TOWARDS A METHOD TO SET PRIORITIES AMONGST SPECIES FOR TREE IMPROVEMENT RESEARCH - A CASE STUDY FROM WEST AFRICA

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JAENICKE, H., FRANZEL, S. & BOLAND, D.J. 1995. Towards a method to set priorities amongst species for tree improvement research - a case study from West Africa. Based on a case study from West Africa a method was devised to set priorities amongst multipurpose tree and shrub (MPT) species for tree improvement research. Regional MPT experts from the humid lowlands of West Africa were consulted during a workshop in which they defined the most important agroforestry products/services (referred to as products hereafter) for the main user groups in the region and identified promising MPT species to provide these products. During this exercise each species was assessed across four key selection categories. These were (a) farmer interest in the species and potential impact of introducing improved varieties, (b) management and growth characteristics, (c) product characteristics of a species for evaluating its suitability for a given end-use and market, and (d) research considerations for tree improvement in regard to each species. There were several criteria per category and each species was rated and an aggregate score calculated. Using this approach a proposed list of priority species for five agroforestry end-products, i.e. fruits, food, poles/posts, stakes and soil improvement, was established for the humid lowlands of West Africa. The findings still need to be verified through surveys to determine farmers' preferences and the relative values they give to different species and products.

Key words: Tree improvement - species prioritization - West Africa - agroforestry

JAENICKE, H., FRANZEL, S. & BOLAND, D. J. 1995. Ke arah satu kaedah menetapkan keutamaan antara spesies untuk penyelidikan pembaikan pokok: satu kajian kes dari Afrika Barat. Berdasarkan satu kajian kes dari Afrika Barat, satu kaedah telah direka untuk menetapkan keutamaan antara spesies pokok pelbagai tujuan dan pokok renek (MPT) untuk penyelidikan pembaikan pokok. Pakar-pakar MPT dari kawasan tanah pamah lembab Afrika Barat dirunding semasa satu bengkel. Dalam bengkel itu, mereka telah mendefinisikan keluaran/perkhidmatan perhutanan tani yang paling mustahak (disebut sebagai keluaran seterusnya) untuk kumpulan-kumpulan pengguna yang utama dalam kawasan yang tersebut dan mengenalpasti spesies MPT yang ada harapan untuk memberikan keluaran-keluaran ini. Semasa latihan ini, setiap spesies ditaksir menurut empat kategori pemilihan yang penting. Kategori-kategori ini ialah (a) minat peladang terhadap sesuatu spesies serta impak berpotensi dari pengenalan varieti yang diperbaiki, (b) ciri-ciri pengurusan dan pertumbuhan, (c) ciri-ciri keluaran sesuatu spesies untuk menilaikan kesesuaiannya untuk sesuatu kegunaan akhir yang ditentukan, dan (d) pertimbangan-pertimbangan penyelidikan untuk pembaikan pokok bagi setiap spesies. Setiap kategori mengandungi beberapa kriteria dan setiap spesies dinilai dan skor agregat dikira. Satu senarai cadangan spesies utama untuk lima kegunaan akhir perhutanan tani iaitu, buah, makanan, tiang, pancang dan pembaikan tanih diwujudkan untuk tanah pamah lembab Afrika Barat dengan menggunakan pendekatan ini. Penemuan-penemuan ini masih perlu ditentukan dengan survei untuk menentukan pilihan peladang dan nilai-nilai relatif yang mereka berikan kepada spesies dan keluaran yang berlainan.

Introduction

Tropical forests worldwide contain a vast array of plant biodiversity. They contain many tree species which produce valuable products to world commerce, e.g. rubber, coffee, palm oil and others. Many of these species have been grown in commercial plantations and their genetic variation in natural forests has been explored and utilized in tree improvement programmes. Besides these well known examples, the tropical forests also contain many other species that are widely used locally but have not been fully domesticated, e.g. *Irvingia gabonensis* (the bush mango) in West Africa. Newton *et al.* (1994) claim that up to 95% of the tree species in Amazonia are used by indigenous communities. This usefulness of many tropical tree species, and their associated genetic diversity are important raw materials for domestication. Leakey and Newton (1994) have recognised this potential and have urged action for a Woody Plant Revolution to carefully identify and more effectively utilize this important resource. These ideas have been incorporated in ICRAF's current tree improvement activities.

Given the large number of potentially useful MPT species for agroforestry development nationally, regionally and globally, there is a need to develop a rational method for setting priorities amongst species for improvement research. The high cost of germplasm collection and tree improvement research makes priority setting essential. Ideally the chosen species should (a) produce an MPT product[1] of greatest value to the community, (b) suit identified agroforestry technologies, (c) have potential for rapid and large gains from tree improvement research, and (d) have the greatest adoption potential amongst farmers. The end product should result in a significant economic and environmental impact to large numbers of farmers and to the economy as a whole.

Whereas there is probably broad agreement with the above considerations, systematic procedures for prioritizing MPTs in agroforestry selection programmes are generally not used for several reasons. First, many of the skills associated with priority setting procedures are in the discipline of economics, and rarely with those involved in tree improvement research. Second, MPT products are difficult to assess in economic terms; most are either used within the household (e.g. fuelwood, poles) or have no easily quantified economic value (e.g. soil erosion control, soil fertility improvement).

In ICRAF's operational context, tree improvement research activities are defined and implemented on the basis of agro-ecological zones within which environmental conditions are relatively uniform. For the purpose of this study, the target was the Humid Lowlands of West Africa (HULWA) (see Figure 1). HULWA is a rich floristic zone (Guinea-Congolia, see White 1983) containing many useful native and exotic species producing a large range of MPT products, e.g. fodder,

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[1] The term product implies products, e.g. fruits and/or services such as soil erosion control.

fruit trees, fuelwood, with potential for a variety of agroforestry technologies. Young (1989) recognised at least 15 different agroforestry sub-systems in which MPTs have been used and of these the current most widely used systems in HULWA are shifting cultivation, trees on cropland, plantation crop combinations and multistorey tree gardens, especially around home compounds. Taking Cameroon as an example, ICRAF scientists identified five interventions in the following priority order for their potential for improvement, (1) improved fallows, (2) indigenous fruit trees for homegardens, (3) live fences and associated fodder banks for livestock, (4) hedgerow intercropping, and (5) diversification of cacao production (ICRAF 1993).

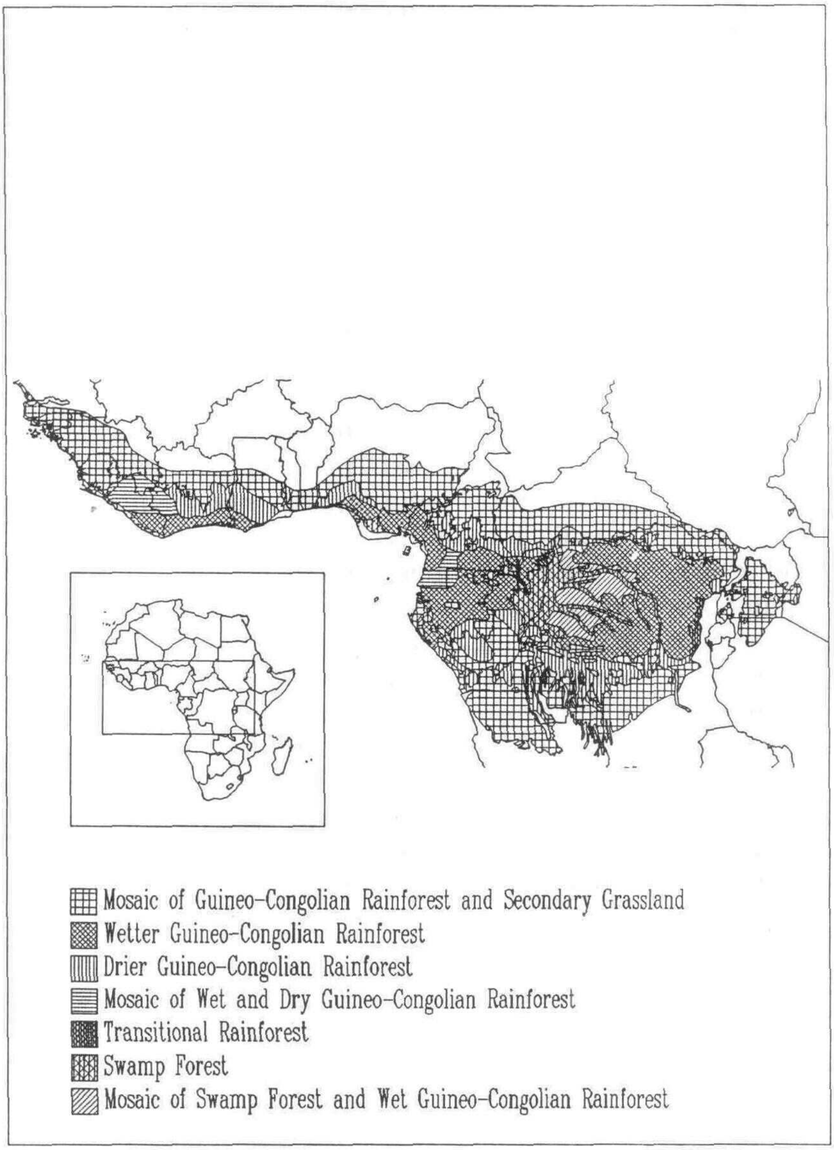

Figure 1. The humid lowlands of West Africa

This paper describes our progress towards a method to prioritize tree species for improvement research and is the first of several future papers related to the priority setting process. The development of a generally applicable method for tree species prioritization is seen as part of a larger effort to integrate farmers' opinions and felt needs with researchers' considerations as a basis for planning research. The intention of the process described here is to arrive at a short list of potentially important MPT species, using input from farmers, key informants and MPT specialists. Systematic scoring methods were used to rate species across criteria according to their researchability and their potential adoptability and economic impact among farmers.

First, selected tree improvement issues are presented followed by discussion of socio-economic issues and prioritization techniques. Next, the actual method used in a workshop is described and results presented. Finally, the method is assessed and future developments are proposed.

Tree improvement considerations

In traditional plantation forestry the selection of species for improvement is usually not a big challenge. More often than not, the identification of species is usually predetermined, i.e. an already economically important species which is already grown in plantations requires further genetic improvement. Alternatively if the species is not known the end-product usually is and the need then is simply to determine the most appropriate species to use, through a set series of species elimination, testing and proving trials (Burley & Wood 1977). After this process is complete the genetic improvement of the selected species can commence. In both of these examples the client is usually a government department or a commercial forestry company, and both have close control over the genetic improvement and adoption process.

In agroforestry, in contrast, the choice of species is much more complex in both socioeconomic and biophysical terms. The client group is very heterogeneous. It consists of many individual small-scale farmers and their needs are difficult to assess and quantify eco-regionally. As several authors have recognised (MacDicken & Mehl 1990, Owino 1992, Simons 1992), this usually requires farmer surveys to establish species and character traits to improve. Owino (1992) paid particular attention to this early phase and noted that general MPT screening, agroforestry technology-specific screening and farmer preference surveys were appropriate activities to undertake before deciding on a species to improve. Simons (1992) also suggested another route to identify important MPTs through seed demand quantification from users. However, actually getting accurate data from groups like farmers is difficult as on-farm germplasm production and subsequent farmer-to-farmer germplasm transfers are common. Such data are usually not reflected in official records.

Tree improvement research that is responsive to farmer needs is still at a very early stage of development. For example, there are few published reports of farmer species and trait preference surveys despite widespread recognition of the need for such studies to be undertaken. MacDicken and Mehl (1990) were amongst the earliest to report survey results of farmer-selected tree ideotypes. Chuntanaparb and MacDicken (1991) further called for an integration of ideas from classical tree breeders and "bare foot tree breeders" to identify and improve MPT species. Species preferences by farmers may also vary within an eco-region according to biophysical (e.g. soil type and rainfall), as well as socio-economic features (e.g. gender, ethnic group and market access) and this makes the selection of a single species for improvement very difficult.

For many lesser-known agroforestry species we often lack much fundamental background research on their basic biology. Simons (1992) correctly stated that for most MPTs "very little is known about the amount and structure of genetic variation, genetic control of characters, reproductive biology and flowering phenology" and that such information is a pre-requisite in deciding on improvement strategies. In setting priorities for species, it obviously would be desirable to have such information available for all species under consideration so that higher priority could be given to those species where quick gains in tree improvement can be made. Unfortunately, we rarely have all of this information in advance although some approximations may be possible, e.g. a species may be known to vary morphologically over its range, or in the size and taste of its edible fruits.

Methods for priority setting

In recent years, the setting of research priorities in a systematic manner has become an important concern of agricultural research organizations. Quantitative models have long been used for selecting among research projects in the private sector in developed countries (Moore & Baker 1969). Mahlstede (1971) was among the first to present the results of priority setting exercises in agricultural research, ranking research programmes for Iowa's agricultural experiment stations. Von Oppen and Ryan (1985) used formal procedures for setting regional research priorities for the International Crops Research Institute for the Semi-arid Tropics (ICRISAT).

Collion *et al.* (1993) identified four types of priority setting tools relevant to agricultural research: checklists, scoring, cost-benefit analysis, and mathematical programming. A checklist is the simplest of the tools and involves checking alternative research areas against criteria. In scoring, the criteria are weighted to allow alternatives to be scored on each criterion and ranked on the basis of a composite score. Cost-benefit analyses compare the total costs and returns of investment in alternative research areas, and mathematical programming optimizes a multiple-goal objective function for choosing the optimal research portfolio. The latter two methods require reliable and detailed data about research costs and returns.

Scoring methods are probably the most commonly used methods, and were selected for use in this study for several reasons. First, they are especially appropriate when dealing with widely varying types of objectives, such as economic impact, equity, and conservation of natural resources. Second, they are relatively transparent and easily understood by decision makers and researchers, therefore improving the participatory nature of the priority setting exercise and the confidence that participants have in the results. Finally, they require less in terms of data, time, and analytical capacity than do cost-benefit analysis and mathematical programming methods (Norton 1993, Falconi 1993, Collion *et al.* 1993). In fact, cost-benefit analyses and mathematical programming methods are not feasible for MPT prioritization because data concerning the costs and returns of research on them are lacking.

However, scoring methods also have important shortcomings. They are susceptible to misuse, especially when criteria overlap, are poorly measured, or do not account for the full range of costs and benefits associated with the different alternatives being evaluated. Finally, as with all priority setting procedures, the weights assigned to different objectives are highly subjective (Norton 1993).

Methods

For this exercise only a few farmer surveys focusing on agroforestry in HULWA were available (ICRAF 1988, ICRAF n.d., Aiyelaagbe & Adeola 1993). As a first step, we sought to obtain information from experts within the zone. In early 1993 a consultant from the region (A. D. Adeola) was hired to assemble background information and to solicit information on priority products and species within HULWA. A meeting of experts was then held in Ibadan, Nigeria in June 1993. Representatives from Nigeria, Cameroon and Côte d'Ivoire were present (representing about 65% of HULWA's total land area) and written inputs were received from Benin, Ghana and Sierra Leone. Participants included staff of research institutes, universities and development projects. HULWA countries not represented were Guinea and Togo. According to the country reports, farmers' priority agroforestry products were fruits, food, fodder, soil fertility and auxiliary roles, including support stakes, poles and medicines. During the meeting, other products and services were considered but were not included, such as firewood, because it is not in short supply, and soil erosion control because erosion is not an important problem in the region. Medicines were excluded because the institutions present did not have a comparative advantage in pharmaceutical research. An expected outcome of the meeting was the prioritization of key species for tree improvement for several agroforestry products and appropriate agroforestry technologies.

The decision process on which the scoring model was based was adapted from Raintree (1991) and involves four stages (Figure 2).

- *Identifying user groups and their problems*. The decision process is user focused and thus begins with an analysis of main user groups in a region and their problems and needs. User groups may vary according to both biophysical characteristics (e.g. soil type) or socio-economic features (e.g. access to markets).
- *Defining products needed by user groups.* The focus here is on defining agroforestry products that can assist users to overcome their principal problems.

- *Defining technologies to provide needed products and services.* Here, experts select the technologies (e.g. home gardens, improved fallows) that are most promising for providing the needed products by farmers.
- *Choosing species to fit the selected technologies.* Lastly, species are scored according to the degree to which their attributes meet the requirements of the technology, product and user group, and their potential for improvement from a scientific perspective (e.g. degree of variation in desirable traits).

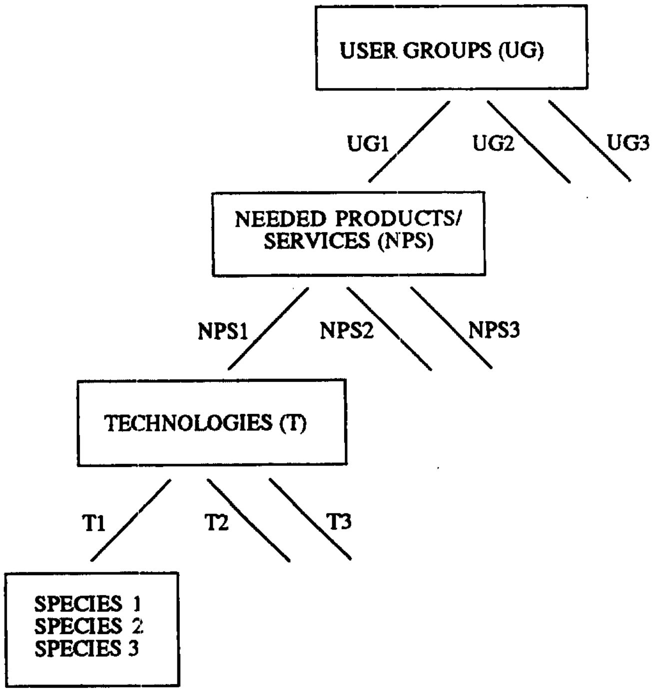

Figure 2. Decision process for selecting species (after Raintree 1991)

The above algorithm is used to determine the most appropriate species by user group, product and technology. To compare species across products or technologies, new criteria have to be defined and the species scored against these. For example, a species for fodder can be compared with one for soil fertility by comparing their potential contributions to farmers' incomes (Hoekstra & Darnhofer 1993).

The decision process for species choice discussed above and presented in Figure 2 was simplified for the purpose of using it in the workshop; focus was given to species selection. Priority products were selected in the plenary based on survey reports as discussed above. User groups and technologies were also discussed during the plenary and participants were asked to consider, in the species scoring working groups, different user groups and different technologies. For example, the group working on soil fertility scored each species on its appropriateness for different user groups (male and female farmers, farmers on acidic and neutral soils) and in different technologies (improved fallows and hedge-row intercropping). A collation from the information in the reports resulted in an initial list of species important for the region. These species provided the basis for the prioritization exercise and were, together with additional species suggested by the participants, prioritized using the techniques described in detail below. Each working group considered 10 - 20 species per product and rated them based on their shared personal experience.

Description of selection criteria

Selection criteria were chosen in order to evaluate the agro-economic potential of an improved MPT species and to assess its feasibility for improvement. There were four main categories in which socio-economic, biological and technical criteria were included:

- Farmer interest in the species and potential impact of introducing improved varieties;
- Management and growth characteristics of the species, so as to evaluate its suitability for a given agroforestry practice or site condition;
- Product characteristics of the species, for evaluating its suitability for a given end-use and market;
- Research considerations for tree improvement, to assess research potentials and needs for improvement programmes.

Each of the four main categories was subdivided into criteria as described below. The criteria for management/growth characteristics and for product characteristics varied somewhat among the different end-products discussed.

Farmer interest and potential impact

This category is important for assessing the socio-economic feasibility of improving an MPT species. The four criteria assessed were

- level of current production: a species already accepted and in wide use is more likely to be adopted when improved.
- the species' potential for adoption: before considering any species for improvement, it is necessary to think about its possible acceptance amongst farmers. This depends on possible uses and by-products, traditional taboos, labour requirements, etc.
- interest in the species by male and female farmers: gender issues are important and deserve special attention in species prioritization exercises. A species that will be accepted by both male and female farmers is likely to have greater impact, whereas there are certain products/services which might be considered important only by one group. For example, in Nigeria, home-consumed foods tend to be preferred by women, whereas men prefer products that can be sold, such as timber.

- potential impact: the potential impact of the introduction of a new/improved species in monetary values or area covered depends on the current production, the likelihood of acceptance, and the value added associated with improved planting material.

The above criteria focus on socio-economic variables, thus the importance of a socio-economic appraisal before the prioritization exercise cannot be over-stressed.

Management and growth characteristics

Criteria in this category deal with the plants' overall suitability for agroforestry arrangements. The five criteria considered were:

- ease of establishment: this addresses the question whether a species can be directly sown, whether cuttings can be used or whether there are complicated nursery conditions to be observed. Do the plants quickly outgrow weeds or is weeding necessary?
- maintenance costs: like "ease of establishment", the maintenance costs greatly influence farmers' acceptance. Does the species suffer from pests and diseases? Does the species grow without heavy management input? Does the species suppress weeds (e.g. by producing a dense canopy)?
- adaptability across location and climate: this addresses the question whether the species is widely distributed throughout the study area, or whether it inhabits only a small niche - why is its distribution restricted to a limited area - would simple improvement or management techniques improve its adaptability?
- adapted to acid/non-acid soils: gives specific information on adaptation to specific soil restrictions. Acid soils are widely prevalent in HULWA.
- compatibility with crops: in an agroforestry context there are often crops growing adjacent to the tree component. It is therefore important to identify whether species have the potential to grow well with crops, show strong competition or have allelopathic effects.

Different end-products are characterized by different criteria. For example, coppicing potential is an important factor when fodder is the main product under consideration, but this aspect is not relevant for products like fruit. Therefore it was necessary to create separate lists of criteria for the different end-products. Table 1 indicates additional criteria that were listed for the different products.

Product characteristics

Product characteristics, like management and growth characteristics, vary across products (Table 2). Important criteria across products include commercial potential, product quality, productivity and storability. For any given product it is necessary to consider useful secondary products (e.g. firewood). For example, *Pterocarpus santalinoides*, a species considered under soil fertility improvement, received high ratings on secondary products because it is also used as a leafy vegetable and for fencing.

Table 1. End-products and management/growth characteristics considered in the prioritization exercise

All products	ease of establishment maintenance costs (e.g. weeds, diseases) adaptability across location/climate adapted to acid soils compatibility with crops
Fruits	quick maturing ease of harvesting seasonality of bearing cuttings/grafts necessary
Fodder	good coppicer/pruner quick maturing ease of harvesting
Poles/posts	quick maturing coppicing ability
Auxiliary supports/ stakes	coppicing ability easy root pruning and pollarding
Soil fertility	coppicing/pruning ability deep rooting nitrogen fixing weed suppression

Research considerations for tree improvement

This category deals with the technical aspects of research planning, for example, are there any collaborators, is germplasm available, what is the state of knowledge of the reproduction biology of the tree? The easier it is to improve a species, the higher will be its rating.

The criteria used are:

- level of variability: gives an indication of phenotypic variability in the species, e.g. morphological, phenological growth rate or product quality. A wide variability implies a high probability that the desired trait is already genetically available in the population.
- availability of germplasm: this indicates whether research can be started quickly or whether germplasm collections might be necessary.
- availability of collaborators: will indicate whether this plant is already under research and whether facilities or resources might be available for joint research or information exchange.
- availability of biological background knowledge: this indicates how much is known about the species in terms of its breeding systems, vegetative propagation potential, etc. Such data are basic for planning any improvement programme.

- storability of germplasm: this criterion focuses on the problem of recalcitrant seeds which cannot be kept under normal storage conditions.
- low risk of duplication: it was decided that species which are under intensive investigation elsewhere with the same focus, should be considered less suitable for possible research. There is no comparative advantage for an incoming research group to start work on a species that has been widely investigated commercially, like mango, coffee or cacao.

Weighting of criteria and ratings

In order to arrive at meaningful results, the above defined criteria were converted into values. To do this it was necessary to weight the criteria according to their relative importance for the respective product. The importance of a criterion was determined by its relevance for user groups and technologies and its contribution to economic value. For example, in Table 3, "quick maturing" received a high weight for its potential to contribute to economic value and its attractiveness to farmers. In contrast, "adaptability to non-acid soils" received a low weight because non-acid soils are not common in the region. The criteria with highest importance was given a weight of "5", and the ones with lowest importance a weight of "1", with the intermediate weighting of "2", "3" or "4". In the working groups, only criteria with the weights "4" or "5" were considered. Thus the number of criteria covered for each product differed.

Table 2. End-products and product characteristics considered in the prioritization exercise

All products	productivity secondary products
Fruits	quality (vitamins, digestible oils) range of products processing potential ease of handling storability (shelf life) commercial potential (demand)
Fodder	quality (proteins) a) general, b) in time of need palatability storability digestibility commercial potential
Poles/posts	straightness small/few branches durability in the ground commercial potential
Auxiliary supports/ stakes	stem abundance fuelwood byproduct mulch byproduct
Soil fertility	quality (mineral content) decomposition rate

Next, the species were rated against each criterion by giving a score of "3" for good performance, "2" for intermediate performance, and "1" for poor performance. Each score was then multiplied by the weight to arrive at species scores for that criterion (Table 3). Scores were then summed for each species and the species with the highest score was considered to be the most promising one. An example is given in Table 3, showing the ratings given to four fruit species.

				weight of criterion[1]	D.E.		I.G.		M.B.		C.P.	
					value[2]	total[3]	value	total	value	total	value	total
Farmer interest and potential impact	level of current production		farmers	3								
			ha	*								
	potential for and constraints to adoption			5	3	15	3	15	2	10	3	15
	interest/potential by gender		female	1								
			male	1								
	potential impact	numbers affected	farmers	4	3	12	3	12	1	4	1	4
			ha	*								
		value (US$) per	farm	5	3	15	3	15	1	5	3	15
			ha	*								
Management/ Growth characteristics	ease of establishment			3								
	maintenance costs (eg. weeds, diseases)			4	3	12	2	8	3	12	2	8
	adaptability across location/climate			4	2	8	3	12	1	4	1	4
	adapted to...soils		acid	5	3	15	3	15	3	15	3	15
			non-acid	1								
	compatibility with crops			4	2	8	2	8	3	12	2	8
	quick maturing			5	2	10	2	10	3	15	1	5
	ease of harvesting			5	3	15	2	10	3	15	3	15
	seasonality of bearing			4	2	8	1	4	3	12	1	4
	cuttings/grafts necessary			5	2	10	2	10	3	15	1	5
***Product* characteristics**	productivity	overall		4	3	12	3	12	3	12	3	12
		in time of need		*								
	quality			5	3	15	2	10	3	15	3	15
	range of products			3								
	processing potential			3								
	ease of handling			4	1	4	2	8	1	4	3	12
	storability			4	1	4	3	12	1	4	3	12
	commercial potential			5	3	15	3	15	2	10	3	15
	secondary products (see list)			4	1	4	3	12	3	12	2	8
Research considerations for Tree Improvement	level of genetic variability	growth rates		5	3	15	3	15	3	15	3	15
		product quality		5	3	15	3	15	3	15	2	10
	availability of	germplasm		5	1	5	1	5	1	5	1	5
		potential collaborators		2								
	availability of biological background knowledge			2								
	storability of germplasm			5	1	5	1	5	3	15	1	5
	low risk of duplication			5	3	15	3	15	3	15	3	15
grand total						237		243		241		222

information gaps are marked "*", [1] weight of criteria: 5 = highest importance, 1 = lowest importance
[2] values of comparative performance: high (3) - medium (2) - low (1), [3] total = rank of criterion x value
D.E.: *Dacryodes edulis*, I.G.: *Irvingia gabonensis*, M.B.: *Maesobotrya barteri*, C.P.: *Cola pachycarpa*.
Only those criteria receiving weights of 4 or 5 were included in the exercise.

Table 3. An example of scoring for four species of fruit trees

Results of the prioritization process

In the MPT prioritization meeting for HULWA, the species shown in Table 4 obtained the highest scores using the above criteria and rating methods.

Table 4. List of species in priority order for each MPT product

Fruits	*Irvingia gabonensis*
	Maesobotrya barteri
	Dacryodes edulis
	Cola pachycarpa
	Chrysophyllum albidum
Food	*Irvingia gabonensis*
	Vernonia amygdalina
	Artocarpus (seedless)
	Garcinia cola
	Ricinodendron heudelotii
Poles/posts	*Gliricidia sepium*
	Cassia spectabilis
	Acioa barteri
	Lecaniodiscus cupanioides
	Nauclea latifolia
Stakes	*Nauclea diderrichii*
	Cassia siamea
	Bambusa spp.
	Enterolobium cyclocarpum
	Milletia thonningii
Soil improvement	*Flemingia macrophylla*
	Enterolobium cyclocarpum
	Pterocarpus santalinoides
	Calliandra calothyrsus
	Albizia lebbeck

Fruits

Species were screened across 22 criteria. *Irvingia* scored well for potential for adoption, value to farmers, adaptability for a range of soil types, commercial potential and level of potential genetic variability in the field. Less favourable attributes were slow maturation, short seasonality of fruiting and difficulty of harvesting. The second ranked species, *Maesobotrya,* scored well with low maintenance costs, quick maturity, long seasonality of production, and ease of harvesting. Major problem areas were low potential impact because of poor adoptability and low fruit storability. *Dacryodes edulis* is of high value to farmers but current major limitations were seasonality and overproduction.

Food

The group screened the species across 22 criteria. The criteria were the same as for fruit species. *Irvingia* and *Vernonia* were both rated highly for farmer interest and value, and good management and product characteristics. Storability of product was poorer for *Vernonia* compared with *Irvingia*. *Vernonia* was rated an easier species to research because of less trouble with seed storage (seeds orthodox, not recalcitrant) and a shorter regeneration time.

Poles/posts

Ten species were screened across six criteria. Potential for adoption, coppicing ability and stem abundance were the criteria for which the species listed in Table 4 performed well. Differences in ranking are mainly due to possible duplication of efforts (*Acioa, Gliricidia*) or information gaps concerning ease of establishment (*Nauclea, Lecaniodiscus*).

Stakes

Ten species were screened across eight criteria. All of the species listed for this product in Table 4 were scored high on the criteria adoptability, coppicing ability, and germplasm availability. *Bambusa* was the only species for which duplication of efforts was anticipated. The two less well performing species were put in this position mainly because of information gaps in one or several criteria.

Soil improvement

Group members screened 15 species across 15 criteria. The five highest ranked species were suitable for improved fallows (the most promising soil fertility technology in the zone) and acid soils, adaptable across locations, nitrogen fixing, and easy to establish. The highest ranking species also had some disadvantages. For example, *Flemingia macrophylla* is initially slow growing, is not very deep rooted, and is not suited for non-acid soils. The compatibility of *Pterocarpus santalinoides* and *Enterolobium cyclocarpum* with crops is not known. The adoption potential of *E. cyclocarpum* and *Calliandra calothyrsus* is uncertain as neither is widely used by farmers. Improvement work is already being conducted on *C. calothyrsus.*

Discussion

The data for systematically ranking important MPT species in the HULWA region were assembled by specialists in the region. It is emphasized that this exercise is seen as a first step in shortlisting potential species and that it is necessary to verify the results from this first workshop through field surveys to determine farmer preferences and relative values they give to different species and products (this work will be published separately). The two groups involved in the prioritization process, viz. farmers and researchers, need to strengthen their channels of communication in the prioritization process. Researchers can gain valuable additional information from farmers on traits to be improved. Conversely, farmers might not be aware of possibilities to change or improve important traits. The two-way exchange of information helps both farmers and researchers and this should be undertaken as early as possible in the tree improvement process.

An important benefit of the species priority setting exercise is the discussion about and agreement on the criteria and rankings. For example, if a species ranks unexpectedly high, the scoring process needs to be scrutinized to see if perhaps an important criterion measuring a constraint has been omitted. Through discussion, the process becomes clearer, and consensus is formed amongst the group. The discussion process clarifies *why* a certain species will be ranked highly, and this will ultimately help to justify the final decision.

The selection criteria have proven to be valuable in general, but several shortcomings have been noticed which we will try to modify in any future exercise. First, questions arose concerning the overlapping of criteria. For example, "farmer adoption" is a function of "ease of establishment", "pest and diseases", "compatibility with crops" and some other criteria, and thus should not be rated separately. Second, the criteria need to be re-defined such that they reflect more closely the objectives of "maximizing value", i.e. tree improvement potential needs to be more closely linked to economic value. For example, the criterion 'seasonality' should be excluded because it does not contribute to a species' overall market value.

We recognised the need for more interaction with farmers, especially because land use surveys have not been conducted in many parts of the region. Such surveys would have provided more information to assist our species selection process and could have helped in the prioritization of product groups as well.

Nevertheless, the procedure as a whole was considered to be acceptable for developing short lists of species by product grouping for improvement considerations. In order to narrow the list further to arrive at 2-3 species for improvement, several steps are required: (1) MPT surveys need to be carried out for representative areas within the region to determine farmer preferences. Because of the high degree of heterogeneity among farmers, these surveys must be carefully designed to reflect both across-area differences (e.g. changes in soil types) and within-area differences (e.g. gender); (2) products need to be prioritized and the 1-2 most important considered for further narrowing down of species; (3) a final farmer survey should be conducted to determine the value and specific areas requiring improvement for the most important 4 - 6 species.

We believe that this exercise was an important first step towards defining an appropriate method to prioritize MPT species for tree improvement. We recognize that the development of such a method is both time consuming and expensive but believe that future attempts to develop general guidelines will be of benefit to MPT improvers world-wide. We anticipate that the method will continue to be improved and eventually tree improvers should be able to use the guidelines as a checklist of activities to consider before embarking on costly and long-term tree improvement programmes. Priority setting is a tool to build consensus amongst the people involved. The key to success is the development of simple systematic assessment procedures and we hope that this paper will help in progressing towards this goal.

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