

Decision Tree for Planning for a Field Genebank (FGB)

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{This outline was prepared during, and reworked subsequent to, the IPGRI Workshop on “Field Genebank Management: Problems and Potential Solutions” 12-18 November 1995, Mayaguez, Puerto Rico. It is certainly not yet a complete decision tree, but offers guidance to those who plan to establish a Field Genebank. Suggestions to improve this decision tree are welcome and will be credited in the event that the tree is published. CRC}

When planning to establish a FGB, considerable preliminary information is necessary to justify it, since a FGB is a long-term, expensive investment. The outline that follows is designed to help organize the information that you will need to justify a FGB and to help decide if it is necessary and, if it is, what kind should be established.

1. Is a FGB necessary?

The information in this section of the tree is designed to clarify exactly the nature of the product to be genebanked. This section contains several yes/no dichotomies; if the answer is no, the entire proposal should be reconsidered.

- a. Type of product targeted
 - i. Basic food staple (e.g., cassava, potato, rice, etc.)
 - ii. Horticultural product
 - (1) Vegetable
 - (2) Fruit
 - (3) Flower
 - (4) Herb or spice
 - (5) Other
 - iii. Forest or multipurpose product
 - (1) Timber
 - (2) Fuel wood
 - (3) Green manure
 - (4) Other
 - iv. Other products
- b. Species identification
 - i. Name of principal species on market
 - (1) Common (scientific)
 - (2) Type of plant genetic resource (PGR) (cultivar, population, wild, etc)
 - ii. Name of alternative species on market
 - (1) Common (scientific)
 - (2) Type of PGR (cultivar, population, wild, etc)

- iii. Name of species with market potential
 - (1) Common (scientific)
 - (2) Type of PGR (cultivar, population, wild, etc)
 - (3) Why might the new species gain market share? Who agrees with you? What do they know? Are they reliable?
- c. Type of market targeted
 - i. Subsistence
 - (1) Local
 - (2) National
 - (3) Export
 - ii. Middle class
 - (1) Local
 - (2) National
 - (3) Export
 - iii. Luxury
 - (1) Local
 - (2) National
 - (3) Export
- d. Market characteristics
 - i. Market exists
 - (1) Current product in market, if not targeted product?
 - (2) Size of market (volume of product or total value of market)
 - (3) Current suppliers (the competition!)
 - (a) Location
 - (b) Quality of product
 - (c) Scale of production (hectarage and costs of production)
 - (d) Profit margin
 - (4) Alternative products in same market niche? (Identify each)
 - (a) Location
 - (b) Quality of product
 - (c) Scale of production (hectarage and costs of production)
 - (d) Profit margin
 - (5) Is market expanding? Or can product substitution succeed? (Who are your sources of information? Are they reliable? Can their opinions be verified objectively?)
 - (a) Yes - continue with this exercise
 - (b) No - think about stopping here! There may not be sufficient justification for a FGB for this crop.
 - ii. Market does not exist
 - (1) Does demand exist? (Who are your sources of information? Are they reliable? Can their opinions be verified objectively?)
 - (a) Yes - continue
 - (b) No - think about stopping here!
 - (2) Who will create the market?
 - (a) You - Are you qualified? Ready to spend the time?
 - (b) Your organization - Is it qualified?

- (c) Someone else - Identify and describe their qualifications
 - (3) Is the market creator capitalized?
 - (a) Yes - continue
 - (b) No - think about stopping here!
- e. Information on genetic resources
 - i. Origin of PGR supplying the market
 - (1) Location (principal, alternatives)
 - (2) Availability (free, patented, other IPR?)
 - (3) Edaphoclimatic requirements
 - (4) Degree of selection (wild, cultivated, landrace, cultivar)
 - ii. Adaptation of PGR to your site
 - (1) Known to be adapted
 - (2) Unknown, but edaphoclimatic requirements similar
 - (3) Totally unknown
 - (a) Are you financially prepared to find out? (This may require a variety trial at your site or a plant improvement program)
 - (i) Yes - continue
 - (ii) No - think about stopping here!
 - (b) Is there someone that, given the projected market, is prepared to finance you?
 - (i) Yes - continue
 - (ii) No - think about stopping here!
 - iii. Yields of PGR at your site
 - (1) Inferior to the competition (think about stopping here!)
 - (2) Similar to the competition
 - (3) Superior to the competition
 - iv. Costs of production of PGR at your site
 - (1) Inferior to the competition
 - (2) Similar to the competition
 - (3) Superior to the competition (think about stopping here!)
 - v. Quality of PGR at your site
 - (1) Inferior to the competition (think about stopping here!)
 - (2) Similar to the competition
 - (3) Superior to the competition
 - vi. Genetic improvement requirement?
 - (1) Yes (if answers to e.i-v are unsatisfactory, but answers to d.i.5., d.ii.1-3 are yes, genetic improvement may be cost effective.)
 - (a) Prepare a cost/benefit study (with best available numbers)
 - (b) Determine that financial support is available for the costs involved
 - (2) No
 - (a) Existing PGRs are satisfactory, therefore FGB unnecessary
 - (b) Genetic improvement is not cost effective - think about stopping here!
 - vii. Objectives of FGB
 - (1) Working collection only
 - (a) Elite PGRs already exists
 - (b) Other long-term collections already exist

- (2) Multi-purpose collection (characterization & evaluation)
 - (a) Preliminary yield evaluations required
 - (b) GxE interactions suspected
- (3) Long-term conservation
 - (a) Is crop valuable enough to justify this?
 - (b) If not, who will pay?
- (4) All of the above

2. Acquiring PGR

Once the decision has been made to establish a FGB, this section outlines some of the options for going about the process of obtaining the PGR that are to be included in the FGB. Besides obtaining PGR, information on the resource is essential in order to manage it adequately. As in section 1, there are several decision nodes that identify places where it may be important to rethink the entire project.

- a. PGRs exist in other FGBs
 - i. At CGIAR
 - ii. At regional FGBs
 - iii. With private individuals or corporations
- b. PGRs do not exist in FGBs
 - i. Preliminary information necessary on species
 - (1) Reproductive strategy (autogamous, allogamous, mixed, apomictic, etc.)
 - (2) Reproductive unit (seed, vegetative, plant)
 - (3) Type of PGR (wild, cultivated, landrace, cultivar)
 - (4) Genetic structure of populations
 - (a) High variability within, low between
 - (b) High variability between, low within
 - (5) Biogeography of species and subspecific groups
 - (6) Define sampling strategy based on 1-5 above
 - (7) Estimate ideal size of FGB
 - (a) Number of accessions to represent species
 - (b) Number of individuals to represent accession
 - (c) Size of FGB (total plant numbers, hectares)
 - (8) Prepare FGB budget (who will pay?)
 - ii. Preliminary information necessary on institution
 - (1) Tradition of institution with PGR
 - (a) Long tradition - good risk
 - (b) No tradition - poor risk
 - (2) Tradition of institution with germplasm improvement
 - (a) Long tradition - good risk
 - (b) No tradition - poor risk
 - (3) Degree of government support to institution and PGR
 - (4) Degree of institution/private sector interaction
 - (5) Number of researchers (also % time to project)
 - (6) Degree of researcher rotativity (Salaries of researchers at institution vs in

- private sector: if ratio is low - rotativity is potentially high.)
- (7) Re-estimate size of FGB in light of 1-6 above
 - (8) Re-estimate budget for FGB
- iii. Preliminary information necessary on financing
- (1) Who will finance FGB?
 - (a) Government
 - (i) Identify risks of policy changes
 - (ii) If brain-child of one politician, financing could evaporate fast - think about stopping here!
 - (b) International agency
 - (i) How long is project length in relation to plant life cycle?
 - (ii) How long is project length in relation to genetic improvement cycle?
 - (iii) Where will funds come from when international agency pulls out?
 - (c) Private sector
 - (i) Evaluate degree of interest (size of market, profit margin, etc, can help here)
 - (ii) Evaluate risk of loss of interest
 - (2) Who will finance acquisition of PGR? (If financing exists for PGR collecting but not FGB, think about stopping here!)
 - (3) Is financing sufficient to attain 2.b.i.7.c?
 - (4) Re-estimate size of FGB in light of iii.1-3
 - (5) Re-estimate budget for FGB
- c. Projected size of FGB
- i. Representativity (if projected size is smaller than ideal size (2.b.i.7.c) representativity is reduced. Some alternatives are:
 - (1) Practice selection during collection - results in working collection less suitable for long-term conservation
 - (2) Reduce sample size - results in reduced representativity throughout collection
 - (3) Reduce biogeographic coverage - results similar to c.i.1.
 - (4) Combination of a-c depending upon apparent variation observed during field collections - results similar to c.i.1.
 - ii. Prepare complete budget for FGB
 - (1) Project budget to cover establishment, characterization, evaluation and use in first cycle of genetic improvement program.
 - (2) Show benefit from these costs, assuming that first cycle results in 10% yield improvement and 20% quality improvement.
 - (3) Calculate cost/benefit ratio - Is it cost effective?
 - (a) Yes - continue
 - (b) No - reduce FGB and genetic improvement objectives and budgets (do not change improvement projections!) until an acceptable cost/benefit ratio is obtained. Is this still worth pursuing? If not, think about stopping here!
 - iii. Is financing available for FGB and PGR collection?
 - (1) Yes - continue
 - (2) No - reevaluate whole program and think about stopping here!

3. Establishing the FGB

This section outlines a few of the major topics to be considered in terms of actually establishing the FGB at your site. Although no specific decision nodes are identified here, full consideration of this information may suggest that the FGB is not practical or cost effective.

- a. Site selection
 - i. Does your institution's site meet the species' edaphoclimatic requirements? Is it similar to producer sites?
 - ii. If not, what are your alternatives?
 - (1) Other institutions?
 - (2) Private corporations?
 - (3) Private growers?
 - iii. Evaluate the risks of each alternative
 - iv. Evaluate the costs of each alternative
- b. Site preparation
 - i. Follow commercial recommendations as closely as possible
 - ii. Only modify for experimental reasons if there is a high probability of the experimental results being immediately adopted by the private sector
- c. FGB design
 - i. Optimize design based upon objectives and PGR representativity
 - ii. Minimize costs where possible
 - iii. Replication for evaluation (and characterization?)
 - (1) At least 3 replicates are required to provide reliable evaluation data at one site
 - (2) Two or more locations over the edaphoclimatic range of growers provides even better data
 - (3) A cost/benefit analysis, assuming greater efficiency in the improvement program, may help justify the added costs
- d. Site maintenance
 - i. Are there options of reducing maintenance costs while maintaining crop performance?
 - (1) Vegetative ground covers to suppress weed growth?
 - (2) Animals to control vegetative ground covers?
 - ii. Can these be recommended to growers also?
- e. Cost recovery
 - i. What can be done to defray costs at the site?
 - (1) Sale of economic product via private sector?
 - (2) Sale of alternative products (animals used to control ground covers?)
 - (3) Sale of PGR to private sector?