would make a more convincing case for the advantage of a CRP on RTB over individual Center programs as they now exist. A discussion of how critical mass and specialization among the participating Centers will be considered and negotiated is also critical for justification of this CRP. The proposal should indicate how the strengths, experience, and capacity of Centers can be best exploited.

While the common features among RTBs suggest that there are opportunities for synergy and economies of scope, there are also significant differences between RTB crops. These should be considered in the proposal as they affect program coherence and priority setting. These crops are used for a range of objectives; from meeting subsistence needs to fully commercialized operations for high-income consumers, or their production for animal feed or for biofuels. This leads the crops and their products into quite different value chains. Consequently, breeding

objectives, for instance, vary. Even within the same species there is often major diversity. Thus the situation is not as homogeneous as described in the proposal.

Most of the priority setting for this CRP is proposed to be developed as programs are implemented. For example, a formal research prioritization effort is proposed under Theme 7 during the first year. This will use geospatial tools to delineate RTB production areas with regard to the number of poor and malnourished, and the expected impact of research products on poverty alleviation and food security. For this purpose, the global importance of RTB expressed through a ranking based on calories or value would give a more realistic rationale for the CRP, rather than ranking the crops on the basis of fresh weight. The proposed prioritization process will be complemented by input from end- and next-users and stakeholders to help identify research priorities and to evaluate research outputs. While this is commendable, the ISPC believes the proponents should provide a better prioritization framework at this stage to ensure that CRP activities are consistent with the SRF and its SLOs, which are barely mentioned in the proposal. For appropriate targeting of activities there should be a better understanding of differences between the RTB crops regarding the different value chains, and in terms of variable impact of prior research and differences in yield growth rates, which are noted in the proposal. Postponing priority setting until the first year will raise many challenges on how to adjust the CRP research plans midstream. Also, the proposal should indicate clearly which are current and continuing activities, what is new, and how the results of the priority-setting will be used to adjust the research agenda.

Improving productivity in these crops is perhaps the most urgent imperative in addressing the needs of the global poor that depend on RTBs. The CRP rightly intends to concentrate the largest share of resources on yield-improving technologies. Considering this, the choice of priority research topics must be informed by thorough analyses of the reasons behind differences in yield growth rates for various RTB crops, as mentioned above. Considering that the CGIAR has spent some decades in research on RTB crops in developing countries, the ISPC expects that there should be some crucial knowledge, or at least hypotheses, presented in the proposal, to explain the reasons for substantial productivity gains achieved in some RTB crops, and lack thereof for others.

Seven Themes are proposed (see discussion by Themes under Quality of Science) and most of them are coherent in terms of research areas, problems, and opportunities across Centers in the generation of international public goods. Theme descriptions tend to focus on process rather than objectives and how they link to the CRP goals. These links should be made clear from the outset with a stronger outcome orientation in the Theme presentations (and in the proposal overall). Theme 2 on developing varieties and enhancing yields is deemed by stakeholders to be the most important function of the CRP, and for this Theme the objectives are well presented and linked with program goals. The breeding possibilities for Theme 2 are discussed in a general manner in the main text, encompassing all species covered by the CRP. The level of detail in the annexes on pre-breeding and breeding activities reflects the differential attention which the various crops in the RTB group have received in the past. While the proponents need to be careful to prioritise the program's efforts to maintain focus among the multiple crops and traits that could be addressed, they should consider at which level to address those "neglected" RTB crops that previously have received relatively little attention. The ISPC does not favour a situation where

work on neglected species dilutes the productivity-enhancing research for existing major staple RTB crops for the poor.

Two Themes deserve careful reconsideration regarding overall coherence and strategic prioritization. Theme 5 on cropping systems contains a spectrum of problems and opportunities that tend to be heterogeneous and are often location-specific. In stakeholder consultations it was considered of lower priority. Theme 7 on partnerships includes partnerships, communications and training as researchable topics, when these activities should be cross-cutting among all Themes. These research areas received relatively low ranking also from stakeholders and the ISPC does not consider the CGIAR or this CRP to have comparative advantages on these topics, which nevertheless are important activities for the CRP as a whole. A clearly-defined strategy on partnership is required.

Analysis of the global research context on RTB crops is not strong. What are the content, volume and nature of RTB research in other organizations in developed and developing countries? And from this analysis, which ones are the most appropriate partners?

The CRP addresses gender and capacity building very well. A comprehensive description of gender research is provided, and similarly, a statement on capacity building is given in the Program Framework. Explicit gender and capacity-building components are considered within each Theme.

2. Delivery focus and plausibility of impact

At a general level the impact pathways are adequately described. Plausibility of impact is weakened, however, by a lack of analysis of why previous CGIAR research efforts on some RTB crops have not had much impact. It seems the proponents cannot explain the reasons for relatively large increases in yields of some RTP crops and not for others, as stated on Pg7 with regard to yield trends shown in Table 1.3. To quote, “Finer grained analysis would be needed to disentangle the contribution of varietal change, new management practices and increased intensity of input use”. To this we would add that understanding the cause(s) of different yield trends for the same crop in different countries and regions is also informative to guide the research and delivery focus.

While cross linkages between themes are recognized as important for enhancing the plausibility of impacts - and exchange of emerging knowledge between the themes will be essential for redefining the impact pathways as research progresses - in the Theme descriptions, such linkages are not elaborated.

The ex-ante estimates of economic value from the CRP would be strengthened by making transparent the underlying assumptions on returns on research investments on the development of RTB technologies (Table 2.2). All assumptions should be provided in an annex, or this table should be removed until more comprehensive analysis is undertaken.

The planned outputs are mostly clear and appropriate and derive logically from the problem setting. However, absence of detail about the relative size of investments, in terms of human

resources and funding, allocated to each product line makes it difficult to determine the feasibility of achieving the outputs and anticipated outcomes. Theme descriptions suggest that much of the proposed research is the same as has been done in the past. The ISPC would like to see a significant move to addressing the barriers to uptake of outputs of the past 10 years, and to address the problem of low productivity of RTBs in general.

3. Quality of science

The science underpinning the proposed research is sound and builds upon past efforts of the participating Centres. Although the detail on the science to be applied is limited, the authors have indicated up-to-date knowledge of new approaches, new technologies and systems and provide a *Critical Assessment of Methods* section, which describes the science in each Theme.

Theme 1 *Conserving and Accessing Genetic Resources*. This theme proposes to maintain and expand the well-known good work of CGIAR Centers and partners in the area of RTB genetic resources conservation and use. New characterization techniques are considered, along with the more traditional ones, to expedite genotyping and phenotyping to generate the basic information required by breeding programs. More efficient conservation methods are to be developed. One concern is that more information should be provided about the main gaps to be filled by new germplasm collection efforts and the main collecting objectives for each crop species covered by this CRP.

The emphasis on seed storage for RTB crops is novel and justified because seed potentially offers many advantages over clonal conservation. The proposed study of morphological variants and phenotyping could become costly in terms of numbers of accessions. Some limits should be placed on this, or alternatively the work could be outsourced to, and funded by, external institutions.

Theme 2 *Accelerating the Development and Selection of Varieties with Higher, more Stable Yield and Added Value*. This Theme is the largest component of the CRP-RTB and will receive one-third of the total budget. In general this is justified given the limited private sector involvement in breeding RTB crops. Justification for this degree of emphasis, however, should remain under active review in tandem with prioritization efforts. At issue is whether adequate investment is given to understanding barriers to adoption to ensure that significant impact will be delivered. Reference is made to how ‘new screening methods and selection schemes will accelerate the rate at which new varieties become available’, which underpins the need for good and novel science in this CRP. The proposed merging of the CIAT and IITA databases on cassava is commendable. Biofuel research should be pursued only if a strong case can be made that their potential impact on income generation outweighs any negative impact on food security for the poor. Some examples of potential research on biofuels include using the biomass ‘wastes’ from processing, or as a catalytic stimulus for attracting investment in the development of the cassava industry in Africa, with adequate spillover to cassava as a staple food crop

Theme 3 *Managing Priority Pests and Diseases*. Justification for research proposed under Product Line (PL) 2 on *Ecology and Management of Beneficial Organism* is weak and would

seem to be a low priority. It confuses biocontrol research that has a tight focus on identifying specific biocontrol organisms that can be released into the ambient environment, with a more tenuous soil ecology approach that seeks to: "... focus on understanding and using agro-ecosystem resilience and soil health as an approach to sustainably control pests and diseases." The soil ecology approach, however, has not been proven at scale and is based on the notion that soils with improved quality (more organic matter and nutrient stocks) provide a better habitat for beneficial organisms that reduce pest pressure through various mechanisms. While this may be true, these kinds of interactions are highly location-specific and require substantial and detailed research efforts to untangle. As such, it is hard to see how this type of work can be a high priority or that the CGIAR can have a comparative advantage in this area. There may be opportunities for synergistic research across crops on vectors of viruses and control strategies, including farmer decision-making on pest and disease management.

Theme 4 Making Available Low-Cost, High-Quality Planting Material for Farmers. The plan to develop more innovative cross-crop approaches that will deliver efficiencies and synergies by improving the quality of planting material used by poor farmers for clonal crops should be elaborated. This will require more crop-specific analysis of common vs. distinct problems associated with the availability of high quality planting material. It is not evident how the cross-crop approach will be addressed in Theme 4. Research into the delivery of these materials to growers will be important in order to meet the objectives of the CRP. Close involvement with the private sector is required to understand the constraints and the logistics of delivery of good quality planting materials, at a cost suitable for commercial growers.

Theme 5: Developing Tools for More Productive and Ecologically Robust Cropping Systems. In the proposal this Theme is justified in part by opportunities for intensification. However, an analysis of the comparative advantage of CRP 3.4 versus alternative suppliers for the proposed research activities is needed. On one hand, the problems and opportunities tend to be heterogeneous and often quite location-specific. On the other hand, considerable work has already been done and universities and NARS may be better positioned to carry out the type of crop-specific modeling proposed. A framework for identifying where intensification is a good idea in terms of access to markets, suitable soils and climate and/or water supply would be useful. Yield gap analysis is essential to identify the relative yield improvements that can be expected due to improvements in integrated management of genotype, soil, and cropping system, but a commitment to understanding the degree of interaction among these production factors is also needed, which requires extensive experimentation and modelling support. The ability of the CRP to do this will depend on strong partnerships, which requires adequate support being made available for the partners' involvement in technology delivery chains.

Theme 6 Promoting Postharvest Technologies, Value Chains and Market Opportunities. This Theme would benefit from a crop-specific assessment of past research on post-harvest technologies because, for some RTB crops, the suggested topics are already well documented. Constraints to the development of value chains and market opportunities are mainly to do with policies and institutions, rather than technical issues, and the proposal rightly calls attention to this point. Similarly, the proponents note that while business development is not synonymous with creating equity, there are opportunities to emphasize pro-poor business model approaches. In this respect, the CRP will need to ensure that strong links are established with other

organizations (including FAO) that have done considerable work on business models specifically targeting small-scale producers.

Theme 7 Enhancing Impact through Partnerships. PL1 proposes to produce geospatial databases on poverty, hunger and RTB crop area distribution, and these data will be used for assessment of priorities for RTB investment at the global level. It can be assumed that subsequent adjustments to research plans will be driven by CRP-level management, but details are not provided. Results from this significant prioritization effort will presumably be used to shape the transition from current, mostly on-going activities to a new portfolio. Results could also be used to identify regions where intensification of RTB crops is possible due to the existence of a large yield gap and proximity to roads and markets. As stated earlier, it is commendable that there are plans to engage in a thorough RTB-wide prioritization exercise, but some prioritization should be done already at this planning stage on the basis of key information on prior investments, impacts or lack of them, and the range of uses and value chains.

Regarding PLs 2, 3 and 4, as stated earlier, the ISPC suggests that CRPs have little comparative advantage in conducting research on partnerships, communication and capacity strengthening, and these area should be addressed as cross-cutting activities. Under this Theme the development of learning alliances will be important for the successes of the CRP. However, potential information overload needs to be carefully managed to ensure that it does not dilute the core activities of the scientists involved. PL5 will assess the impacts of prior RTB investment and it needs to link with and build on the Centres' current impact assessment efforts.

4. Quality of research and development partners and partnerships

The Centers have undertaken substantial consultations with partners when drafting the proposal, which is commendable. Partnerships are presented at multiple levels: for each theme and as a component of Theme 7. The narratives in each section provide the strongest sense of the capacity of the proposed CRP to identify and deliver partnerships that are targeted to provide pathways to achieving and scaling results. Theme 7 focuses heavily on the theory of partnership, rather than describing how the CRP partnership strategy will be developed, integrated, managed, evaluated and improved on the basis of Centers' existing experiences. CRP management should have a stronger link to the coordination of the partnership strategy, as well as broader oversight of communication and knowledge-sharing activities. The potential links with other CRPs are well articulated but these need to be supported by collaborative research.

5. Appropriateness and efficiency of Program management

A collaborative program on RTBs presents an opportunity to combine the strengths of four Centers that work on these crops in a cohesive way, yet some aspects of the proposed management structure serve to undermine this cohesiveness rather than enhance it. The proposal is highly attentive to balancing the interests and influence of the four core Centers with respect to management and priority setting. The DG of each Center serves on the Steering Committee (which is likely to include only the DGs for some time); at least one theme will be led by a candidate nominated and employed by each of the Centers; resource mobilization remains with

each Center (although this responsibility appears to also belong to the Steering Committee, the Research Theme Leaders (RTL) and the Program Director); the proposal gives considerable attention to articulating the hierarchy for the resolution of conflict; resource allocation and decision making are recommended and reviewed at multiple levels. This elaboration of process provides an impression of being overly precautionary, to avoid potential problems, rather than evoking the spirit of a new endeavour based on partnership.

Providing each of the founding Centers with the right to appoint the leader to at least one of the research themes sends the wrong signal about what criteria matter when identifying the leadership for the program at the research level. While this distribution of appointments will probably emerge at the beginning of the CRP, it is not advisable to formalise this as a way to maintain equilibrium among the four Centers. The expectation that RTLs remain part of the staffing structure at the Centers complicates the lines of authority, allegiance and accountability within the CRP as a whole. From the start, RTLs should identify with the CRP and its goals, rather than the interests and agendas of a specific Center. It would minimize the potential for conflict if the Program Director were involved in the performance evaluation of RTLs and also in the selection process.

The scale of integration and alignment necessary, as well as the refinement of strategy and priorities would justify that the face-to-face meeting of the Management Committee should be held more than once per year. As partnerships will be crucial for the CRP, the partnership strategy would be better served if it were within the management orbit of the Program Director, rather than included in Theme 7, about which concerns have been voiced above. Similarly, communications and knowledge management are vital activities if the CRP is to build awareness and advocacy for its goals, and therefore these activities should have a better defined and more influential place in CRP management.

The budget for management has been arrived at by the simple calculation of 5 percent of the total cost of program plus overhead, rather than building a budget that estimates the actual cost of management as it is presented in the proposal. If the cost of the proposed management arrangements were subject to more accurate estimation, the total would probably be less; even if more face-to-face meetings for the Management Committee were included, and partnerships and communications were coordinated at CRP management level.

6. Clear accountability and financial soundness, and efficiency of governance

The proposal presents detailed financial projections that include base and upside scenarios. However, it is not clear how much the CRP is requesting from the Fund and the size of additional resources expected from other sources. In presenting an upside scenario, it is also not clear whether the CRP is making the case for a higher investment on the part of the CGIAR, or indicating what will be required from all sources to fund the program at the most effective level. There are multiple references to raising additional resources, but the budget presentation does not specify what level of funding the CRP expects to procure in this way. A detailed resource-mobilization strategy is needed against specific goals for either scenario.

In general, CIP, as the lead Center, has balanced its need for the authority and oversight necessary to fulfil its fiduciary and contractual obligations, with its role as a partner with the other Centers. There is a strong reporting relationship between the CIP board and the Science Advisory Committee. A link is also suggested between the board and the Steering Committee. However, the ISPC does not think it would be appropriate if the CIP board were to have a formal representation in the Committee. The balance continues at the management level with the DG of CIP chairing the Steering Committee and the CRP Director serving as a member of the committee, *ex officio*. It is commendable that additions to the Steering Committee are reviewed and recommended by the Management Committee. It is reassuring that a place on the Committee is not automatically granted in exchange for support, and thus the Committee retains its integrity as a body that contributes to the continuing processes of prioritization and alignment of research.

The proposed Science Advisory Committee provides a good mechanism for independent oversight of science quality, overall performance and priority setting. Its work is linked to that of the Program Director and the Management Committee. The chair of the Committee also makes a direct report to the Lead Center's board, and has the authority to recommend external evaluations of the program. Although the Committee's value and role is clear there is no indication of how the Chair will be appointed and it is not clear how open the process of appointing members will be. It would be good practice if the Chair were selected from among Committee members, and through a process that requires members' approval of the Chair. The Steering Committee, which appoints the members of the Science Advisory Committee, should open the process of recommending potential candidates to broader input, including partners and stakeholders. A reasonable term ought to be established for committee members and reasonable expectations established for the time required to serve effectively.