A Research Article in AJRTC (2010) Vol. 8 No. 1: Pages 6–12

Setting priorities: case study of IITA's root and tuber crops systems program

V. M. Manyong[1], R.U. Okechukwu[1], P. Ojiambo[2], and R. Asiedu[1]

[1]International Institute of Tropical Agriculture, PMB 5320 Oyo Road, Ibadan, Nigeria.

[2]Department of plant pathology, North Carolina State University, Raleigh, USA.

Corresponding Author: V.M. Manyong

Email: v.manyong@cgiar.org

Manuscript received: 30/04/2008; accepted: 30/06/2008

Abstract

This report presents results from a priority setting exercise conducted on the strategic objectives and activities of the Root and Tuber Systems Program as a part of a process to develop strategic plans to guide the activities of IITA for the following 10 years. The scoring method was applied to rank activities and statistical tests were used to validate the ranking from the scoring method. Thirty-five Project members participated in data generation.The results indicate the proportion of each strategic objective between 18 and 22%. Within each strategic objective, the score of each activity relative to the maximum achievable score resulted in the ranking of activities. Statistical tests showed some activities to be significantly not different in ranking from others. There is a clear importance attached to activities of strategic objective 1, compared to those of the others. Activity 4 of strategic objective 1 emerged as a top activity among all the activities. The disciplines of scientists did not affect the scores significantly or the perceived importance of activities. It is advocated that priority setting is an iterative process that needs to be implemented continuously in various steps to improve the efficiency of the project operations.

Key words: priority setting, Root and Tuber Systems Project, IITA

Introduction to priority setting

Priority setting is relevant for decision-making and resource allocation at the institute level, i.e., for investments across agroecological zones or across projects. Priority setting is important to achieve a better understanding of the factors leading to changes in the use of technology at the farm, regional, or ecoregional level. Priority setting can also take place at the Project level, i.e., for the choice of research activities within the Project. Priority setting is important because it results in greater efficiency of operations through a better choice of interventions among alternative options, and it leads to an optimal allocation of scarce resources to operations. During the process of priority setting there is a greater participation of stakeholders leading to increased ownership of the Project.

IITA has a long tradition of setting priorities for its research agenda. The Institute has been using a bottom to top approach to define its research priorities across programs and ecoregions. For example, the strategic plans and priorities developed by the three regional agricultural research organizations provided a solid basis for the new research agenda in the IITA Strategic Plan 2001–2010. The process of setting priorities at the Institute level takes place through several mechanisms. During the development of the rolling three-year Medium Term Plan (MTP) program, priorities are discussed. Yearly, scientists meet during the Strategic Planning Week organized to agree on the future directions of the Institute. Occasionally, members of an MTP Project also meet to define priorities within their Project.

There are many approaches that can be used in priority setting. Manyong et al 2001 identified 11 approaches. Each has its strengths and weaknesses and priority setting may involve a combination of two or more. One of these is the scoring method that was deemed appropriate for setting priorities within the MTP for the Roots and Tuber Crops System Project. It can be conducted in a relatively short period of time and no advanced analytical skills are required. It is possible to include all disciplines in the priority setting exercise and both qualitative and quantitative information can be used. It is based on a multitude of criteria that reflect a set of research objectives. Relative weights are attached to the objectives and finally priority setting takes place. Some of the disadvantages are from the overlap on objectives, duplicate criteria, or subjectivity in assigning weights. A more complete description of the scoring method can be found in Alston et al 1995.

Process for setting priorities of the MTP R & T crops. To advance IITA's seven MTP Projects from reporting units into planning and operational ones , the Institute's Management asked all Projects to develop strategic plans that would guide their activities for the next 10 years. In line with this directive, the members of the Root and Tuber Systems Project met in November 2006 and developed a draft strategic plan. This draft was presented early in 2007 to IITA's Research-for-Development Directorate, IITA's Board of Trustees, and the panel for the Institute's sixth External Program and Management Review. A major comment from these reviews was the need to reduce and prioritize the number of proposed activities (tactical objectives) for the Project. A workshop was therefore organized in Maputo, 13–15 October 2007, to review the draft, with emphasis on prioritization. Several Project members and representatives of partner institutions attended this workshop. The participants at the workshop actually increased the total number of activities from 57 to 59 following the revision of proposed activities in the November 2006 meeting (Table 1). These 59 activities were subjected to the first round of priority setting using the methodology described below Twenty-six Project members present in Maputo contributed to this first round. Based on an extensive discussion of the results, some activities were eliminated or merged with others, leading to a total of 28 activities that were subjected to a second round of prioritization.

Materials and Methods for setting priorities

Source of data and data input. The results from the first round of priority resulted in five strategic objectives and 28 activities (Table 1), which were submitted to the second round of priority setting. Data were from 35 respondents who are members of the MTP Root and Tuber Systems Project. The Project members were from 11 major disciplines, agronomy (2), biotechnology (5), crop protection (2), economics (4), entomology (1), food technology (2), GIS (1), pathology (4), plant breeding (8), soil science (3), and virology (1).

Each respondent was asked to assess each activity under each strategic objective, based on five outcome criteria that more and less describe the IITA mission: contribution to food security (Cr1), contribution to income generation (Cr2), contribution to protection of the environment (Cr3), contribution to building institutions involved in research for the development of root and tuber crops in Africa (Cr4), and contribution to quality of science (Cr5). During the 2007 meeting, Project members assigned relative weights such that most important criteria had a heavier weight (see details on weights in annex 1).

Using a structured questionnaire (annex 1), respondents were asked to score each activity between 1 and 10 for each criterion. The score of 1 indicates

Table 1. Project strategic objectives and corresponding numbers of proposed activities in 2006 and 2007.

	Project Strategic Objective	No. of Activities		
		Nov 2006	Oct 2007, first round of priority setting	Oct 2007, second round of priority setting
1	Increase productivity of root and tuber crops	6	8	7
2	Reduce production and consumer risks	13	15	7
3	Add value and expand markets	7	8	5
4	Analyze policies and advocate those supportive of the root and tuber sector	15	12	6
5	Strengthen NARS capacity for root and tuber crop research	16	16	3
	Total	57	59	28

a low contribution of an activity to an outcome criterion and 10 indicates a high contribution. Data management used the aid of an Excel spreadsheet. All completed forms were received from respondents through emails. Each received form was cross-checked to confirm that it was filled according to the guidelines, and whether each data cell had been completed. Where there was non-compliance, attempts were made to get the respondent to resubmit the completed form or to clarify it.

Analytical models. Two analyses were conducted: first to define priorities and then to validate results from the priority setting.

Defining priorities. The definition of priorities is based on the weighted mean score of positive responses; that is the product of mean score and frequency of responses with scores more than 0 over the total number of responses. This method combines the relative importance scientists attach to a criterion, as shown by the mean score, and the popularity of that criterion, as shown by the proportion of scientists who chose it.

score showed the relative importance of the activity for a strategic objective (SO). A plot of the proportion of each grand mean score of each SO to total maximum achievable mean score for SOs indicated the importance of an SO relative to all the others.

Validating the ranking of priorities. The results from priority setting were further subjected to general linear model test using SAS GLM procedure (SAS 2003) to evaluate if weighted means scores for activities within each SO were statistically different ($p<0.05$). Means were separated for each SO by means of Duncan multiple range test (DMRT) (Gomez and Gomez 1984) when the analysis of variance showed a significant difference in activities.

Because of the non-uniform distribution of the disciplines of respondents, the effect of discipline on scores provided was also tested. To reduce this variance a reclassification of disciplines was done, based on expert advice. Group 1 was constituted with technical scientists (plant breeders, agronomists, biotechnologists, and soil scientists). Group 2 were Integrated Pest Management scientists (pathologists,

Let us assume

N	=	total number of responses
n_j	=	number of respondents with a weight > 0 to criterion j
s_{ij}	=	score given by Respondent i to criterion j (I = 1…35)
i	=	Respondent i (i = 1…35)
j	=	Criterion j (j = 1…5)

$$\bar{X}_j = \textit{Mean score for criterion } j$$

$$W\bar{X}_j = \textit{Mean score weighted by frequency for criterion } j$$

Then

$$\bar{X}_j = \frac{\sum_{t=1}^{N} s_{ij}}{N} \quad \text{and}$$

$$W\bar{X}_j = \frac{n_j}{N} * \bar{X}_j = \frac{n_j}{N} * \frac{\sum s_{ij}}{N} \qquad \text{---------(1)}$$

Equation (1) describes the set of formulas that were embedded in the Excel spreadsheet to derive the weighted mean score used in ranking of activities or strategic objectives.

A plot of the proportion of each weighted score for each activity to the maximum achievable weighted

entomologists, virologists, nematologists, and others in crop protection). Group 3 were “human” scientists (economists, food technologists, and GIS specialists). The distribution of respondents under this grouping is shown (Fig. 1). Using this new classification, Chi-square analysis was performed to test unweighted scores obtained for activities by the discipline doing the assessment for each criterion using SAS FREQ procedure. For confirmation, SAS GLM was also used to assess the three groups of disciplines for each activity and criteria based on the unweighted scores provided by respondents.

The weighted mean scores of each SO were subjected to SAS GLM procedure and means separation, where significant, was done using DMRT ($p < 0.05$).

Results and Discussion

Ranking among SOs. For the SOs in descending order of ranking, results showed SO1 (22.2%), SO3 (20.4%), SO2 (20.3%), SO4 (18.8%), and SO5 (18.4%). While these percentages are used to show the relative ranking of each SO, they can serve as well as ways to share resources among SOs within the Project.

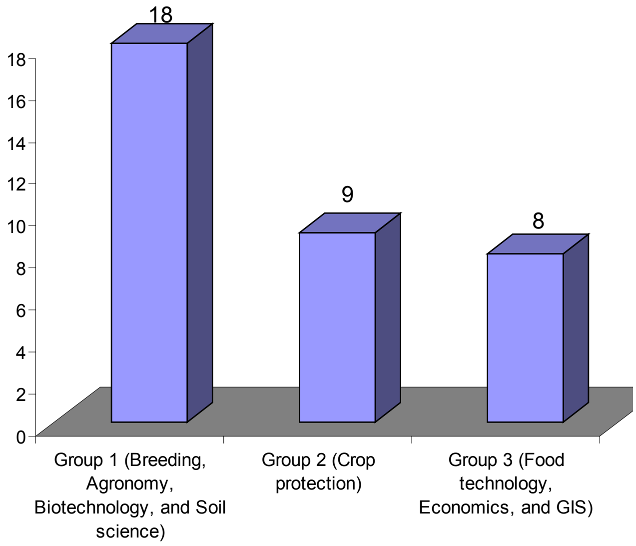

Figure 1. Classification of number of respondents in three discipline groups for the priority setting of the IITA Root and Tuber Crops Systems Project.

Ranking within SOs. Within SO1, in descending order, the activities were ranked as follows: Act. 4 (80.6%), Act. 6 (76.6%), Act. 2 (74.7%), Act. 5 (70.0%), Act. 1 (68.8%), Act. 3 (65.4%), and Act. 7 (58.4%). The analysis of variance (ANOVA) test showed a significant difference ($p < 0.05$) among activities. Three major groups emerged: Act. 4 alone, Acts 6, 2, 5, 3 in a cluster, and Act. 7 alone. In terms of the “disciplinary bias” test, both the Chi square and GLM analyses showed no significant difference ($p < 0.05$).

Within SO2, in descending order, the activities ranked as follows: Act. 3 (68.4%), Act. 1 (68.2%), Act. 5 (67.7%), Act. 2 (67.0%), Act. 6 (61.7%), Act. 4 (60.7%), and Act. 7 (58.7%). The ANOVA showed no significant ($p > 0.05$) difference between activities, and between assessments made by disciplines.

Within SO3, in descending order, the activities ranked as follows: Act. 4 (68.9%), Act. 3 (68.8%), Act. 2 (66.7%), Act. 1 (60.5%), and Act. 5 (59.4%). The ANOVA showed no significant ($p > 0.05$) difference between activities, or between assessments made by disciplines.

Within SO4, in descending order, the activities ranked as follows: Act. 4 (71.4%), Act. 6 (65.1%), Act. 1 (61.2%), Act. 2 (55.0%), Act. 3 (53.2%), and Act. 5 (53.1%). The ANOVA test showed a significant difference ($p \leq 0.05$) among activities. Two major groups were evident. Group 1 was made of Acts 4, 6, and 1 that are not statistically different from one another. Group 2 was Acts 2, 3, and 5. In terms of disciplinary bias, both the Chi square and GLM analyses showed no significant difference ($p < 0.05$).

Within SO5, in descending order, the activities ranked as: Act. 1 (60.7%), Act. 3 (58.1%), and Act. 2 (56.7%). The ANOVA showed no significant ($p > 0.05$) difference between activities, and between assessments made by disciplines.

Comparing activities across SOs. The main objective of this exercise was to define priorities within and among SOs. However, results from the analyses give an additional opportunity to compare activities across SOs. This is facilitated by the use of common criteria, the same analytical tools in data analysis, and scoring by the same respondents (=same perception in ranking). In descending order, the ten first activities are as follows: SO1Act. 4 (80.6%), SO1Act. 6 (76.6%), SO1Act. 2 (74.7%), SO4Act. 4 (71.4%), SO1Act. 5 (70.0%), SO3Act. 4 (68.9%), SO3Act. 3 (68.8%), SO1Act. 1 (68.8%), SO2Act. 3 (68.4%), and SO2Act. 1 (68.2%). Five activities belong to SO1, with three activities taking the lead out of 10. Across SOs and on the whole, respondents perceived five out the seven activities of SO1 as being very important. SO3 has two activities in ranks six and seven. SO2 also has two activities but in the last two ranks out of ten. The only activity for SO4 was ranked fourth. None of the activities of SO5 appear among the top 10, probably because respondents perceive the activities of capacity building of partners as an integrated component of technical activities in the other objectives. This raises the issue of mutually exclusive criteria required for a proper priority setting. Where criteria overlap, some of the activities under priority setting cannot appear in the final ranking exercise, not because they are un important but because criteria applied to rank them are not mutually exclusive.

Identifying strengths and weaknesses within SOs. Another interesting outcome from a priority setting exercise is the identification of weaknesses and strengths. This would assist managers and Project members in developing strategies to overcome weaknesses and to reinforce strengths, therefore improving overall efficiency.

An example can be given (Fig. 2) for the activity that ranked first within its SO and across all SOs. That is Activity 4 of SO 1 (SO1Act4). This activity scored 80.7% out of the maximum achievable 100%.

Results in Figure 2 compare the score of Act. 4 to the average of scores for all activities of SO1 per criterion. Although Act. 4 realizes a score above 100% compared to the average in all criteria except one (which was expected), its highest perceived benefit is in its contribution to Cr 4 about building of institutions and the lowest contribution is in Cr 1 about food security. Building on the above results, Project members should challenge themselves on answering the question why an SO that is all about increasing productivity of root and tuber crops is perceived by its members as having lowest contribution to food security out of the five criteria used in the analysis. Answering such questions could lead to the design of new strategies to correct for possible weaknesses identified in the Project operations.

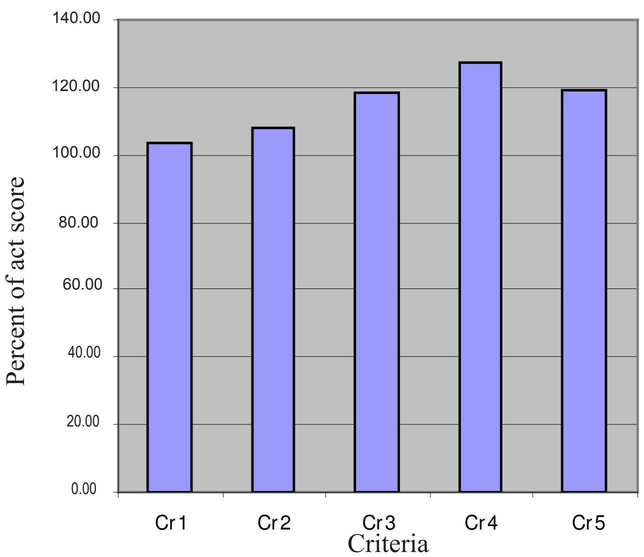

Figure 2. Comparing the score of first ranked Act. 4 of SO 1 to the average score of all activities of same SO.

Conclusion

The results from priority setting provide a scientific means of deciding where a project should emphasize the focus on its operations, thus contributing to a better planning of operations and allocation of resources. While the ranking among SOs was done in this study, the same resulting proportion calculated for each SO could serve as a basis for allocating resources to the five SOs of this Project.

The ranking of activities indicated priorities for each SO. Across SOs, the assessment revealed the perceived high rank attached to the activities relative to SO 1 about increased productivity. Project members also identified at least one activity from each of the other SOs among the top 10 activities ranked for this Project (the exception was SO 5 that did not show any ranked activity among the top 10).

The hypothvesis about “discipline bias” in priority setting was not validated by the statistical tests. Project members made a fair assessment of the activities, regardless of their discipline of origin.

Priority setting is also a useful tool for the management of a project as the analysis can lead to the design of new strategies to improve efficiency. This report shows how the process of priority setting began in November 2006 and was followed by two levels of priority setting in 2007. More insights can be gained through a further analysis of input data. Therefore , a one-time priority setting is not an end in itself. It can be the beginning of an iterative process whereby results from one step become a valuable input for the next step. Project members can fully benefit from priority setting only when they consider and value it as an important and permanent element in the planning and implementation of their activities. Priority setting must be embedded in our culture of everyday business for impact.

The participation of many is a key to a good priority setting exercise. It is important to mobilize all Project members to take part in the priority setting exercise for their Project. To facilitate the involvement of all, it is important to adopt approaches, methods, and techniques that allow all the disciplines to participate effectively.

Annex 1: Priority Assessment Scoring template

Date:
Name of assessor (optional):

Discipline of assessor (write the name):
Code for discipline of assessor (see below):

Activities	(1) Criteria: Food Security	(2) Income Generation	(3) Protection of Environment	(4) Building Institutions	(5) Quality of Science
Weight for Criteria:	21	22	19	19	19
SO1: Increasing Productivity of Root and Tuber Crops					
1. Design sustainable nutrient management options for root and tuber systems					
2. Breed more nutrient-responsive, water and nutrient-use-efficient, and pest resistant varieties					
3. Improve seed systems for root and tuber crops					
4. Develop sustainable integrated soil, water, crop and pest management systems					
5. Adapt and promote appropriate methods of farm mechanization and other labor-saving technologies					
6. Develop and apply biotechnology tools to introduce tolerance / resistance to biotic and abiotic stresses into improved germplasm					
7. Expand production and use of root and tuber crops into non-traditional areas					
SO2: Reduction of production and consumer risks					
1. Generate knowledge on emerging biological risks, consumer risks for root and tuber products, and develop strategies to mitigate them					
2. Develop and promote diagnostics to manage biological risks					
3. Identify and promote strategies to minimize postharvest risks and biological risks to seed systems					
4. Conduct risk analysis of transgenics					
5. Determine the impact of environmental risks on root and tuber crop systems and develop strategies to reduce them					
6. Develop strategies to minimize the impact of root and tuber crop systems on the environment					
7. Develop and promote standard guidelines for compliance with trade and quarantine obligations					
SO3: Adding value and expanding markets					
1. Analyze market preferences for traditional and novel products from root and tuber crops and study the relevant functional properties					
2. Develop and apply biotechnology tools to improve germplasm for specialty traits					
3. Breed and select germplasm for market and nutritional traits					
4. Develop safe and competitive products from roots and tubers, and determine safety thresholds in food and feed products					
5. Design, adapt and promote appropriate machines to add value and expand markets					

Activities	(1) Food Security	(2) Income Generation	(3) Protection of Environment	(4) Building Institutions	(5) Quality of Science
	Criteria				
Weight for Criteria:	21	22	19	19	19
SO4: Advocacy and policy					
1. Model competitiveness of root and tuber crops under different fertilizer policy regimes and land intensification					
2. Monitor and evaluate return to investment of research and training on root and tuber crops and assess their economic and social impacts					
3. Make an inventory of policies and other economic factors that influence development of root and tuber crops					
4. Advocate policies that support and promote development and utilization of root and tuber crops					
5. Provide relevant information on genetically modified organisms to African national governments and assist them in the development of biosafety guidelines					
6. Promote and assist the development of national policies and protocols for release of new varieties, and development and regional harmonization of seed regulations.					
SO5: Strengthening partners					
1. Identify and respond to appropriate training needs of partners					
2. Promote and assist efforts to strengthen infrastructural capacity of partners for research and development					
3. Promote public-private partnerships					

Scales for scores: 1-10 (1 = Very bad and 10= Very good)

Code for discipline of assessor: 1 = Plant breeding, 2 = Food technology, 3 = Weed science, 4 = Economics (Agric. Economics), 5 = Biotechnology (including Tissue culture), 6 = Statistics, 7 = Pathology, 8 = Agronomy, 9 = Crop protection, 10 = Soil science, 11 = Agroenterprise, 12 = Entomology, 13 = Virology, 14 = Agric. Extension, 15 = Animal science, 16 = GIS

Acknowledgement

The authors acknowledge the contributions of all of the members of the Root and Tuber Crops System Project in this priority setting.

References

Alston J., Norton W. and Pardey G. 1995. Science under scarcity. Principles and practices for agricultural research evaluation and priority setting. CAB International, Wallingford, Oxford, UK.

Gomez K.A. and Gomez A.A.1984. Statistical PRocedures for agricultural research. Second Edition, John Wiley & Sons Inc. NY, USA.

Manyong V.M., Kormawa P., Diels J., Dixon A. and Hughes J. 2001. Priority setting at IITA: Report by the task force on priority setting. IITA. Mimeo. Ibadan, Nigeria.

SAS 2003. SAS/STAT software, version 9.1. for Windows. Cary, NC, USA.