



RESEARCH
PROGRAM ON
Roots, Tubers
and Bananas

RTB Seed Systems: Conceptual Frameworks for Guiding Practical Interventions

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RTB Seed Systems: Conceptual Frameworks for Guiding Practical Interventions¹

Note: This is a preliminary version of the working paper which we are making available to stimulate discussion. We are still incorporating comments provided during an earlier workshop and will broaden the authorship as we move forward.

Overview and rationale

This Working Paper (RTB WP#1) presents a first set of conceptual tools for use in designing, developing and implementing seed² system interventions linked to the RTBs (Root, Tubers and Banana). The aim of these tools is to help policy makers, researchers and other implementing stakeholders (i.e. private sector, government organizations, farmer organizations, etc.):

a) think strategically and b) plan practically.

These tools are regarded as in draft form (and the facilitators title this draft #1), as we expect RTB and seed systems specialists to refine and improve them quickly, as they are used across crops and contexts and varied types of seed system programs. In addition, the framework will need to be further validated with a range of real cases of RTB seed system interventions in order to test its robustness to guide decision making.

Rationale

The rationales for developing these frameworks for thinking and action are straightforward.

- A Descriptions of what is needed for seed system improvement, for the RTBs and other crops, often tend to be piecemeal. Understandably, researchers and practitioners often focus on their own leverage points-- e.g. improving seed quality, or breeding, or seed storage (etc.), rather than looking at the whole, that is, taking a holistic view.
- B Linked to A, seed program activities often focus on the supply side, how to multiply seed and how to ensure that such seed is of good quality (hence issues of 'availability' and 'quality'). Needed features that may emerge on the demand side, from users (and especially issues of 'access') frequently are given less visibility.
- C Different perspectives, different stakeholders may see the problems or solutions for seed system enhancement differently. These different perspectives to 'a problem or an opportunity' need to be taken into account. If seed systems are to function well, roles of

¹ Sperling *et al.* in preparation RTB Seed Systems Conceptual Frameworks for Guiding Practical Interventions, Working Document 2013-1 CIP-RTB:Lima.

² Note that 'seed' is used as a short-hand for all types of RTB planting material, tubers, vines, stems....

different stakeholders need to be complementary and seamless. Stakeholders need to see how they fit together in a seed system whole.

- D Seed system frameworks need to be problem-oriented or problem-solving oriented, and not just descriptive. There may be numerous options for dealing with any one constraint or for taking advantage of a distinct opportunity. Those options need to be brought together and compared.
- E Finally, not everything can or should be tried in programs aiming for seed system improvement. The CRP-RTB (and other research and development initiatives) need to decide where to invest and where may be the 'best or better bets' (according to goals and contexts). A framework has to guide these decisions. A framework has to help people think. It has to serve as a decision-making tool.

So, in brief, we aim for a framework that is: holistic, balanced to meet varied user needs, and problem-solving so as to achieve maximum effectiveness. The tools presented below should help move us in these positive directions.

Tools/frameworks introduced

Three separate tools are presented in RTB Working Paper:

- I. A broad conceptual framework:
entitled: **Multi-stakeholder framework for intervening in RTB seed systems**
- II. A guide for thinking through the overriding goals of any seed system intervention:
entitled: **Definition of Goals of Seed System Work**
- III. A table of salient features for distinguishing among varied contexts:
entitled: **Key parameters for differentiating among Seed Systems Contexts**

The three are introduced separately only for ease of presentation: they need to be used as a unit, and as an interactive unit, to guide effectively seed system development.

I. Multi-stakeholder framework for intervening in RTB Seed Systems

Structure of framework

The framework proposed to guide planning interventions in RTB seed systems (see Table 1) has two basic axes.

- The basic features that need to be place for effective seed system functioning form the horizontal axis.
- The varied stakeholders who need to be informed and engaged in seed system development form the vertical axis.

Horizontal Axis: Critical Seed System features

The critical features identified for effective seed system functioning draw and build upon those routinely used for ensuring food and seed security in diverse regions of the world. The central set has been tested for well over a decade. The proposed CRP-RTB framework learns from these but expands them greatly. Specific RTB issues are incorporated; features are reinforced to ensure that both supply side and demand side parameters are integrated into planning.

The key features needed to help design functioning and sustainable RTB seed systems include:

- **Availability/supply.** Seed has to be available in sufficient quantity (at varied levels of production. Breeder, foundation/basic/ decentralized..., depending on the goals of the intervention and the context).
- **Accessibility:** Seed has to be accessible in time and in proximity. Here we have subdivided this category for a set of practical features linked to 'accessibility'.

Delivery channels:- Delivery channels have be in place to reach a range of stakeholders (at different levels)

Affordability/profitability features: the seed has to be affordable (from enduser point of view); It also has to be profitable (profitable to plant, from user point of view; profitable to sell- from producer or provider point of view)

Information systems: These systems have to be in place at many levels for two central purposes:

- To create awareness of seed/products (including how to use)
- To create a sustainable demand

Theoretically, training/skill building could also be in this 'information' category (although for programming actions, it can also be integrated within each other feature.)

- **Variety quality.** The variety (or clusters of varieties) put on offer have
 - To be adapted;
 - To meet users' needs: in terms of use preferences, market preferences, processing preferences

(Note that biodiversity issues would fall within the feature of variety quality)

- **Seed quality.** The seed/planting material has to be healthy, in good physical condition; true to type (if requirement)....

Vertical Axis: Stakeholders in Seed System Development

Vertically, the varied stakeholders involved in seed system research development (R+D) are listed. The set is a basic one, which can crosscut crops. The list can be refined further (stakeholders added or removed) depending on crop use and context.

The purpose of the list is to ensure that key stakeholder needs/concerns/roles are addressed and built upon to promote complete seed system development.

Obviously, different stakeholders might have different visions and roles. There may also be a trade-off in stakeholder roles. For instance, roles currently filled by NARS extension (e.g. passing information on new varieties) might also be accomplished by working through NGOs or farmer cooperatives.

The basic list (tentative) of RTB seed system stakeholders includes:

- Farmers (using RTB for home consumption or local sale)
- NARS scientists
- NARS extension
- Formal seed parastatals (government linked)
- Regulatory bodies (linked to variety release and seed quality maintenance)
- Private sector seed companies
- Private sector processors/agro-enterprise developers
- Private sector individual entrepreneurs (including farmers)
- Farmer organizations/cooperatives
- Non-governmental organizations (NGOs)
- Traders (those who move RTB among regions and within markets)
- IARCs
- Service providers (such as credit and insurance providers)

However, not all the stakeholders listed are relevant for all crops and in all contexts.

Functions of Framework

The functions of such a framework are multiple.

1. *It allows for the kind of holistic view needed to ensure seed systems are operational.* It helps to ensure that all key features of seed systems are given attention (for example, not just a focus on seed quality or seed production). It also helps to ensure that appropriate stakeholders are engaged--- according to the features addressed.

In some cases, the actions needed will be research ones. In other cases, actions required may be mainly developmental, or even policy related.

2. It should help clarify the roles of different stakeholders and suggest how collaboration can be maximized (or where conflict might be anticipated). It will suggest who or which organizations might be best placed to do what. In this sense it should optimize involvement and help eliminate any duplication.
3. *If used as a thinking tool, the framework tool can identify the super leverage points for R+D action.* What is working? What is not working? What is not even known? What might be the trade-offs among doing X actions or building on Y stakeholders?
4. *The framework is a useful coordination tool, when done crop by crop and country by country.* The analysis will show differences and similarities among crops and regions. The mapping as a baseline will also allow for monitoring of RTB seed system progress.
5. *The framework can be used as a useful tool for hypothesis formulation:* among features (e.g. variety is more important than seed health in x context); among stakeholders (e.g. There are more cost-benefits generated working with farmer cooperatives than with NGOs); among research thrusts (e.g. demand creation can be more effectively accomplished through mobile apps than through posters). Obviously, hypotheses need to be tailored by crop, goal and context.
6. *The framework can be used to negotiate among stakeholders, especially on key thrusts of a seed-related intervention:* This is critical and is related to the roles, responsibilities and perceptions that stakeholders may have regarding how to improve the seed system. There are examples of interventions implemented towards formalization of the seed system, but others oriented to strengthen farmers' own systems. But the thrusts should be agreed (or at least discussed) with most of the stakeholders in the system.

The framework is best used first by crop and country (context). For instance, the framework might be applied to a) native potato systems in the Andes; or b) yam seed systems in Nigeria.

Table 1. Multi-stakeholder framework for intervening in RTB seed systems (example)

Stakeholder	Availability/supply	Accessibility			Quality- 'Variety' (incl. biodiversity issues)	Quality- • Health • Physical condition
		Delivery channel features	Affordability/profitability issues	Information: • Awareness creation • Demand creation		
Across Stakeholders: Aims	Sufficient quantities available	Sustainable delivery means	Attaining cost-benefits: seed use pays off	<i>Sufficient information to allow informed choices</i> <i>Strategies in place to ensure demand</i>	Variety 'acceptable' • Is adapted • Meets user+ market prefs	Seed material is: • of desired health • In desired physical condition
<u>Farmer</u> (for own use/sale) <i>Desired aims</i> <i>Areas for intervention</i>	<i>Needed seed quantities are available</i> <i>Use better storage techniques (is this a research thrust?)</i>	<i>Seed accessible nearby</i> <i>Seed accessible in time</i>	<i>Seed is affordable (cash, barter, other)</i> <i>Use of 'X' seed is cost-effective (price versus product received)</i>	<i>Sufficient information so as to allow informed choices</i>	<i>Variety grows</i> <i>Has nice attributes (taste, cooking)</i> <i>Can sell on local market</i>	Seed condition is 'okay' <i>Develop community capacity for disease control + prevention</i>
<u>NARS (scientist)</u> <i>Desired aims</i> <i>Areas for intervention</i>	<i>Breeder seed available</i> <i>Foundation seed available</i> <i>Decentral. Multiplication network in place (fast and at scale)</i> <i>Ensure breeder seed supply through.....</i> <i>Develop rapid mult techniques.</i> <i>Develop techniques which give higher rates of mult.</i> <i>Identify better storage techniques?</i> <i>Facilitate decentralized networks</i>	<i>(multiple Foundation seed venues?</i> <i>Delivery channels in place to sell (move) more seed</i>	<i>Br. Seed cost-benefits</i> <i>Fd. Seed cost-benefits</i> <i>Assess cost-benefits of rapid mult. techniques</i> <i>Conduct specific cost-benefit analyses of quality seed use</i> <i>Characterize contexts where X quality seed pays off</i>	 <i>Develop effective communication systems on varieties and seed health</i> <i>Via PPP, assess commercial/ feed/ industrial product devel possibilities</i>	<i>Varieties ID-ed with special added attributes (linked to goals: e.g. (resistant to pathogens, healthier, geared for markets</i> <i>(more breeding, where needed)</i>	<i>Br seed is healthy</i> <i>Fd. seed is healthy</i> <i>Decentral. multipliers have capacity to control diseases</i> <i>ToT Training on 'better VPC seed management?</i> <i>(Should not this be decentralized?)</i>



Stakeholder	Availability/ supply	Accessibility			Quality- 'Variety' (incl. biodiversity issues)	Quality- • Health • Physical condition
		<u>Delivery channel features</u>	<u>Affordability/ profitability issues</u>	<u>Information:</u> • Awareness creation • Demand creation		
NARS- Extension <i>Desired aims</i> Areas for intervention				Strong communication strategy, with needed tools, in place <i>Solid set of information tools (not an R issue; a D issue)</i>		
<u>Formal seed parastatals (gov't</u> <i>Desired aims</i> Areas for intervention	Foundation seed available <i>Test/develop organizational options for producing fd seed</i>			Foundation seed in demeaned, with multiplication cost-effective <i>Assess costs of varied fd seed multiplication options</i>		
<u>Regulatory bodies</u> <i>Desired aims</i> Areas for intervention						<i>Inhibit movement of diseased materials</i> <i>Hasten movement of clean materials</i> <i>Develop realistic (+ independent) natl + regional quarantine procedures</i> <i>Reform quality standards- (realistic)</i> <i>Develop s capacity for on site inspection (when/where)</i> <i>Work to formally recognize farmer- based systems</i>



Stakeholder	Availability/ supply	Accessibility			Quality- 'Variety' (incl. biodiversity issues)	Quality- • Health • Physical condition
		<u>Delivery channel features</u>	<u>Affordability/ profitability issues</u>	<u>Information:</u> • Awareness creation • Demand creation		
<u>Private sector seed companies</u> <i>Desired aims</i> Areas for intervention	Seed of commercially profitable VPC products available <i>Scale up multiplication where VPC crop already high value</i>		<i>With NARS/farmer organizations, Test models of sale (e.g 20 kg packs)</i>	<i>Farmers know about profitable VPC products</i> Stimulate / expand market for VPCs (planting material + product) <i>Widespread information campaigns on profitable attributes and sites for buying material</i> <i>Via PPP assess potential for commercial/ feed/ industrial product development</i>		
<u>Private sector- product developers: processors/agroentr</u> <i>Desired aims</i> Areas for intervention	Need larger volumes of product—not seed) <i>Test decentralized organizational options to produce larger volumes, on schedule</i>		<i>Develop true business models (linked to value chains-)</i>	<i>Farmers know about profitable VPC products</i> Stimulate / expand market for VPCs (planting material + product) <i>(linked to seed company above) Via PPP assess potential for commercial/ feed/ industrial product development</i>		



Stakeholder	Availability/ supply	Accessibility			Quality- 'Variety' (incl. biodiversity issues)	Quality- • Health • Physical condition
		<u>Delivery channel features</u>	<u>Affordability/ profitability issues</u>	<u>Information:</u> • Awareness creation • Demand creation		
<u>Private: farmer entrepreneurs</u> <i>Desired aims</i> Areas for intervention						
<u>Farmer Orgs/cooperatives</u> <i>Desired aims</i> Areas for intervention	<i>Working w/Coops as possible key node of seed production?</i>	New, better varieties available to members- for sale		Solid information on varieties + their sourcing/production		

Stakeholder	Availability/ supply	Accessibility			Quality- 'Variety' (incl. biodiversity issues)	Quality- • Health • Physical condition
		<u>Delivery channel features</u>	<u>Affordability/profitability issues</u>	<u>Information:</u> • Awareness creation • Demand creation		
<p><u>NGOs</u></p> <p><i>Desired aims</i></p> <p>Areas for intervention</p>	<p>Ensure local availability of planting material</p> <p><i>Work on decentralized initiatives to multiply (linked to sale)</i></p> <p><i>Test range of <u>technical</u> and <u>organizational</u> options for multiplication at 'decentralized levels'</i></p>	<p>Ensure <i>sustainable</i> delivery of planting material—even among poorest</p> <p><i>Stimulate marketing channels through nodal farmers? Community groups?</i></p>	<p><i>Offer partial vouchers? (shared costs?) for stressed/ vulnerable farmers</i></p> <p><i>Evaluate cost-benefits of varied technical + organization options for multiplying and diffusing seed</i></p>	<p><i>Catalyze <u>sustainable</u> demand</i></p> <p><i>Raise awareness on:</i></p> <ul style="list-style-type: none"> <i>better varieties?</i> ... 		
<p><u>Market traders</u></p> <p><i>Desired aims</i></p> <p>Areas for intervention</p>		<p>(leverage on trader seed flows to move new materials)</p> <p><i>Have specialized traders selling new VPCs?</i></p>		<p>Stimulate awareness to stimulate demand for VPC, esp. new varieties</p> <p><i>Better link traders to information on new varieties</i></p>		



Stakeholder	Availability/ supply	Accessibility			Quality- 'Variety' (incl. biodiversity issues)	Quality- • Health • Physical condition
		<u>Delivery channel features</u>	<u>Affordability/ profitability issues</u>	<u>Information:</u> • Awareness creation • Demand creation		
IARCS (as NARS, <i>plus</i>) <i>Desired aims</i> Areas for intervention						
<u>Service providers:</u> <u>e.g. credit providers</u> <i>Desired aims</i> Areas for intervention		<i>Link Serv P. to nodes of entrepreneurship</i>				

II. Definition of Goals of Seed System Work³

Seed security programs might potentially be designed to meet very different goals. The most common goal in advocating seed security projects is that they promote food security through brute production gains. Hence the logic of the goal toward seed security might run as follows: seed production needs to be scaled up; increased seed availability will drive increased and widespread adoption of new varieties; increased production of staple crops will then result.

However, in reality, the scope of agriculture is multifunctional and goes far beyond scaling up production of staples. To the extent that seed is one basis of agriculture, seed must also be multifunctional.

So seed security interventions can be designed to meet goals beyond aggregate increases in food supply and subsequent calories. For instance, they can and are being linked to programs to enhance nutrition: that is, crafted to move biofortified varieties, crafted to move nutritious local varieties and to multiply and deliver planting material of a diversified set of dietary options. As another goal, seed security programs can and are being designed mainly to link with agro-enterprise initiatives. Here, the major driving force is income generation and the seed system design needs to be streamlined to provide large quantities of uniform material (planting material and product) on a relatively continuous basis. Alternatively, promoting agricultural system resilience and 'climate smart' responses might serve as the overall development aim of seed security programs which are then tailored to offer a basket of options of varieties and crops to meet varied and flexible production niches. (Note that seed system programs which promote biodiversity share some of the features of those which aim for system resilience).

At the most basic level, seed systems designed to meet different program goals might start with very different types of crops and variety characteristics, might engage somewhat different stakeholders and might embrace divergent awareness-raising strategies (as examples of features which might need to be tailored). In Table 2, we have sketched, practically, some suggestions on how seed system program goals might shape some of the specific seed program features. The table is indicative and not aiming to be comprehensive (Table 2).

³ This section draws substantially from: L. Sperling and S. McGuire 2012. Fatal gaps in seed security strategy. *Food Security* (4):569-579.

Table 2. Select features in planning and implementing seed system projects with diverse goals*

Goal	Partners: broad profile	Quality- Variety	Awareness-raising /information strategy
1. Food production	<p>NARS and agriculture + food production ministries (from field level to centralized offices)</p> <p>Formal seed producers (private companies/ gov't parastatals)</p> <p>Community-based seed multiplication groups</p> <p>Local seed/grain market traders</p> <p>NGOs/Farmers' organizations interested in general seed multiplication</p>	<p>Preferred agronomic traits (often yield, early maturity, resistance to specific stresses)</p> <p>Preferred end-user traits for consumption, especially post-harvest processing and cooking qualities</p> <p>Preferred end-user traits for local market acceptance</p>	<p>Use of 'Classic channels'</p> <ul style="list-style-type: none"> • Agricultural extension visits • posters • field days • rural radio with agronomic messages <p>(should increasingly use: social networking, mobile phones, SMS)</p>
2. Nutrition	<p>As above in #1 <i>plus</i></p> <p>Government nutrition, home economics and health programs (from field level to centralized offices)</p> <p>NGOs/CBOs linked to mother-child health and nutrition programs.</p> <p>Emergency feeding programs, and others supplying ready-to-use therapeutic foods</p>	<p>Key agronomic acceptance traits as well as targeted nutritional traits (such as high micronutrient content)</p>	<p>Needs an information- rich outreach strategy (e.g. social marketing)</p> <p>Information strategy geared to showing value of the 'invisible', and possibly guidance on food preparation.</p> <p>Geared to nutrition managers, incl. mothers!</p> <p>Requires sophisticated demand-creation techniques (possibly to reach an unconventional buyer: malnourished, especially vulnerable).</p>
3. Income generation	<p>(#1 government actors to be informed, <i>plus</i>)</p> <p>Those along market chain</p> <p>Public or private sector buyers</p>	<p>Products that meet rigorous market requirements, including uniformity (note that varieties may be suboptimal in agronomic terms)</p> <p>Volumes for intermediary buyers that are guaranteed</p> <p>Enterprise models that lower individuals' risk of market exposure</p>	<p>Needs sophisticated demand creation techniques across full value chain (including processors as well as users and buyers of raw products).</p> <p>Needs successful branding of seed product (i.e. outward-looking information component).</p> <p>May need clear information strategy on the trade-offs between yield and market value.</p>

* modified from Sperling and McGuire, 2012

III. Key parameters for differentiating among Seed Systems Contexts

Finally, not all contexts in which seed system programs are strengthened or developed are the same. One important input to developing effective seed systems is to understand the salient features of these contexts, that is, which are the truly determinant or driving features which shape the kinds of seed systems which can be promoted. If we are able to characterize the salient features of seed system context (the big driving forces), our ability to learn lessons and transfer 'better practices' from one context to another, even across RTB crops, should be enhanced.

Below, find below a first suggested list of driving forces shaping seed systems for RTBs (Table 3). Our aim to capture those that salient features that are more universal. Note that it is easy to draw up a long list (including features that are less important as key) and to create a list that encompasses all sorts of seed system peculiarities. However, to arrive at a set of essential features takes a good deal of thinking and cross-site comparisons. The list below aims to stimulate discussion: it is tentative and open to revision. Next to each feature (the left column) is a description of its content (middle column). Additional explanatory notes are on the right.

Table 3. Key contextual features driving design and development of RTB seed systems

Context feature		Content	Comment
1	Goal of seed system intervention (end use)	<p>Of-cited goals:</p> <ul style="list-style-type: none"> • Food security • Income generation (including value addition/processing-commercialization) • Health/ nutrition outcomes • Social safety net (welfare) outcomes • Biodiversity enhancement/conservation 	<p>Other specialist goals also arise: e.g. developing seed systems to meet transborder quarantine regulations</p> <p>Also note that seed systems can be designed to meet multiple goals.</p> <p>Goal affects: type of material multiplied (variety profiles) , quality, timing of product production , volumes needed, partners engaged, information systems needed</p>
2	Seed quality/ease of propagation	<p>Degree to which producers themselves can control needed seed quality.</p> <p>Degree to which producers can multiply planting material with relative 'ease'</p>	<p>Materials that are easily managed can often be moved fairly effectively through informal systems</p> <p>Presence/absence of key pests diseases esp. affect ability to manage second generation materials</p>
3	Portability (transportability) or seed/planting material	Degree to which potential seed demanders could access seed from production areas located far away and with limited transport infrastructure	Might include issues of volume, perishability. Tubers very different from vines/suckers
4	Scale of desired operation	Geographic scale Volume targets	Seed system interventions at local level would be different from regional systems, where economies of scale and comparative advantages among regions would influence seed production efficiency
5	Regulatory System (enabling or less so)	Tradeoff between formalization of the system or strengthening of farmer own-systems, or intermediate schemes such as quality declared seed (QDS)	<ul style="list-style-type: none"> • What quality of planting material is recognized • Ease of moving materials across borders
6	Strength of R+D institutions	National R+D set up	Are important institutions functioning? Can any weaknesses in functioning be compensated for by other stakeholders?

Concluding comments

These three tools together, focusing on seed system features/stakeholders; goals, and contexts for seed system development can go a long way in helping us all think and plan in more effective ways. They remind us that seed system development goes well beyond 'seed' (multiplication, deliver, etc). Such development needs to be tied to stakeholders wants and needs, often being shaped with in dynamic and challenging contexts.