

**Analysis of a Questionnaire**

**“Research Activities  
Related to  
Underutilized Plant Species”**

by  
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## **Introduction**

The Global Facilitation Unit for Underutilized Species conducted a survey amongst members of National Agricultural Research Systems (NARS) with the purpose to collect information for a data base "Who is doing what in the field of underutilized plant species" and to identify information needs of research institutions in order to better serve them in the future.

The survey was conducted with a questionnaire that was distributed as hard and soft copy in several occasions (see Appendix 2).

A total of 62 people responded to the survey (33.9% from Africa, 30.6% from Europe, 19.3% from Asia, 11.3% from America and 4.8% from Oceania) consisting of open-ended questions (about the reasons of the disuse of these species, the research priorities of the organizations to which the respondents belonged, their interest and the national policies on underutilized species) and multiple-choice questions. They were not obliged to respond all the questions. The results of the survey have been collected and analyzed by means of the "SurveyMonkey" database (<http://www.surveymonkey.com/>).

**Tab. 1 Respondents' expertise with Underutilized Plant Species**

	<b>N. of responses</b>	<b>%</b>
Conservation	37	61,7 %
Production	28	46,7 %
Processing	13	21,7 %
Marketing	15	25,0 %
Breeding	7	11,7 %
Information management	4	6,7 %
Promotion	3	5,0 %
Policy	3	5,0 %
Other*	13	21,7 %
<b>Total Respondents</b>	<b>60</b>	
(skipped this question)	2	

\*This category comprises the following responses: research (2), genetic resources characterization (2), food security (2), extension (1), use of halophytes (1), utilization (2), analytical chemistry (1), eco-physiology (1), ethnobotany and culture (1).

Sixty out of the 62 respondents expressed their personal expertise on underutilized plant species and, as shown in Table 1, most of them were experienced in conservation of genetic resources (61.7%), followed by 46.7% experienced in production, 25% in marketing, 21.7% in processing, 11.7% in breeding, 6.7% in information management and only 5% were involved with promotion and 5% with policy. A percentage of 21.7, corresponding to 13 responses, considered their expertise not included among the suggested categories. Their involvement was in research (2), genetic resources characterization (2), food security (2) extension (1), use of halophytes (1), utilization (2), analytical chemistry (1), eco-physiology (1), ethnobotany and culture (1). Note that in the tables and figures of this report the sum of the percentages is greater than 100 because it was possible to select multiple options among those suggested.

## Results

According to the question n. 1 (To which of the following categories does your organization belong?) it emerged that 29% of the respondents' organizations belonged to National Research Centers, 25.8% to University and Training Institutions, 22.6% to NGOs, 17.7% to International Research Organizations, 8.1 % to Business and Industry sector, 1.6% to Farmers' Organizations and 4.8 % to other areas comprising no further specified governmental and private institutions.

In Table 2 are highlighted the research priorities of the different organizations to which the respondents belonged (Question n. 4: What are the research priorities of your organization?). The highest percentage (50.8%) was involved in Plant Genetic Resources, and only 1.7% in Legal and Policy Issues.

**Tab. 2 Research priorities of respondents' organization (Question n. 4)**

	<b>N. of responses</b>	<b>%</b>
Plant genetic resources	30	50,8 %
Ecology	4	6,8 %
Production	16	27,1 %
Food security and health	5	8,5 %
Socioeconomics and ethnobotany	18	30,5 %
Processing technology development	3	5,1 %
Marketing	4	6,8 %
Capacity building	13	22,0 %
Legal and policy issues	1	1,7 %
<b>Total Respondents</b>	<b>59</b>	
(skipped this question)	3	

With regard to Tab. 2 and Fig. 2, Fig. 3 and Tab. 4, the nine categories mentioned group the following issues according to what was indicated by the respondents in their answers:

### **Plant genetic resources:**

- Exploration, collection and evaluation of genetic diversity
- In-situ/ex-situ conservation
- Biodiversity conservation
- Morphological/chemical/molecular characterization
- Genetic structure of germplasm collections
- Genetic improvement
- Domestication

### **Ecology:**

- Screening for resistance to abiotic stresses (drought and salinity)
- Eco-physiological studies
- Ecogeographic survey
- Population genetics
- Erosion control
- PGR as renewable energy source
- Bio-remediation
- Geographic distribution

**Production:**

- Agronomy
- Organic agriculture
- Water management
- Horticultural and agronomic package of practices
- Soil fertility
- Crop diversification
- Pest control
- Seed multiplication and technology
- Propagation
- Fodder
- Forest conservation
- Sustainable use/sustainable agriculture

**Food security and health:**

- Nutrition and functional health properties
- Toxicity evaluation
- Livelihood orientation

**Socioeconomics  
and ethnobotany:**

- Indigenous knowledge
- Public awareness creation (through rural radio programme)
- Ecology and socioeconomic value of the species
- Promotion and women promotion
- Local initiatives
- Improved farmers' incomes/income generation
- Cooperation with NGOs and institutions
- Poverty reduction
- Utilization

**Processing technology  
development:**

- New marketable products
- Usage of oil and fruits to produce cosmetics, drugs, food
- Moringa seeds as water-clarifier
- Source for further product development
- Technology adoption

**Marketing:**

- Local market development
- Non-tariff export barriers
- Potential for commercialization
- Uniqueness/novelty
- Abundance of new materials
- Value addition

**Capacity building:**

- Training and documentation
- Human resources development

**Legal and policy issues:**

- Policy and regulation (IPR)

The respondents were also asked to list some plant species considered underutilized in their country (Question n.2: List some plant species which are considered underutilized in your country). The question was formulated as an open-ended question and later the responses were entered in a list of 545 species and genera. This list is a merge of species mentioned to be underutilized by various sources (Appendix 1):

- FAO-Ecoport orphan commodities database <http://www.ecoport.org/>
- IPGRI NUS website <http://www.ipgri.cgiar.org/nus/>
- Neglected no more website <http://www.neglectednomore.org/>
- Global Research on Underutilized Crops by ICUC, IPGRI and DFID,
- Fruits from America by IPGRI and CIRAD,
- IPGRI-IFAD program on NUS
- and from personal communications with stakeholders.

Only 89 plant species (Tab. 3) identified by the respondents belonged to that list, 84.2% of the responses dealt with species and genera not included in the list and indicated in Tab. 3.1. The number of ticks gives an indication of the number of times the species has been mentioned.

In some cases non concrete species were mentioned, but groups of plants, such as medicinal plants, aromatic plants, grain legumes, salt and drought resistant species, cut flowers, orchids and leafy vegetables. Some species mentioned like *Zea mays*, *Manihot esculentum* are generally not considered to be underutilized, but could probably enjoy a wider utilization in the respondent's country and were therefore listed.

**Tab. 3 Plant species considered underutilized by respondents and included in the merged list (Question n. 2)**

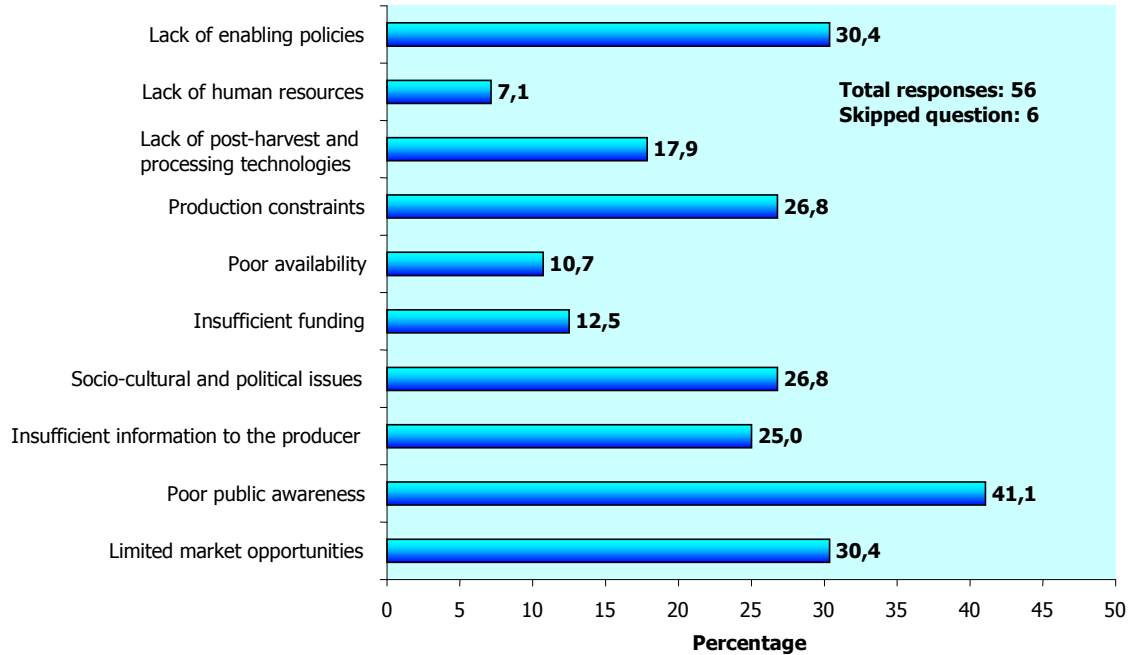
Plant species	Responses	%	Plant species	Responses	%
Abelmoschus caillei	1	1,8	Lupinus mutabilis	1	1,8
Adansonia digitata	1	1,8	Manilkara zapota	1	1,8
Aloe vera	1	1,8	Mirabilis expansa	1	1,8
Amaranthus spp.	4	7,0	Moringa spp.	1	1,8
Amaranthus hybridus	1	1,8	Moringa oleifera	4	7,0
Amaranthus viridis	1	1,8	Moringa stenopetala	1	1,8
Atriplex spp.	1	1,8	Myrciaria dubia	2	3,5
Bactris gasipaeas	2	3,5	Origanum syriacum	2	3,5
Balanites aegyptiaca	1	1,8	Pachyrhizus erosus	1	1,8
Benincasa hispida	1	1,8	Panicum miliaceum	2	3,5
Bixa orellana	1	1,8	Panicum miliare	1	1,8
Canarium indicum	1	1,8	Paspalum scrobiculatum	1	1,8
Canna edulis	1	1,8	Pouteria sapota	1	1,8
Capparis spp.	1	1,8	Punica granatum	1	1,8
Carthamus tinctorius	1	1,8	Rhus coriaria	1	1,8
Ceratonia siliqua	1	1,8	Schlerocarrya spp.	1	1,8
Chenopodium spp.	1	1,8	Schlerocarrya birrea	3	5,3
Chenopodium pallidicaule	4	7,0	Sesamum indicum	2	3,5
Chenopodium quinoa	1	1,8	Setaria italica	2	3,5
Chrysophyllum cainito	1	1,8	Solanum macrocarpon	2	3,5
Citrullus spp.	2	3,5	Solanum nigrum	1	1,8
Colocasia esculenta	3	5,3	Solanum quitoense	1	1,8
Corchorus olitorius	2	3,5	Solanum scabrum	1	1,8
Crocus sativus	1	1,8	Solenostemma arghel	1	1,8
Cucurbita foetidissima	1	1,8	Sphenostylis stenocarpa	1	1,8
Cyamopsis tetragonoloba	1	1,8	Tamarindus indica	2	3,5
Cynara cardunculus	1	1,8	Terminalia koernbachii	1	1,8
Dacryodes edulis	2	3,5	Theobroma grandiflorum	1	1,8
Digitaria spp.	1	1,8	Triticum spp.	1	1,8
Digitaria exilis	2	3,5	Triticum dicoccon	1	1,8
Dioscorea spp.	3	5,3	Tropaeolum tuberosum	1	1,8
Eleusine coracana	3	5,3	Tylosema esculentum	1	1,8
Eugenia stipitata	1	1,8	Uapaca kirkiana	1	1,8
Euterpe oleracea	1	1,8	Ullucus tuberosus	1	1,8
Fagopyrum esculentum	2	3,5	Vigna subterranea	7	12,3
Garcinia spp	1	1,8	Vigna umbellata	1	1,8
Glycyrrhiza glabra	1	1,8	Xanthosoma sagittifolium	1	1,8
Gnetum africanum	1	1,8	Zingiber officinale	1	1,8
Hancornia speciosa	1	1,8	Ziziphus spp.	2	3,5
Harpagophytum procumbens	1	1,8	Ziziphus mauritiana	1	1,8
Hibiscus sabdariffa	2	3,5	<b>Others (Tab. 3.1)</b>	<b>48</b>	<b>84,2</b>
Irvingia gabonensis	2	3,5			
Jatropha spp.	2	3,5			
Kerstingiella spp.	1	1,8			
Lablab purpureus	2	3,5			
Lagenaria spp.	1	1,8			
Laurus nobilis	2	3,5	<b>Total respondents</b>	<b>57</b>	
Lepidium meyenii	1	1,8	(skipped this question)	5	

**Tab. 3.1 Plant species considered underutilized by respondents and not included in the merged list (Question n. 2)**

Abelmoschus esculentus	✓✓	Medicinal plants	✓✓
Abelmoschus manihot	✓	Aromatic plants	✓
Adenium spp.	✓	Cucumis spp.	✓
Allium ampeloprasum	✓	Millets	✓
Altea spp.	✓	Minusops spp.	✓
Amaranthus spinosus L.	✓	Mkilua spp.	✓
Ampelocissus cavicaulis	✓	Mondia spp.	✓
Anisophyllea quangensis	✓	Moringa peregrina	✓
Araceae spp.	✓	Musa textilis	✓
Aster tripolium	✓	Nasturtium officinale	✓
Beta vulgaris	✓✓	Native potatoes	✓
Bryophytes	✓	Ocimum spp.	✓
Cajanus cajan	✓	Olea europaea	✓
Canarium schweinfurthii	✓	Orchids	✓
Cassia tora	✓	Oryza glaberrima	✓
Chlorophytum comosum	✓	Pandanus julianettii	✓
Chromolaena mikamia	✓	Petroselinum crispum	✓
Chromolaena odorata	✓	Pimpinella anisum	✓
Citrus aurantium	✓	Pithecellobium dulce	✓
Cnidoscolus acontifolius	✓	Polymnia sonchifolia	✓
Cola acuminata	✓	Pometia pinnata	✓
Conotrachelus nenuphar	✓	Prunus persica	✓
Coula edulis	✓	Puccinellia maritima	✓
Cucumaropsis manii	✓	Pyrus cydonia	✓
Cucurbita maxima	✓	Rheum rhabarbarum	✓
Cucurbits	✓✓	Ricinodendron heudelotii	✓
Cut flowers	✓	Saccharum edule	✓
Echinochloa crusgalli	✓	Salt & drought resistant species	✓
Fadogia ancyrantha	✓	Salvia fruticosa	✓
Fimbristylis spp.	✓	Sauropus androngynus	✓
Fragaria spp.	✓	Sesbania grandiflora	✓
Garcinia livingstonei	✓	Sorghum vulgare var. sudanense	✓
Gentiana	✓	Spartina townsendii	✓
Glossostemon bruguieri	✓	Spondias tuberosa	✓
Gossypium spp.	✓	Strychnos espinosa	✓
Grain legumes	✓	Talinum fruticosum	✓
Grewia tenax	✓	Teucrium polium	✓
Gundelia tournefortii	✓	Traditional varieties of fruit species	✓
Hippophae spp.	✓	Trichilia emetica	✓
Hymenaea courbaril	✓	Tropaelum majus	✓
Hypericum spp.	✓	Trychnos madagascariensis	✓
Jasmine	✓	Typha spp.	✓
Landolphia lanceolata	✓	Vaccinium spp.	✓
Lavandula angustifolia	✓	Vangueria tomentosa	✓✓
Leafy vegetables	✓✓	Vigna radiata	✓
Leptadenia hastata	✓	Vigna unguiculata	✓
Manihot esculentum	✓	Zea mays	✓
Matricaria chamomilla	✓	Ziziphus spina-christi	✓

Noteworthy were the responses to question n.3: What do you think are the reasons why these species are not more widely used in your country? (Fig. 1).

**Fig. 1 Reasons of disuse (Question n. 3)**

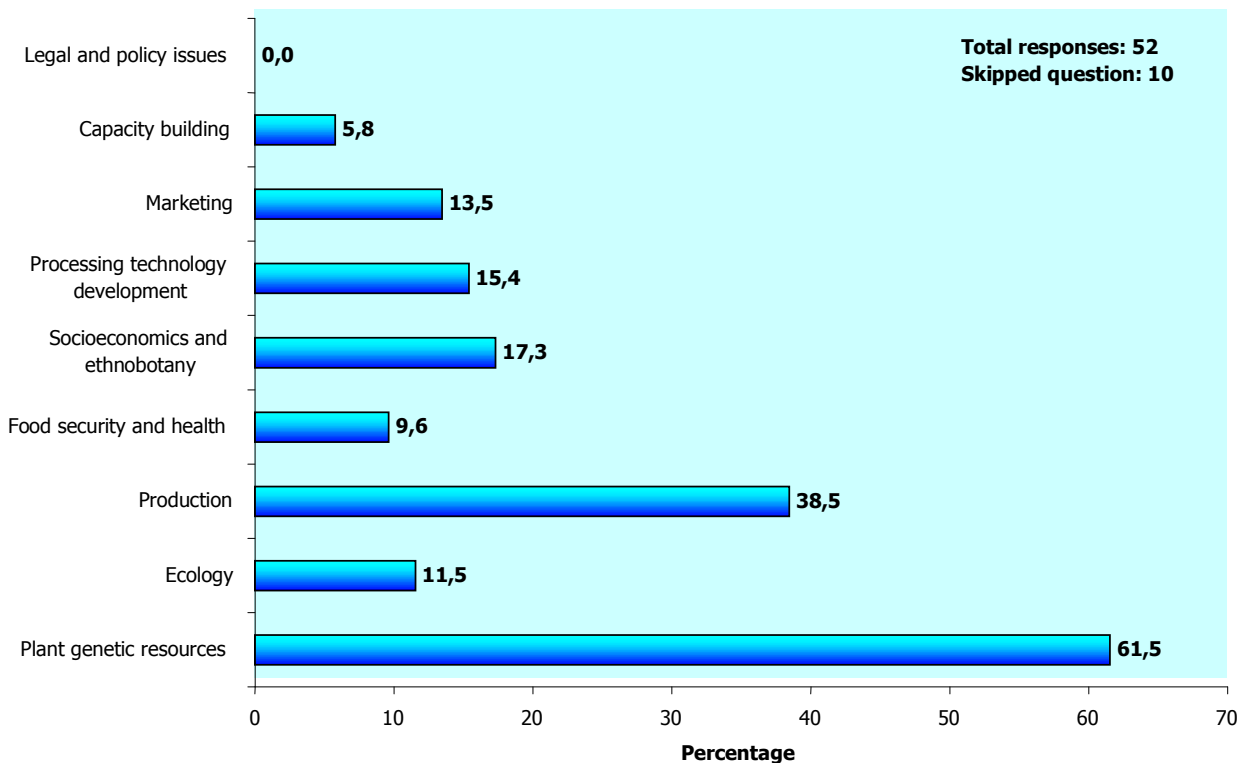


It is evident from Fig. 1 that "Poor public awareness" (41.1%) in respondent's country, comprising lack of interest by social elites, lack of knowledge of properties and nutritional value, promotion of substitute crops and focusing on "world economic plants" is the reason mainly indicated as the cause for underutilization of some plant species. The second ranking with 30.4% is held by "Lack of enabling policies" including national policies reluctant to favour research and promotion of underutilized plant species and the neglect of the international community, and by their "Limited market opportunities" (high production costs, species with low potential as a cash crop, no market exploration for new use opportunities and transport difficulties). Other reasons for their disuse are mainly due to "Socio-cultural and political issues" (26.8%) as well as "Production constraints" (26.8%). "Insufficient information to the producer" on economic value, production and processing (25%), "Lack of post-harvest and processing technologies" (17.9%), "Insufficient funding" by governments, international community and private sector (12.5%) and "Poor availability of resources" (10.7%), have been reported only as less important causes. Surprisingly the "Lack of human resources" and skills has been indicated as the least hindrance among the identified categories (7.1%).

"Socio-cultural and political issues" deal with bad image of such crops considered as poor man's food, ignorance, cultural perception, globalization, cultural-social changes in general, modern life styles in diet and cooking and, in some cases, civil wars. The "Production constraints" category represents a wide range that includes seed and harvest losses, no attention to genetic improvement and production management, propagation difficulties, low yield and productivity, limited water resources, lack of domestication, monocropping, lack of sustainable production and lack of production technologies as well as lack of attractive varieties. Within the category "Poor availability" are included the low density and availability of these plant species in natural habitats, rare wild materials and their limited geographical coverage.

In addition, the survey asked respondents whether their organizations were involved in research on underutilized plant species or not (Question n. 5: Has any research been done in your organization with regard to underutilized plant species?). Fifty-three respondents (85.5%) answered affirmatively, while 9 of them (14.5%) replied in the negative, no one skipped this question. 50 out of 53 respondents specified also the plant species they were studying on (Appendix 1, Column C) and 52 out of 53 specified the research topics as graphically shown in Fig. 2.

**Fig. 2 Research activities of respondents' organization with regard to underutilized plant species (Question n. 5.1)**



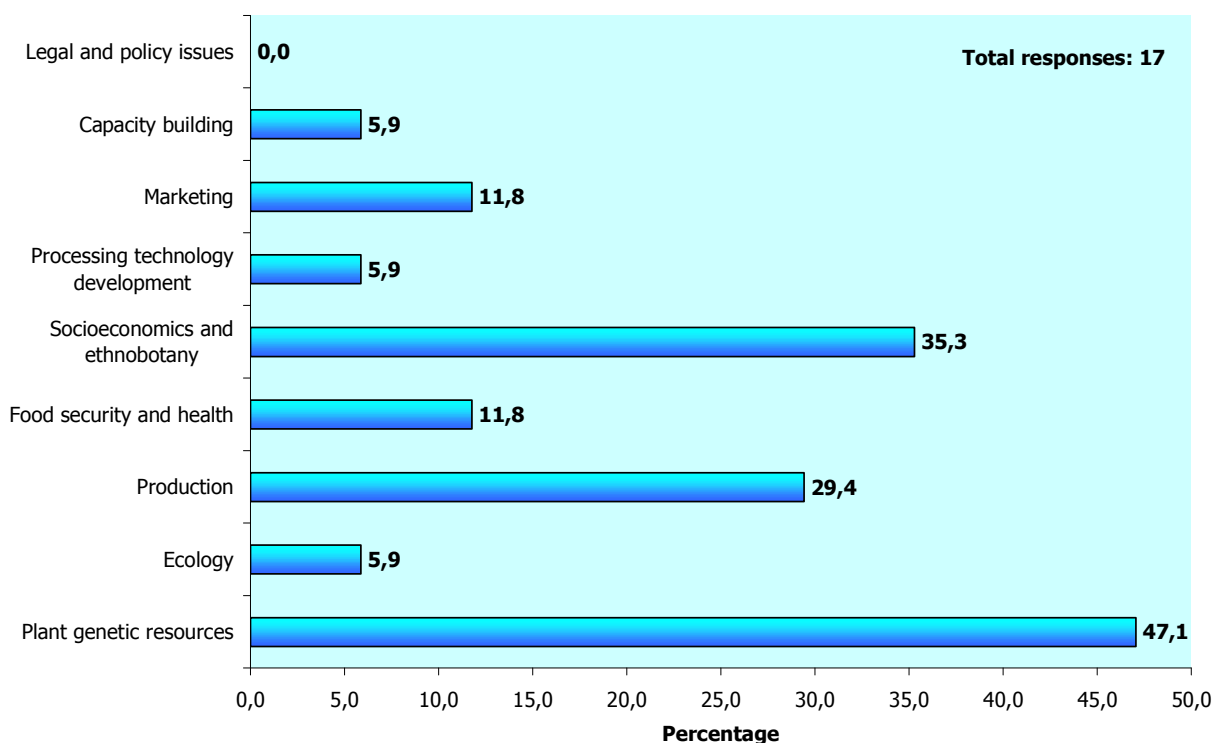
23 respondents replied affirmatively to Question n. 6: If not, does your organization plan to work on underutilized plant species?, but 15 of them, because of a misinterpretation of the questionnaire, had already replied affirmatively to the previous question in which they affirmed they were already working on underutilized plant species. In the light of the misinterpretation, the supplied replies were very imprecise and probably referred to other sectors of their organizations not involved at present in research projects on underutilized plant species but planning to start them up. In any case, 36.8% of the replies of 19 respondents (out of 23) indicated that the main reason to work on underutilized plant species was related to their potential for income generation, 26.3% to food security, 21% to the preservation of biodiversity and healthy agroecosystems, 10.5% to on-going collaborative projects, public awareness spread, vast ecological distribution and abundance of raw material of underutilized plant species, alternative food source and potential for commercialization. 5.2% of the responses indicated in crop diversification the reason of interest (Tab. 4)

**Tab. 4 Reasons of interest in underutilized plant species for organizations planning to work on them (Question n. 6.1)**

	<b>N. of resp.</b>	<b>%</b>
Potential for regional income generation	7	36,8%
On-going collaborative projects with NGOs and research institutions	2	10,5%
Public awareness spread	2	10,5%
Vast ecological distribution of underutilized plant species	2	10,5%
Crop diversification	1	5,2%
Food security	5	26,3%
Food supply	2	10,5%
Preserve biodiversity and healthy agroecosystems	4	21,0%
Potential for commercialization	2	10,5%
<b>Total respondents</b>	<b>19</b>	

As shown in Fig. 3, 47.1% of the replies of 17 respondents to question n. 6.1 What will the research topics be? whose organization planned to work on underutilized plant species, intended dealing with plant genetic resources, 35.3% with socioeconomics and ethnobotany topics and 29.4% with production.

**Fig. 3 Envisaged research topics of organizations not working at present on Underutilized Plant Species (Question n. 6.1)**



Another objective of the survey was to investigate about the presence of other institutions in the respondents' countries doing research on underutilized plant species (Question n. 7: Is any other institution in your country doing research on underutilized plant species?). 43 out of 51 respondents replied affirmatively (84.3%). Only 25 out of these 43 respondents then indicated the specific research sectors in which these institutions were involved (Question n. 7.1: What are the research topics?). The results are shown in Tab. 5.

**Tab. 5 Research activities on Underutilized Plant Species carried out by other institutions in respondents' country (Question n. 7.1)**

	<b>N. of responses</b>	
		<b>%</b>
Plant genetic resources	16	64.0 %
Ecology	1	4.0 %
Production	10	40.0 %
Food security and health	4	16.0 %
Socioeconomics and ethnobotany	3	12.0 %
Processing technology development	4	16.0 %
Marketing	2	8.0 %
Capacity building	2	8.0 %
Legal and policy issues	1	4.0 %
<b>Total Respondents</b>	<b>25</b>	
(skipped this question)	37	

In addition 67.3% of 52 respondents judged the existing national policies in their country encouraging the research on underutilized plant species (Question n. 8: Does the national research policy encourage research on underutilized plant species?) and, specifically, 70% of them asserted the existence of national programs to promote these species in order to increase food security and income generation (Question n. 9: Are any underutilized plant species promoted in your country to increase food security and to generate income?).

From the section dedicated to the information needs of the respondents (Question n. 10: What kind of information would your organization need in order to do research on underutilized plant species?), came out that the most required information concerned potential research funding sources, followed by information about the value of the species, market information, agronomic data, etc. (Tab. 6). It could be inferred from the present result and from that previously analyzed (Fig. 1) that funding itself is not considered a strong constraint to the more wider utilization of currently underutilized species but the access to available funds is a necessary condition to promote and exploit their potential.

**Tab. 6 Information needs (Question n. 10)**

	<b>N. of responses</b>	<b>%</b>
Agronomic data related to the species	40	70,2 %
Husbandry information	19	33,3 %
Economic, ecological, nutritional, social and other values of the species	44	77,2 %
Seed supply sources	31	54,4 %
Post-harvest handling technologies	34	59,6 %
Market information	41	71,9 %
Who else is working on the species	37	64,9 %
Potential research funding sources	52	91,2 %
Training opportunities for staff	38	66,7 %
<b>Total Respondents</b>	<b>57</b>	
(skipped this question)	5	

96.6% of the respondents were personally interested in receiving information on underutilized plant species; 80% of them preferred receiving information via e-mail, other choices were CD-Rom (51.8%), print material (53.6%) and Internet (46.4%) (Question n. 11: Would you personally be interested in receiving information on underutilized plant species? and Question n. 12.1: If yes, on which form?).

In Appendix 1 are reported all the Underutilized Plant Species mentioned by the respondents in the survey. In column A are ticked off the species that the respondents mentioned as underutilized in their country in question n. 2 (see also Tab. 3) and which belong to the merged list mentioned on page 5, in B the plant species considered underutilized in respondent's country but not included in the merged list and corresponding to those indicated as "Others" in table 3 in 84.2% of the responses to question n. 2 (see also Tab 3.1), in C the underutilized plant species which the respondents' organizations are dealing with (Question n. 5.1), in D the underutilized plant species which the respondents' organizations not involved at present in research activities on underutilized species could be interested in (Question n. 6.1), in E the species investigated by other institutions in respondents' countries (Question n. 7.1) and in F the underutilized plant species favoured at present by national policy in respondents' countries, because they are potentially able to increase food security and income generation (Question n. 9.1). The number of ticks gives an indication of the number of times the species has been mentioned.

On the whole, it could be inferred from Appendix 1 that *Vigna subterranea*, *Amaranthus* spp., *Eleusine coracana*, *Chenopodium pallidicaule*, Cucurbits (including *Citrullus*, *Cucurbita* and *Cucumis* genera), *Schlerocarrya birrea* and *Dacryodes edulis* represent the most mentioned underutilized plant species. *Vigna subterranea* and *Eleusine coracana* are the species on which different organizations are already doing research (Column C). On the contrary it is not possible to identify a specific species the respondents' organizations not working on underutilized plant species are interested in (Column D). *Amaranthus* spp., *Eleusine coracana*, *Gnetum africanum* and *Origanum syriacum* are the species on study by other institutions different from that of the respondents in their own country (Column E), while *Amaranthus* spp. and *Chenopodium quinoa* are the species promoted to increase food security and income generation in respondents' countries.

## Appendix 1

### List of Underutilized plant species merged from different sources

Abelmoschus caillei	Anacardium occidentale	Brassica carinata
Abies amabilis	Annona cherimola	Brassica juncea
Abies balsamea	Annona. cherimola x Annona squamosa	Brassica napus
Abies cephalonica	Annona diversifolia	Brassica oleracea
Abies concolor	Annona montana	Borassus aethiopicum
Abies fraseri	Annona muricata	Bromelia karatas
Abies lusiocurpu	Annona reticulata	Bunchosia armeniaca
Acacia auriculiformis	Annona squamosa	Butyrospermum kirkii
Acacia boliviana	Aronia alnifolia (Amelanchier alnifolia)	Byrsonima crassifolia
Acacia hemiteles	Arracacia xanthorrhiza	Calathea allouia
Acacia jacquemontii	Artemisia abrotanum	Calocarpum mammosum
Acacia karroo	Artemisia afra	Calocarpum viride
Acacia leucophloea	Artemisia arbuscula	Campomanesia lineatifolia
Acacia mangium	Artemisia cana	Canarium indicum
Acacia mearnsii	Artemisia dracuncululus	Canarium ovatum
Acacia prainii	Artemisia granatensis	Canavalia ensiformis
Acacia subrigida	Artemisia herba-alba	Canavalia gladiata
Acacia tortilis	Artemisia lactiflora	Canna edulis
Acacia villosa	Artemisia ludoviciana	Capparis spp.
Acca sellowiana	Artemisia rothrockii	Capparis cynophallophora
Acrocomia aculeata	Artemisia tripartita	Capparis decidua
Acrocomia totai	Artemisia vulgaris	Capparis micracantha
Adansonia digitata	Artocarpus altilis	Capparis spinosa
Adansonia grandidieri	Artocarpus heterophyllus	Carica papaya
Aegle marmelos	Artocarpus communis	Carica pubescens
Aiphanes aculeata	Artocarpus incisa	Carissa edulis
Allium atrovioleaceum	Artocarpus odoratissimus	Carthamus laevis
Allium tricoccum	Astrocaryum vulgare	Carthamus tinctorius
Allium vineale	Atriplex spp.	Carya cathayensis
Alocasia macrorhiza	Atriplex halymus	Caryocar glabrum
Alocasia sanderiana	Attalea allenii	Caryocar nuciferum
Aloe ssp.	Attalea cohune	Caryocar villosum
Aloe boylei	Azadirachta indica	Casimiroa edulis
Aloe ferox	Bactris gasipaeas	Castanea dentata
Aloe polyphylla	Balanites aegyptiaca	Castanea mollissima
Aloe vera	Basella alba	Castanea pumila
Amaranthus spp.	Basella rubra	Celosia argentea
Amaranthus caudatus	Benincasa hispida	Ceratonia siliqua
Amaranthus gracecisane	Bertholletia excelsa	Cereus hexagonus
Amaranthus hybridus	Bidens pilosa	Chamaedorea tepejilote
Amaranthus hypochondriacus	Bixa orellana	Chenopodium spp.
Amaranthus palmeri	Blighia sapida	Chenopodium album
Amaranthus paniculatus	Boerhavia elegans	Chenopodium pallidicaule
Amaranthus retroflexus	Bombacopsis glabra	Chenopodium quinoa
Amaranthus tricolor	Borojoa patinoi	Chenopodium ambrosioides
Amaranthus viridis	Borojoa sorbilis	Chenopodium berlandieri
Ambelania acida	Brachiaria deflexa	Chenopodium rubrum
Ambelania sagotii	Brassica carinata	Chrysobalanus icaco
Amelanchier pallida		Chrysophyllum cainito

Citrullus spp.
Citrullus colocynthis
Citrullus lanatus
Citrus grandis
Cleome gynandra
Clidemia biformis
Clidemia petiolata
Clidemia rubra
Cnidioscolus chayamansa
Coccoloba uvifera
Coleus dysentericus
Colocasia esculenta
Corchorus olitorius
Cordeaxia edulis
Coriandrum sativum
Couepia longipendulata
Couma utilis
Crambe cordifolia
Crocus sativus
Crotalaria arenaria
Crotalaria brevidens
Crotalaria burhia
Crotalaria juncea
Crotalaria lonirostrata
Crotalaria micans
Crotalaria ochroleuca
Crotalaria spectabilis
Cucurbita foetidissima
Cucurbita moschata
Cuminum cyminum
Cuphea hyssopifolia
Cuphea micropetalum
Curcuma angustifolia
Curcuma aromatica
Curcuma longa
Cyamopsis tetragonoloba
Cydonia oblonga
Cynara cardunculus
Cyphomandra betacea
Dacryodes edulis
Dactylis glomerata
Digitaria spp.
Digitaria exilis
Dimocarpus longan
Dioscorea spp.
Dioscorea alata
Dioscorea bulbifera
Dioscorea cayenensis
Dioscorea cotinifolia
Dioscorea esculenta
Dioscorea esculenta
Dioscorea floribunda
Dioscorea hirtiflora

Dioscorea nummularia
Dioscorea rotundata
Dioscorea villosa
Dioscorea zingiberensis
Diospyros digyna
Diospyros kaki
Diospyros mespiliformis
Diploaxis muralis
Diploaxis tenuifolia
Dovyalis caffra
Dovyalis hebecarpa
Dovyalis longispina
Duckesia verrucosa
Duguetia lepidota
Durio zibethinus
Echinochloa frumentacea
Echinochloa utilis
Elettaria cardamomum
Eleusine coracana
Embllica officinalis
Eragrostis tef
Eriobotrya japonica
Eruca sativa
Eruca vesicaria
Erythrina edulis
Eugenia dombeyi
Eugenia latifolia
Eugenia patrisii
Eugenia stipitata
Eugenia uniflora
Euphorbia lagascae
Euterpe oleracea
Fagopyrum esculentum
Fagopyrum homotropicum
Feijoa sellowiana
Ficus carica
Flemingia congesta
Garcinia spp
Garcinia mangostana
Genipa americana
Glycyrrhiza glabra
Gnetum africanum
Grias peruviana
Guizotia abyssinica
Gustavia macarenensis
Gustavia superba
Gynandropsis gynandra
Hancornia speciosa
Harpagophytum procumbens
Hibiscus cannabinus
Hibiscus sabdariffa
Hibiscus sabdariffa var. altissima

Hibiscus sabdariffa var. sabdariffa
Hippophae rhamnoides
Hovenia dulcis
Hylocereus triangularis
Hylocereus undatus
Inga edulis
Inga feuillei
Inga laurina
Inga meissneriana
Inga stipularis
Inga vera
Ipomea aquatica
Irvingia gabonensis
Jatropha spp.
Jatropha curcas
Juglans neotropica
Juglans regia
Kerstingiella spp.
Kerstingiella geocarpa
Lablab purpureus
Lagenaria spp.
Lagenaria siceraria
Lathyrus sativus
Lathyrus articulatus
Lathyrus cicer
Lathyrus jepsonii
Lathyrus ochroleucus
Lathyrus odoratus
Laurus nobilis
Lawsonia inermis
Lecythis pisonis
Lepidium meyenii
Lesquerella fendleri
Leucaena leucocephala
Lippia multiflora
Litchi chinensis
Lucuma obovata
Lupinus mutabilis
Lupinus albus
Lupinus angustifolius
Lupinus arboreus
Lupinus luteus
Lupinus perennis
Lupinus sulphureus
Macrotyloma uniflorum
Malpighia glabra
Malva alcea
Malva pusilla
Malva sylvestris
Mammea americana
Mangifera indica
Manilkara zapota

Matisia cordata
Mauritia flexuosa
Maximiliana maripa
Melicoccus bijugatus
Mentha piperita
Metroxylon sagu
Mirabilis expansa
Momordica balsamina
Momordica charantia
Momordica dioica
Monstera deliciosa
Morinda citrifolia
Moringa spp.
Moringa oleifera
Moringa stenopetala
Mucuna aterrima
Mucuna deeringiana
Mucuna enana
Mucuna pruriens
Mucuna prutita
Mucuna solanei
Myrciaria cauliflora
Myrciaria dubia
Nephelium lappaceum
Nigella damascena
Nigella sativa
Oenocarpus bacaba
Oenocarpus bataua
Opuntia ficus-indica
Opuntia coccinellifera
Opuntia compressa
Opuntia humifusa
Opuntia maxima
Orbygnia phalerata
Origanum dictamnus
Origanum dubium
Origanum syriacum
Origanum vulgare
Oxalis tuberosa
Pachira aquatica
Pachyrhizus ahipa
Pachyrhizus erosus
Pachyrhizus tuberosus
Panicum miliaceum
Panicum miliare
Panicum amarum
Panicum hemitomom
Panicum laetum
Panicum repens
Panicum sumatrense
Panicum virgatum
Parkia biglobosa
Parthenium argentatum

Paspalum scrobiculatum
Passiflora alata
Passiflora antioquiensis
Passiflora caerulea
Passiflora capsularis
Passiflora cincinnata
Passiflora coccinea
Passiflora cumbalensis
Passiflora edulis
Passiflora edulis f. flavicarpa
Passiflora foetida
Passiflora gabrielliana
Passiflora laurifolia
Passiflora ligularis
Passiflora maliformis
Passiflora manicata
Passiflora mixta
Passiflora mollissima
Passiflora nitida
Passiflora pergrandis
Passiflora pinnatistipula
Passiflora popenovii
Passiflora quadrangularis
Passiflora tarminiana
Passiflora tiliifolia
Passiflora tripartita var. mollissima
Passiflora tripartita var. tripartita
Pastinaca sativa
Patinoa almirajo
Paullinia cupana
Pennisetum americanum
Pennisetum glaucum
Perilla frutescens
Persea americana
Phaseolus angularis
Phoenix dactylifera
Physalis alkekengi
Physalis peruviana
Physalis philadelphica
Physalis pubescens
Phytolacca acinosa
Pistacia lentiscus
Pistacia vera
Pistacia atlantica
Pistacia chinensis
Platonia insignis
Plectranthus esculentus
Phyllanthus acidus
Phyllanthus emblica
Phyllanthus niruri
Phyllanthus niruroides

Pongamia pinnata
Poraqueiba sericea
Pouroma cecropiaefolia
Pouteria caimito
Pouteria campechiana
Pouteria lucuma
Pouteria macrocarpa
Pouteria macrophylla
Pouteria sapota
Pouteria speciosa
Prunus africana
Prunus capuli
Prunus angustifolia
Prunus emarginata
Prunus geniculata
Prunus laurocerasus
Prunus lusitanica
Prunus maritima
Prunus mexicana
Prunus mume
Prunus nigra
Prunus salicifolia
Prunus sargentii
Prunus serotina
Prunus spinosa
Prunus subhirtella
Prunus triloba
Prunus virginiana
Psidium angulatum
Psidium cattleianum
Psidium guajava
Psophocarpus tetragonolobus
Punica granatum
Quercus acutissima
Quercus alba
Quercus bicolor
Quercus coccinia
Quercus douglasii
Quercus engelmannii
Quercus garryana
Quercus geminata
Quercus hiolensis
Quercus macrocarpa
Quercus muhlenbergii
Quercus nigra
Quercus palustris
Raphia australis
Raphia farinifera
Raphia hookerii
Rhaphanus sativus
Rheedia madruno
Rhus coriaria
Ricinodendron rautanenii

Ricinus communis
Rollinia mucosa
Rollinia pulchrinervia
Rorripa indica
Salacca zalacca
Salsola soda
Salsola vermiculata
Salvia bengalensis
Salvia hispanica
Schlerocarrya spp.
Schlerocarrya birrea
Scolymus hispanicus
Secale cereale
Sechium edule
Sesamum indicum
Setaria italica
Simmondsia chinensis
Solanum aethiopicum
Solanum americanum
Solanum betaceum
Solanum macrocarpon
Solanum melongena
Solanum muricatum
Solanum nigrum
Solanum quitoense
Solanum scabrum
Solanum sessiliflorum
Solanum stramonifolium
Solenostemma arghel

Solenostemon rotundifolius
Sphenostylis stenocarpa
Spondias cytharea
Spondias lutea
Spondias mombin
Spondias purpurea
Stevia rebaudiana
Stipa lagascae
Stipa tenacissima
Strychnos cocculoides
Talinum triangulare
Talisia esculenta
Tamarindus indica
Tamarix aphylla
Telfairia occidentalis
Terminalia koernbachii
Theobroma bicolor
Theobroma grandiflorum
Thymus mastichina
Treculia africana
Trigonella foenum graecum
Triticum spp.
Triticum aestivum x Secale cereale
Triticum dicoccon
Triticum monococcum
Triticum spelta
Tropaeolum tuberosum
Tylosema esculentum

Tylosema fassoglense
Uapaca kirkiana
Ullucus tuberosus
Valerianella locusta
Vangueria infausta
Vangueria madagascariensis
Vasconcellea cauliflora
Vasconcellea pubescens
Vasconcellea x heilbornii
Vernonia calvoana
Vernonia cinerascens
Vernonia galamensis
Vernonia noveboracensis
Veronica amygdalina
Veronica hymenolepis
Vetiveria zizanioides
Vigna aconitifolia
Vigna angularis
Vigna subterranea
Vigna umbellata
Vigna vexillata
Vitellaria paradoxa
Voandzeia subterranea
Xanthosoma sagittifolium
Zingiber officinale
Ziziphus spp.
Ziziphus mauritiana

## Appendix 2 Underutilized plant species mentioned by respondents

	A	B	C	D	E	F
	belonging to the merged list	not belonging to the merged list	currently working with	planning to work with	other inst. working on	promoted by national policies
Abelmoschus caillei	✓					
Abelmoschus esculentus		✓				
Abelmoschus manihot		✓	✓			✓
Adansonia digitata	✓					
Adenium spp.		✓				
Allium ampeloprasum		✓	✓			
Allium sativum			✓			
Aloe vera	✓					
Altea spp.		✓				
Amaranthus spp.	✓✓✓✓		✓✓✓	✓	✓✓	✓✓✓
Amaranthus hybridus	✓					
Amaranthus spinosus		✓				
Amaranthus viridis	✓					
Ampelocissus cavicaulis		✓	✓			
Anisophyllea quangensis		✓	✓			
Aquilana malaccensis			✓			
Araceae spp.		✓				
Aromatic plant		✓	✓✓			
Artocarpus spp.			✓			
Aster spp.				✓	✓	
Aster tripolium		✓				
Athyrium esculentum				✓		
Atriplex spp.	✓					
Atriplex halimus			✓			
Atriplex leucoclada			✓			
Atriplex nummularia			✓			
Bactris gasipaeas	✓✓				✓	
Balanites aegyptiaca	✓					
Banana (Musa spp.)			✓			
Batis maritime			✓			
Benincasa hispida	✓					
Beta spp.				✓	✓	
Beta vulgaris		✓✓	✓			✓

	A	B	C	D	E	F
	belonging to the merged list	not belonging to the merged list	currently working with	planning to work with	other inst. working on	promoted by national policies
Bixa orellana	✓		✓	✓		
Blumea balsamifera					✓	
Bryophytes		✓	✓			
Buddleja globosa			✓			
Cajanus cajan		✓				✓
Cakile spp.				✓	✓	
Canarium indicum	✓		✓		✓	✓
Canarium schweinfurthii		✓				
Canna edulis	✓					
Capparis spp.	✓		✓		✓	
Carthamus tinctorius	✓			✓		
Cassia tora		✓				
Ceratonia siliqua	✓					
Chenopodium spp.	✓		✓		✓	
Chenopodium pallidicaule	✓✓✓✓		✓		✓	
Chenopodium quinoa	✓		✓✓		✓	✓✓✓
Chlorophytum comosum		✓				✓
Chromolaena mikamia		✓	✓			
Chromolaena odorata		✓	✓			
Chrysophyllum cainito	✓					
Cichorium spp.			✓			
Citrullus spp.	✓✓	✓✓✓	✓✓✓			✓
Citrus spp.		✓	✓			
Citrus aurantium		✓				
Cleome gynandra			✓			
Cnidoscolus acontifolius		✓				
Cola acuminata		✓				
Colocasia esculenta	✓✓✓		✓✓			
Conotrachelus nenuphar		✓				
Corchorus capsularis						✓
Corchorus olitorius	✓✓		✓			
Coula edulis		✓	✓			
Crescentia cujete			✓			

	A	B	C	D	E	F
	belonging to the merged list	not belonging to the merged list	currently working with	planning to work with	other inst. working on	promoted by national policies
Crocus sativus	✓					
Cucumaropsis manii		✓				
Cucumis spp.		✓✓✓	✓✓			✓
Cucurbita foetidissima	✓					
Cucurbita maxima		✓				
Cucurbita spp.		✓✓✓	✓✓			✓
Curcuma longa					✓	
Cyamopsis tetragonoloba	✓					
Cynara cardunculus	✓					
Dacryodes edulis	✓✓		✓✓		✓	✓✓
Digitaria spp.	✓		✓	✓		
Digitaria exilis	✓✓		✓			✓
Dioscorea spp.	✓✓✓		✓			
Dolichos spp.			✓			
Echinocloa crusgalli		✓				
Eleusine coracana	✓✓✓		✓✓✓✓	✓✓	✓✓	✓✓
Eugenia stipitata	✓		✓			
Euterpe oleracea	✓		✓			
Fadogia ancylantha		✓		✓		
Fagopyrum esculentum	✓✓		✓	✓	✓	✓
Fimbristylis spp.		✓		✓		
Fodder crops			✓		✓	
Fragaria spp.		✓				
Fruit species		✓✓✓	✓✓✓✓✓		✓✓✓	✓
Garcinia spp.	✓		✓			
Garcinia livingstonei		✓	✓			
Glossostemon bruguieri		✓	✓		✓	✓
Glycyrrhiza glabra	✓		✓			
Gnetum africanum	✓				✓✓	
Gossypium spp.		✓				
Grain legumes		✓				
Grewia tenax		✓	✓			
Gundelia tournefortii		✓				

	A	B	C	D	E	F
	belonging to the merged list	not belonging to the merged list	currently working with	planning to work with	other inst. working on	promoted by national policies
Hancornia speciosa	✓					
Harpagophytum procumbens	✓		✓			
Herbal plant		✓			✓	
Hibiscus sabdariffa	✓✓		✓	✓	✓	✓
Hippophae spp.		✓		✓		
Hordeum vulgare					✓	
Hymenaea courbaril		✓				
Hypericum spp.		✓			✓	
Innula crithmoides			✓			
Irvingia gabonensis	✓✓		✓		✓	✓
Jatropha spp.	✓✓		✓		✓	
Jatropha curcas				✓		
Kerstingiella spp.	✓					
Lablab purpureus	✓✓		✓			
Lagenaria spp.	✓		✓			
Landolphia lanceolata		✓	✓			
Laurus nobilis	✓✓				✓	
Lavandula spp.					✓	
Lavandula angustifolia		✓				
Leafy vegetables		✓✓✓	✓✓✓	✓✓	✓✓✓✓	✓✓✓
Legumes			✓			✓✓
Lepidium meyenii	✓					✓
Leptadenia hastata		✓				
Limoneastrum cristallinum			✓			
Lupinus mutabilis	✓					
Manihot esculenta		✓	✓			
Manilkara zapota	✓					
Matricaria chamomilla		✓				
Medicinal plant		✓✓	✓✓✓		✓✓✓✓	✓✓
Mentha spp.			✓		✓	✓
Mentha cordifolia Opiz					✓	
Minusops spp.		✓				
Mirabilis expansa	✓					

	A	B	C	D	E	F
	belonging to the merged list	not belonging to the merged list	currently working with	planning to work with	other inst. working on	promoted by national policies
Mkilua spp.		✓				
Momordica charantia	✓					✓
Mondia spp.		✓				
Moringa spp.	✓					
Moringa oleifera	✓✓✓✓		✓	✓	✓	
Moringa peregrina		✓				
Moringa stenopetala	✓		✓	✓		
Musa textilis		✓				
Myrciaria dubia	✓✓		✓			✓✓
Nasturtium officinale		✓				
Native potatoes		✓✓				
Ocimum spp.		✓				
Ocimum basilicum					✓	
Olea europaea		✓	✓			
Orchids		✓	✓			✓
Origanum syriacum	✓✓		✓		✓✓	✓
Oryza glaberrima		✓			✓	✓
Oxalis tuberosa			✓			
Pachyrhizus erosus	✓		✓			
Pachyrhizus tuberosus			✓			
Pandanus julianettii		✓				
Panicum miliaceum	✓✓		✓	✓		
Panicum miliare	✓		✓	✓		
Paspalum scrobiculatum	✓					
Passiflora ligularis			✓			
Petroselinum crispum		✓				
Pimpinella anisum		✓				
Pithecellobium dulce		✓				
Polymnia sonchifolia		✓				
Pometia pinnata		✓				
Potatoes		✓✓				
Pouteria sapota	✓					
Prunus persica		✓				

	A	B	C	D	E	F
	belonging to the merged list	not belonging to the merged list	currently working with	planning to work with	other inst. working on	promoted by national policies
<i>Puccinellia maritima</i>		✓				
<i>Punica granatum</i>	✓					
<i>Pyrus cydonia</i>		✓				
<i>Rheum rhabarbarum</i>		✓				
<i>Rhus coriaria</i>	✓					
<i>Ricinodendron heudelotii</i>		✓	✓			
<i>Rosmarinus officinalis</i>					✓	
<i>Sacharum edule</i>		✓	✓		✓	
<i>Salvia fruticosa</i>		✓			✓	
Sapotaceae			✓			
<i>Sauropus androgynus</i>		✓				
<i>Schlerocarrya</i> spp.	✓					
<i>Schlerocarrya birrea</i>	✓✓✓		✓	✓		
<i>Sesamum indicum</i>	✓✓					✓
<i>Sesbania grandiflora</i>		✓				
<i>Sesuvium portulacastrum</i>			✓			
<i>Setaria italica</i>	✓✓		✓✓	✓✓		
<i>Solanum aethiopicum</i>			✓			
<i>Solanum macrocarpon</i>	✓✓		✓✓			✓
<i>Solanum nigrum</i>	✓		✓			
<i>Solanum quitoense</i>	✓					
<i>Solanum scabrum</i>	✓		✓			
<i>Solenostemma arghel</i>	✓		✓		✓	
<i>Sorghum</i>				✓		
<i>Sorghum vulgare</i> var. <i>sudanense</i>		✓				✓
<i>Spartina townsendii</i>		✓				
<i>Sphenostylis stenocarpa</i>	✓			✓		
<i>Spondias tuberosa</i>		✓				
<i>Strychnos espinosa</i>		✓	✓			
<i>Talinum</i> spp.			✓			
<i>Tamarindus indica</i>	✓✓		✓			
<i>Terminalia koernbachii</i>	✓					
<i>Teucrium polium</i>		✓				

	A	B	C	D	E	F
	belonging to the merged list	not belonging to the merged list	currently working with	planning to work with	other inst. working on	promoted by national policies
Theobroma grandiflorum	✓		✓			
Timber trees					✓	
Trichilia emetica		✓				
Triticum spp.	✓		✓			
Triticum dicoccon	✓		✓			
Tropaelum majus		✓				
Tropaeolum tuberosum	✓					
Truffle			✓			
Trychnos madagascariensis		✓	✓			
Tylosema esculentum	✓				✓	
Uapaca kirkiana	✓			✓		
Ullucus tuberosus	✓					
Uncaria tomentosa						✓
Vaccinium spp.		✓				
Vangueria tomentosa		✓	✓			
Vernonia spp.			✓			
Vigna radiata		✓				
Vigna subterranea	✓✓✓✓✓✓✓		✓✓✓✓	✓		✓
Vigna umbellata	✓		✓			
Vigna unguiculata		✓		✓		
Vitex negundo					✓	
Xanthosoma sagittifolium	✓					
Zea mays		✓				
Zingiber officinale	✓					
Zingiberaceae					✓	
Ziziphus spp.	✓✓					✓
Ziziphus jujuba				✓		
Ziziphus mauritiana	✓			✓		
Ziziphus spina-christi		✓				



## Appendix 3



### Questionnaire on Research Activities Related to Underutilized Plant Species

The purpose of the present questionnaire is to collect information for a database "Who-is-doing-what in the field of underutilized plant species" and to identify information needs of research institutions with regard to underutilized plant species.

Access to the database will be available to the public through our web portal currently under construction.

Fill all items of the survey, save a copy as: **YOUR NAME.SURVEYGFU** and e-mail to Paul Bordoni - [p.bordoni@cgiar.org](mailto:p.bordoni@cgiar.org) - attaching the file.

By doing so you will agree that your data will be entered in the database

Thank you for your contribution

**Paul Bordoni**

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**Personal data**

First name:

Surname:

Organization:

Country:

Address:

Tel.:

Fax:

e-mail:

Homepage of your organization: <http://www>.

Your special expertise with Underutilized Species (**see Tab. 1**):

- |                                       |   |
|---------------------------------------|---|
| <input type="checkbox"/> Conservation | <input type="checkbox"/> Production             |
| <input type="checkbox"/> Processing   | <input type="checkbox"/> Marketing              |
| <input type="checkbox"/> Breeding     | <input type="checkbox"/> Information management |
| <input type="checkbox"/> Promotion    | <input type="checkbox"/> Policy                 |

Others (please specify):

Languages you speak

- |                                  |                                  |
|----------------------------------|----------------------------------|
| <input type="checkbox"/> English | <input type="checkbox"/> Spanish |
| <input type="checkbox"/> French  |                                  |

Others (please specify):

**1. To which of the following categories does your organization belong?**

- |  |   |
|--|---|
| <input type="checkbox"/> Governmental          | <input type="checkbox"/> NGO                                  |
| <input type="checkbox"/> Private               | <input type="checkbox"/> University                           |
| <input type="checkbox"/> Farmers Organizations | <input type="checkbox"/> International Research Organizations |

**2. Please list some plant species, which are considered underutilized in your country (see Tab. 3 and 3.1)**

**3. What do you think are the reasons why these species are not more widely used in your country? (see Fig. 1)**

**4. What are the research priorities of your organization? (see Tab. 2)**

**5. Has any research been done in your organization with regard to underutilized plant species?**

- yes       no

**5.1 If yes,**

on which species? **(Appendix 1, column C)**

what are the research topics? **(see Fig. 2)**

**6. If not, does your organization plan to work on underutilized plant species?**

- yes       no

**6.1 If yes,**

why? **(see Tab. 4)**

on which species? **(Appendix 1, column D)**

what will the research topics be? **(see Fig. 3)**

**7. Is any other institution in your country doing research on underutilized plant species?**

yes       no

**7.1 If yes,**

name of institution:

what species? **(Appendix 1, column E)**

what are the research topics? **(see Tab. 5)**

**8. Does the national research policy encourage research on underutilized plant species?**

yes       no

**9. Are any underutilized species promoted in your country to increase food security and to generate income?**

yes       no

**9.1 If yes,**

which species? **(Appendix 1, column F)**

who is promoting them (organization, name, contact)?

**10. What kind of information would your organization need in order to do research on underutilized plant species? (see Tab. 6)**

- agronomic data related to the species
- husbandry information
- economical, ecological, nutritional, social and other values of the species
- seed supply sources
- post-harvest handling technologies
- market information
- who else is working on the species
- potential research funding sources
- training opportunities for staff

**11. In which form should this information be provided?**

- print material
- via internet
- via e-mail
- CD-Rom

**12. Would you personally be interested in receiving information on underutilized plant species?**

- yes
- no

**12.1. If yes, in which form?**

- print material
- via internet
- via e-mail
- CD-Rom

please provide mailing details here: