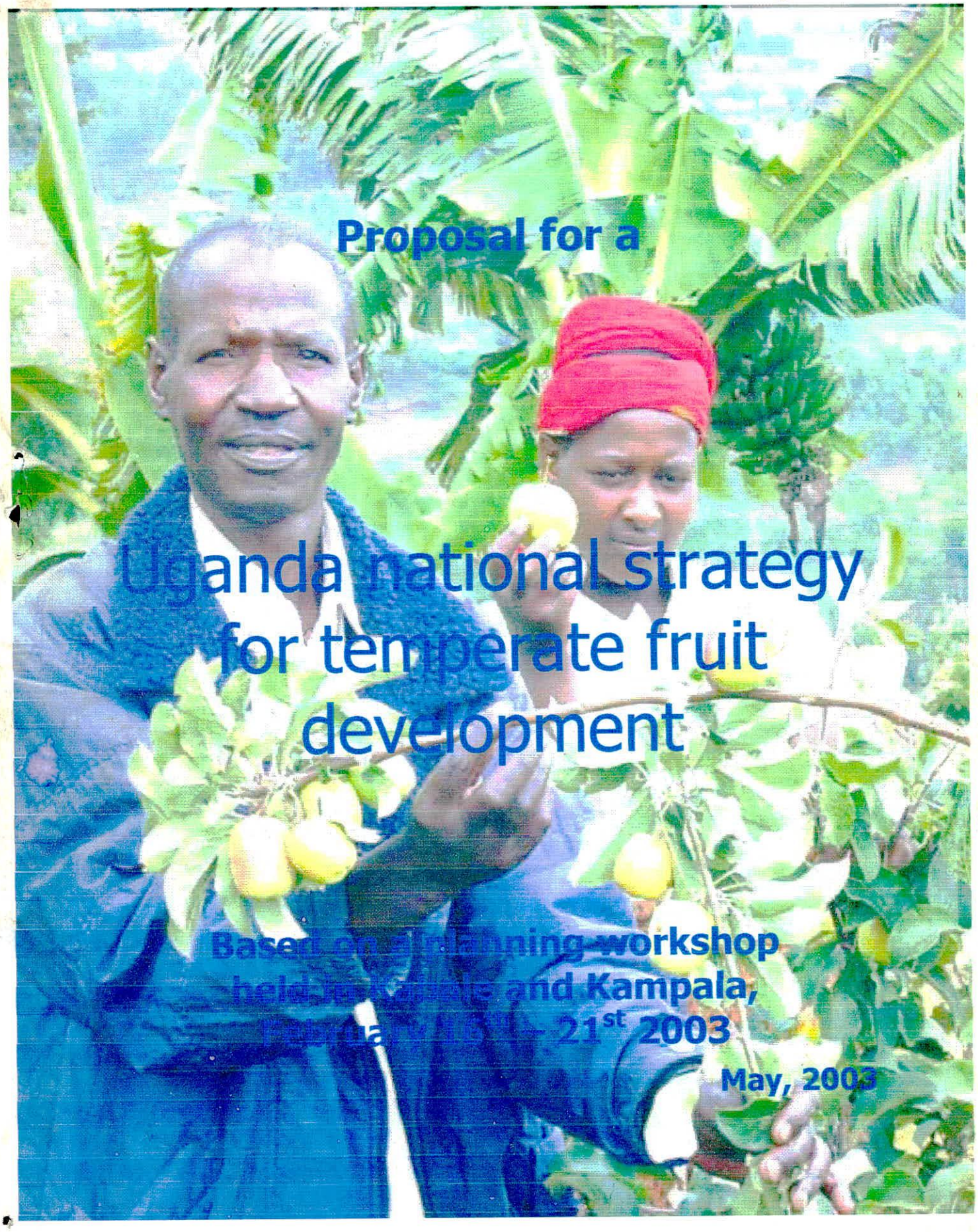
World Agroforestry Centre
TRANSFORMING LIVES AND LANDSCAPES

UGADEN

NARO



Proposal for a

Uganda national strategy for temperate fruit development

Based on a planning workshop held in Kabale and Kampala, March 15th – 21st 2003

May, 2003

Proposal for a

Uganda national strategy for temperate fruit development

Based on a planning workshop
held in Kabale and Kampala,
February 16th – 21st 2003

World Agroforestry Centre
TRANSFORMING LIVES AND LANDSCAPES

Compiled and edited by T. Raussen

for the World Agroforestry Centre (ICRAF)

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Acronyms and abbreviations

AEZ	Agro-ecological zone
AF	Agroforestry
ARDC	Agriculture Research and Development Centre
ASARECA	Association for Strengthening Agricultural Research in East and Central Africa
FORRI	Forestry Resources Research Institute
ECA	East and Central Africa
EU	European Union
ICRAF	International Centre for Research in Agroforestry
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
NAADS	National Agricultural Advisory Services
NARO	National Agriculture Research Organization (Uganda)
PMA	Plan for Modernization of Agriculture
PRA	Participatory Rural Appraisal
TOFNET	Trees on farm network (of ASARECA)
TOR	Terms of Reference
UGADEN	Uganda Agroforestry Development Network

1 Preface

By Hon. J. Nkuuhe

The Uganda Ministry of Agriculture, Animal Industries and Fisheries (MAAIF) has defined some important policy objectives through the Government's Plan for the Modernization of Agriculture (PMA). The vision is to have a profitable, competitive, sustainable and dynamic agricultural and agro-industrial sector by year 2017. Emphasis in PMA is placed on:

- The generation and dissemination of improved technologies in all parts of the country
- Ensuring that they are environmentally sound
- Promoting private sector activity in agricultural development (production of seeds, input supply, information materials)
- Commercialization of agriculture through liberalization and promotion of agricultural trade
- Strengthening rural institutions (credit, market, information and input delivery systems) to support agricultural development
- Devolving selected agricultural research and development functions to the private sector
- Remove policy, legal and institutional constraints related to agricultural development

Fruit tree crops represent one of the important opportunities in the agricultural sector of Uganda. They have the important advantage of combining several very positive characteristics.

- They produce food and contribute to food security and the nutritional quality of diets of Ugandans, especially children, mothers and the general population.
- They can be a significant source of income for rural producers if production can meet the requirements of the market, be it local or international
- They are perennial crops and can contribute to sustainable land use systems if their cultivation is combined with appropriate conservation measures.

As such they represent improved technologies which have an important role to play in the Modernization of Agriculture of Uganda, and their promotion will require that specific issues are addressed including:

- ways of supporting their dissemination,
- promoting private sector activities,
- developing rural groups and institutions which can support production, transport, processing and marketing
- and a number of related questions

Together with ICRAF and NARO, UGADEN, a young non-governmental organization promoting agroforestry in Uganda called for a workshop on temperate fruit development in Uganda. In February 2003 this event brought together a wide range of actors in the sector of fruit tree crops ranging from farmers, extensionists, researchers, local governments, political leaders, donors as well as representatives of the private sector. A pre-conference field tour further enhanced their confidence that fruit trees can play a very important role in

enhancing farmers' nutrition and income while supporting growth of the Ugandan economy in general.

The workshop saw excellent presentations from various countries in East and Central Africa shedding light on all aspects of temperate fruit development including propagation, management, post harvest handling, marketing, research and dissemination experiences. Based on this information, workshop participants developed a blueprint for the development of temperate fruit production in Uganda and enhanced regional collaboration. Further, clear recommendations on the next steps required to scale-up the still small but already vigorous enterprise of temperate fruit production in Uganda's highlands were adopted.

It is my pleasure to present to you the main elements of the proposed **Uganda national strategy for temperate fruit development**.

2 Summary and recommendations

On the foundation of existing institutional set-ups and regional cooperation the Uganda temperate fruit development strategy rests on 4 main pillars (see Figure 1):

(1) An economic system for the propagation of quality planting materials

(2) The development of local, national, regional and eventually international markets for Ugandan fruits

(3) Applied socio-economic and biophysical research on fruit production and marketing

(4) Competent and locally available horticultural advisory services

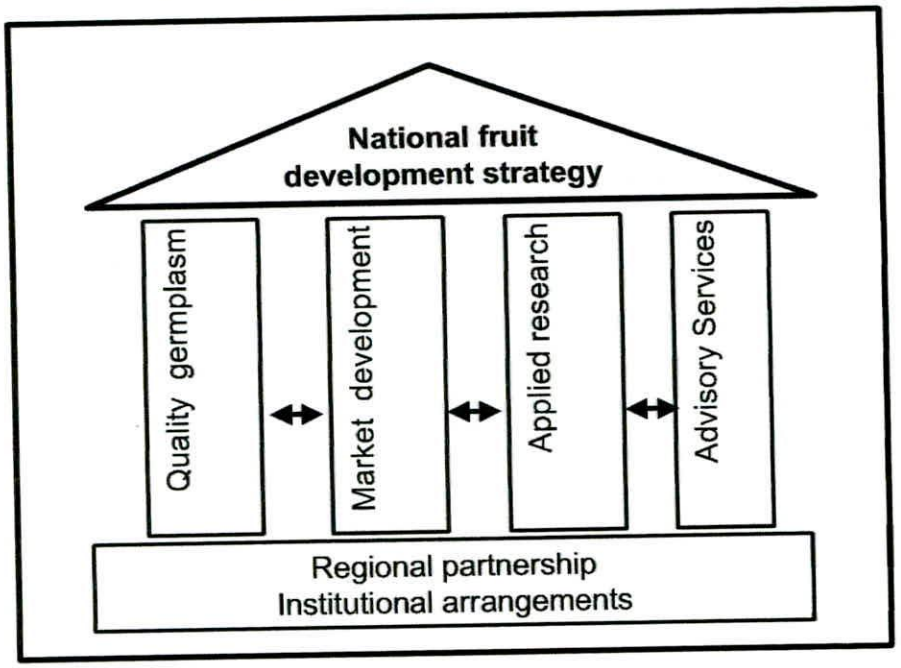


Figure 1: Core Elements of Uganda's temperate fruit development strategy

During the early stages of the development process on temperate fruit production the scaling up of two commodities for which only core "material" exists (the left and right pillar in Figure 1) should be emphasized:

(1) Rootstock and scion material

(2) Knowledge and practical skills on the propagation and management of temperate fruit trees

In both cases the development strategy has to be based on a well-designed and organized scaling-up strategy relying mainly on the material and manpower available in Uganda. The main pathways of the strategy are summarized as follows:

2.1 Quality planting material

Only appropriate vegetative multiplication approaches guarantee quality planting material. Informing about the importance of grafting, providing training in grafting and monitoring the quality of propagation material is key to fruit production development in Uganda.

Making planting material (rootstock, scions and grafted seedlings) locally available will depend on a well-planned strategy including:

- Early establishment of well managed seed orchards for fruit trees in all target areas
- Early establishment of multiplication sites for vegetative propagation of apple and pear rootstocks provides excellent opportunities for rapid multiplication of rootstock. High management levels and phytosanitary monitoring are important for success.
- Tissue culture could provide a supportive role for certain aspects in fruit tree multiplication.
- Early establishment of well managed mother gardens for the production of fruit tree scions in all target areas is of high importance for the fruit development strategy.
- While fruit nurseries play a vital role in promoting fruit production, emphasis should be laid on the more economic and technically more successful grafting of rootstocks in the field. Mobile grafters play an important role in successful fruit production areas in the region.

Regarding the timeframe for the propagation strategy, a midterm time horizon of 5 to 10 years is essential for a meaningful strategy. Shortcuts are not available or not sustainable. A decentralized approach is important. Ideally, decentralized may be defined in this case as within "bicycle distance". Initial targets may well be to provide the above facilities at least in each county and later in each subcounty of relevant agroecological zones (AEZ). Ownership of the propagation facilities plays a key role. Focus on field grafting, supplemented by private nurseries and strategically located fruit tree centres managed by research, will lead to a successful fruit tree propagation strategy.

While it is tempting to assume that smallholder farmers are best supported by free fruit tree seedlings, evidence shows that free fruit tree seedlings do not support fruit development in Uganda.

2.2 Competent advisory services

Similar to the biophysical case of limited core planting material within Uganda, a strategic approach to rapidly share the knowledge and experiences of few specialists has to initiated to build up competent advisory services.

Practical training on all aspects of fruit production and handling is key for the training of trainers and for training farmers. Rather than training large numbers, intensive training for core groups including regular refresher courses is called for. Practical training for trainers and farmers should be supplemented by brochures, handouts and radio programmes for the general public.

While extension approaches and techniques are similar to those for other commodities, NAADS will have to invest in the training of trainers on temperate fruit production to be in a position to respond favourably to farmers' requests for services on this topic.

2.3 Market development

A key constraint to the development of markets for temperate fruits in Uganda and within the region is the lack of reliable information. Hence the urgent need to collect and document market information. However, it is clear that for the next decade, the main markets for temperate fruits are within Uganda. It appears to be rationale to rather concentrate on tropical fruit for international markets.

Development efforts for temperate fruits should concentrate on high-potential areas and promote collection points as well as farmer associations. Alongside with production promotion, cottage industry and local processing need to be developed. Home consumption of temperate fruit should be stimulated through nutritional information on temperate fruits.

Appropriate quality standards for the various markets should be set by farmer associations. Like for all market development, favourable frame conditions need to be provided by national and local governments

2.4 Applied research

Interdisciplinary applied research on topics of practical importance to farmers, combined with good market research is required.

Market research should concentrate on consumer preferences, niches, non-price information and processing opportunities. Monitoring and socio-economic research is important to document progress made and to evaluate the biophysical and socio-economic impact of the activities. Biophysical research should be mainly based on constant observation and documentation of performance indicators for the various species and cultivars under different management levels in southwestern Uganda. Research on the management of pests and diseases will be key for the development of the industry.

2.5 Institutional arrangements and regional partnerships

Acknowledging the various important players in the development of temperate fruit industry in Uganda, a small working committee is proposed, coordinated by the chairman of UGADEN. At regional level a committee with one representative per country and representation of key players should be coordinated by ICRAF.

Information exchange, joined development of markets, safe exchange of planting materials and policy research are important tasks for regional support to temperate fruit development in East and Central Africa.

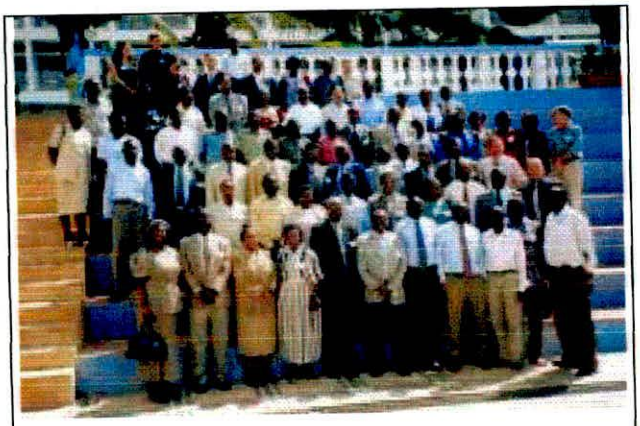
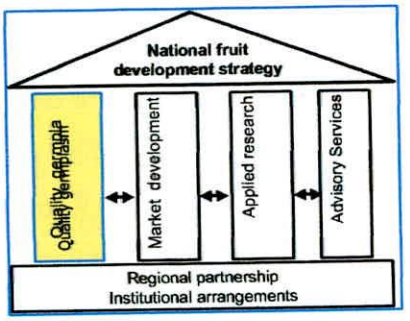


Figure 2: Meeting of experts on fruit production from Uganda, the ECA region and overseas. Kampala, February 2003

3 Sustainable supply of quality germplasm

Past efforts to develop tropical and temperate fruit production in Uganda for home consumption and marketing have been hampered by inappropriate propagation methods. For productive, quality fruit trees it is usually not enough to raise a tree from seed. Investment in improved propagation methods is an absolutely necessary ingredient for any strategy to develop fruit production.



3.1 Vegetative propagation as basis for fruit production

There are two basic methods of producing a fruit tree:

(1) By seed (sexual) or

(2) Vegetatively (asexual).

The natural method of multiplying a plant is by seed, but most crosspollinating plants, such as fruit trees, do not produce fruit like the parent. They are therefore generally disappointing because:

(1) They take many years to start fruiting

(2) Fruits are of unknown, often inferior, quality

(3) Fruit trees from seed grow into large trees, difficult to harvest and occupying much land.

Fruit seedlings from seed should therefore generally be avoided for meaningful fruit production.

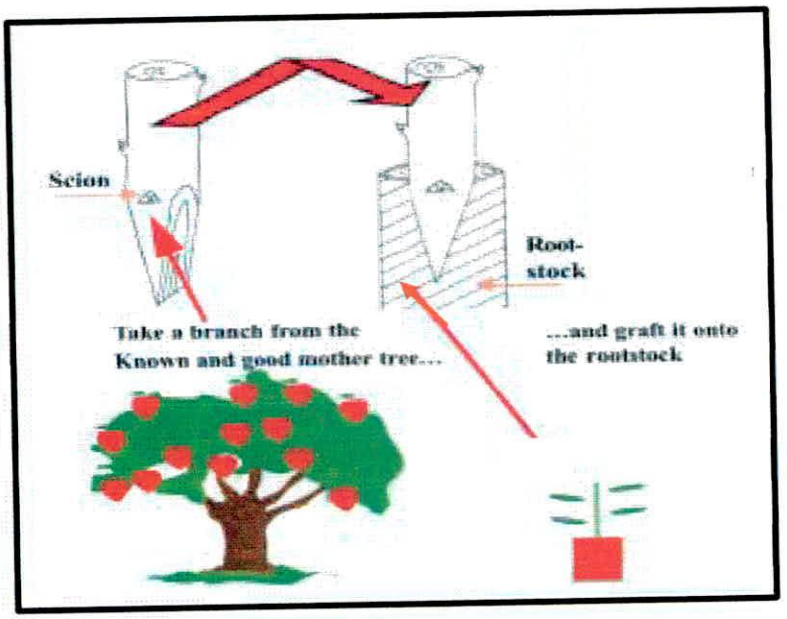


Figure 3: Grafting as the basics for successful fruit production

Appropriate planting material is grown as rootstocks onto which the desired fruit cultivars are budded or grafted.

The above is the basic of successful fruit production (see Figure 3).

Grafted fruit trees:

(1) Fruit 2 to 4 years after planting

(2) Produce quality fruits

(3) Do not grow into large trees.

Informing about the importance of grafting, providing training in grafting and monitoring the quality of propagation material is key to fruit production development in Uganda.

Few fruit tree species are multiplied through other vegetative propagation technologies such as cuttings and layers.



Figure 4: Guavas for example are multiplied by air layering

3.2 Production of rootstock material

As described above (3.1), rootstocks are one element of appropriate planting material for most fruits. The rootstocks themselves are often raised from seed but may also be produced vegetatively.

3.2.1 Rootstock production through seed

Like any other trees, rootstocks can be raised from seed in a nursery or directly in the field. For good germination the seed often requires some treatment, i.e. cold and wet stratification for most seed of temperate fruits. Seed for rootstocks should usually be sown 4 to 6 months prior to the intended grafting time. For temperate fruits in Uganda this is between December and February.

Seed for rootstocks is available for most tropical fruits in Uganda, since seed can be collected from vigorous ungrafted fruit trees. For temperate fruits however, only few fruit orchards for the production of rootstock seed have been established so far. Some orchards of selected cultivars were established in southwestern Uganda to produce rootstock seed particularly suited for the highlands of East and Central Africa. They are expected to begin producing seed 5 years after their establishment.

Future generations of such orchards should be established with scions from these fruit orchards grafted on rootstocks to reduce the period from establishment to production.

Until enough seed orchards are established, rootstock seed for temperate fruits should be imported, observing all relevant quarantine regulations.

Early establishment of well-managed seed orchards for fruit trees in all target areas is of high importance for the fruit development strategy.

3.2.2 Clonal rootstock production

Vegetative multiplication of rootstock material is often feasible in the field, but can also be complemented by modern multiplication approaches in tissue culture laboratories.

3.2.2.1 Production of clonal rootstock in the field

Through banana growing, most farmers are well aware that suckers can be used for multiplication. Similarly, suckers from some fruit tree rootstocks, such as certain apple and pear cultivars, are commercially used for clonal multiplication. Appendix 0 provides an overview on the approach to clonal multiplication in the field.

Such material is currently multiplied at research sites in southwestern Uganda. More than 10 suckers are raised from each plant per year and although initial multiplication rates are slow, within few years many multiplication centres can be established.

Good management, particularly hygiene and proactive pest management are important for successful clonal multiplication.

Early establishment of multiplication sites for vegetative propagation of apple and pear rootstocks provides excellent opportunities for rapid multiplication of rootstock. High management levels and phytosanitary monitoring are important for success.

3.2.2.2 Production of clonal rootstock through tissue culture

The variety of techniques used to initiate plant development through tissue culture is considerable. Shoot tip culture is the method in widest use for the mass propagation of woody species. If conditions are managed favourably up to a hundred shoots may be produced in as little as eight to twelve weeks from a single tip. The resulting rooted shoot is referred to as a "plantlet" because of its miniature size, but these can generally be grown in the greenhouse at a rapid rate and with a high degree of survival.

Tissue culture for woody species is an emerging approach which holds good promises. In Uganda good results are already obtained for banana, coffee and Irish potato.

However, not every nursery will operate a tissue culture laboratory. Operation and management of a tissue culture facility requires personnel and physical facilities which are expensive and quite different from those required by a container or field production nursery. It should be emphasized at this point, that the training and quality of the laboratory manager is more important than the laboratory itself.

Strategically located tissue culture laboratories are well suited to back-up multiplication efforts for fruit rootstocks, particularly for cultivars which are slow or difficult to multiply otherwise. Production of disease free material for further conventional multiplication is an important support function of tissue culture.

3.3 Production of scion material and grafting

3.3.1 Production of scion material

Choice of the scion influences most characteristics of the resulting fruit tree. Research has selected superior fruit cultivars which can only be multiplied through grafting scions from these trees on appropriate rootstocks. Scions may be collected from any healthy fruit tree with the desired fruit quality, often of a known cultivar.

Like in the case for rootstocks, such improved tree material is available at some research sites in Uganda. Since grafting has to be done during short periods of tree dormancy and since grafting needs to be done soon after the scion ha s been cut, decentralized orchards with fruit trees suitable for scion collection need to be developed.

Early establishment of well managed mother gardens for the production of fruit tree scions in all target areas is of high importance for the fruit development strategy.

3.3.2 Grafting

Graftage is the technique in which a portion -such as a bud or a twig (scion)- of one plant is placed onto another plant (rootstock) in such a manner that union of the two takes place [1]. Many methods of grafting have been developed and although often seen as a specialized art, with practical training many farmers quickly become successful grafters. Experience indicates that for rapid scaling up investing in training on grafting has higher potential than investing in sophisticated nurseries.

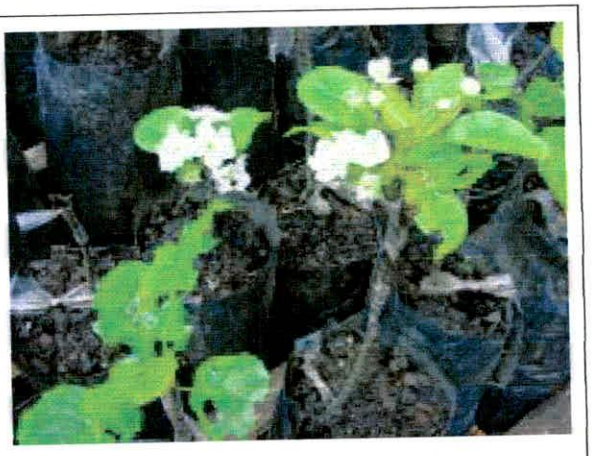


Figure 5: Grafted tree seedlings

3.3.3 Nursery and field grafting

The usual approach to propagation of fruit trees is to raise rootstock as bare-rooted or container plants in a nursery. Grafting also takes place in the nursery and after about one year the grafted seedlings are ready for sale.

Observations within Uganda and the East African region show that a modified approach often shows better physical results at lower costs. There, rootstock seedlings are raised in farmer nurseries for 3 to 6 months and then planted in the field. After their establishment

they are grafted there. Since the rootstock is transplanted at a more appropriate growth stage and the root system not restricted by nursery conditions better establishment and growth as well as earlier fruiting are observed.

While fruit nurseries play a vital role in promoting fruit production, emphasis should be laid on the more economic and technically more successful grafting of rootstocks in the field.

Mobile grafting units

In Lushoto, Tanzania good success is reported through private grafters. During the grafting season these skilled, often young men move through the farmland and offer their services to graft scions from a range of cultivars on farmers' rootstocks. A fee is agreed and 50% paid at grafting while the rest is due after take-up of the scion. An affordable service for farmers, which at the same time provides a source of income for skilled artisans.

3.4 Comprehensive fruit tree propagation strategy

Fruit tree propagation requires more time and efforts than the propagation of perennial crops. Due to prohibitive costs and phytosanitary requirements, importation of planting material can only support the development of basic material. Importation is not a solution for broad multiplication. As described above (3.2 and 3.3), strategically located orchards for rootstock and scion materials have to be established as top priority.

A midterm time horizon of 5 to 10 years is essential for a meaningful strategy. Shortcuts are not available or not sustainable.

3.4.1 Preconditions

It is a simple fact that a key pillar for fruit production development in Uganda is easy access for fruit producers to quality planting material. Past approaches with centralized nurseries did not show the desired impact, particularly upcountry. While central stations play a role for further research and provision of basic clean material the following elements are considered key to a successful scaling-up strategy:

(1) Decentralized seed orchards for rootstock seed,

(2) Decentralized multiplication centres for vegetative rootstock multiplication.

(3) Decentralized mother orchards for clean scion material for relevant fruit tree cultivars.

Ideally decentralized may be defined in this case as within "bicycle distance". Initial targets may well be to provide the above facilities at least in each county and later in each subcounty of relevant agroecological zones.

For recommendations on management and ownership see paragraph 3.4.4.

3.4.2 The scope of the task

Home consumption and local markets will be the initial targets for fruit development (see chapter 6.1). Assuming that each household in the areas suitable for temperate fruits would only want an average of 5 fruit trees, about 1.7 million grafted fruit tree seedlings would be required. With a solid foundation of several thousand temperate fruit trees of more than 40

cultivars under adaptive research, in southwestern Uganda, the target could be met within the next decade if a well-planned strategic approach is taken.

Table 1: Areas of Uganda suitable for temperate fruit production (based on agroecological data by: / 6/)

Region	**No. of households**	**farmland** (km^2)
Kigezi highlands	200,000	4600
Rwenzori footslopes	78,000	1600
Mt. Elgon	48,000	700
Nebbi	10,500	500
	~ 336,500	**7400**

3.4.3 Priority and niche species

Farmers, middlemen, marketers and exporters need to be consulted to determine which species and cultivars to prioritise. Various approaches exist to conduct PRAs, market surveys etc. Long-term trends have to be considered in this research since fruit trees produce economically for several decades.

While certain fruits are well known internationally, there exists a wide range of fruits with good local markets and local consumer preferences. Multiplication activities should make use of these potentials and include such species in their programmes.

Include indigenous (non-temperate) and tropical tree species in multiplication programmes.

3.4.4 Ownership and management

Specialized research institutions should manage strategically localized fruit tree centres to produce disease free core material for further multiplication. ARDC's and substations of the institutes should be considered.

While field grafting is considered the best approach (see 3.3.3), nurseries for the production of rootstocks and some grafted fruit tree seedlings are required in all suitable agroecological zones. Experience with other tree crops in Uganda and experiences with fruit trees in the ECA region show that privately owned nurseries are superior in terms of output, quality and costs. Development projects could follow this experience and contract private fruit tree nurseries for their programmes rather than setting up their own nurseries.

Focus on field grafting, supplemented by private nurseries and strategically located fruit tree centres managed by research, will lead to a successful fruit tree propagation strategy.

3.4.5 Timing

Successful multiplication and planting of quality fruit tree seedlings depends on appropriate timing. Investing in a quality fruit tree seedling and planting it at an inappropriate time of the year is wasteful. Similarly, multiplication operations depend on seasons and on the state of the mother trees. For example: scions should be collected when the trees are mainly dormant. Figure 6 proposes a time frame for the multiplication of temperate fruit trees under conditions of southwestern Uganda.

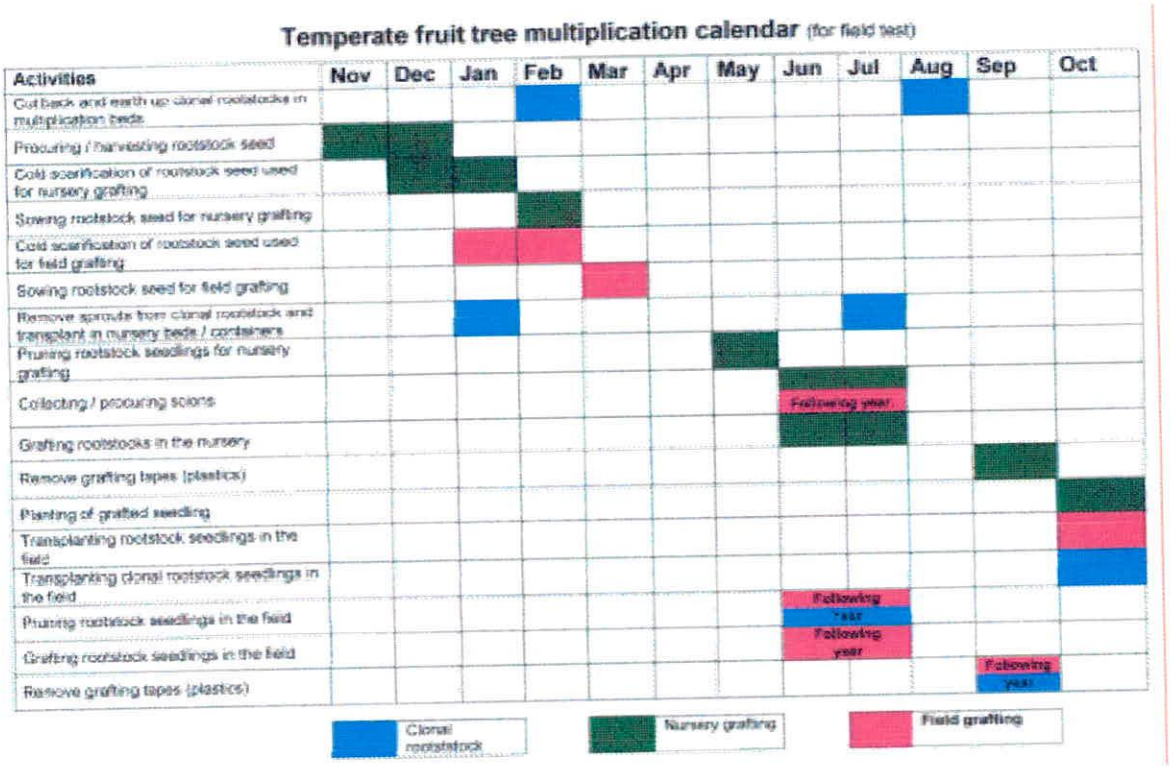


Figure 6: Proposed timing for temperate fruit tree multiplication under conditions of southwestern Uganda [3]

Multiplication and planting of fruit trees depend on seasons. A fruit tree propagation strategy has to be based on appropriate timing.

3.4.6 Free fruit seedlings?

It is tempting to assume that giving out free seedlings to smallholder is the best and most equitable approach to support fruit development and the economic growth of the agricultural sector. While there will be special cases in which subsidizing procurement of fruit tree seedling may be appropriate, a number of reasons call for undisturbed market in tree seedlings:

- Sustainability: Once experienced that fruit trees are given out free, markets for nursery products become distorted and private nursery operators will hardly invest in quality fruit nurseries.

- Quality: All buyers have the right to choose and to expect good quality seedlings. Free seedlings will be accepted even if their quality may be low resulting ultimately in high costs to the farmers during decades managing fruit orchards of low quality material.
- Costs for the national economy are much higher if tree seedlings are distributed rather than procured by individuals with their own interest of finding cheap and efficient solutions. Experiences with economic solutions for the procurement of fruit trees seedlings are described under 3.3.3.
- Social: Free goods have less value and are usually less cared for. Free goods reach influential / prominent farmers, not necessarily the best fruit growers or the needy group of society.

Free fruit tree seedlings do not support fruit development in Uganda. Special cases where subsidizing their procurement could be appropriate may exist.

3.4.7 Monitoring and certification

Planting fruit trees is an investment in the future. Quality trees will begin producing after 2 to 4 years and stay productive for several decades. Low quality of the planting material will prevent this and is therefore a major constraint to the development of the fruit sector.

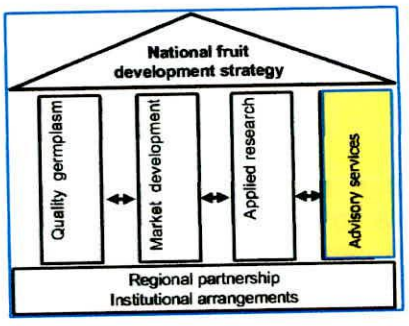
An appropriate, simple and practical certification system for fruit nurseries, grafters and multiplication material needs to be developed to protect consumers and the industry from poorly propagated material. The certification process has to consider the needs of small farm nurseries and mobile grafters.

Discovering and documenting innovations as well as new constraints in tree propagation is an important input to researchers, development specialists and policy makers. A viable, simple monitoring system is required.

Certification and monitoring are required.

4 Competent local horticultural advisory services

Unlike tropical fruit which produce to a certain extent in the absence of management, temperate fruits do not produce in the tropics unless appropriate management is provided. Most of the management practices as well as the above-described (chapter 3) propagation methods are new subjects to farmers and extension agents. A comprehensive approach to competent advisory services for temperate fruit production and marketing is proposed. It is based on the Ugandan system for demand driven, publicly financed and privately organized extension services (NAADS).



Given the currently limited horticultural advisory capacity, dissemination efforts for temperate fruits should initially be clearly localized and concentrated geographically, to reduce logistic requirements for the upcoming advisory services.

4.1 Know-how

Detailed knowledge from fruit tree propagation, to tree management and post-harvest / marketing activities is required to develop temperate fruit production in Uganda. This requires a range of approaches. Methodological approaches to extension do not generally differ from other agricultural topics and do therefore not require special efforts.

4.1.1 Technical

Key areas on technical knowledge for temperate fruit production include:

- Propagation
- Tree management (i.e. orchard establishment, pruning, pest management)
- Post harvest techniques

While certain areas on the above topics require adaptive research within the agroecological zones of Uganda, the basic knowledge for temperate fruit production in the tropics has already been developed internationally and in the ECA region. However, only a very limited number of researchers and extension specialists (probably less than 10 in 2003) currently has sufficient theoretical and practical knowledge / experience to competently train others in temperate fruit production.

Similar to the biophysical case of limited core planting material within Uganda, a strategic approach to rapidly share the knowledge and experiences of few specialists has to initiated.

4.1.2 Marketing

Hardly any information on marketing of temperate fruits within Uganda and on realistic export opportunities exists (see chapter 5). Hence currently advisory services should concentrate on market advice suited to local conditions. These include:

- Highlighting the quality aspect for successful marketing

training of trainers it will be important to train those farmers thoroughly, since these farmers will act as 'model' for other farmers. Further, these farmers may become involved in schemes of farmer-to-farmer extension.

Just like for advisors, thorough and repetitive practical training of fruit growers is required.

4.2.3 Information material

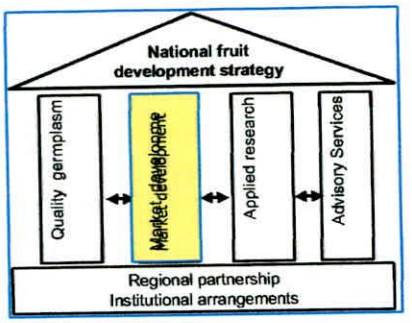
While the above – described extension methods focus on direct training, brochures, handouts, radio programmes and other information material supplement scaling-up efforts. Although practical training is emphasized in this strategy, initial information on fruit production, market information and specialized topics can be communicated through these information materials. Again, these materials should avoid scientific jargon and be practically oriented, such as the publications / 1/ / 2/ / 4/ mentioned in the references (chapter 8.1).

4.3 Appropriate structures

The Ugandan extension system based on demand driven, publicly - financed and privately organized services (NAADS) is well suited to provide the required support to temperate fruit development. What needs to be developed are competent horticultural consultancy services that farmers could contract via NAADS to get the required information and training. Given the need for regular local support, feedback and response to urgent request such as phytosanitary advise, these consultants should be based in the agro-ecological zones where temperate fruit production is appropriate.

NAADS will have to invest in the training of trainers on temperate fruit production to be in a position to respond favourably to farmers' requests for services on this topic.

5 Market development



A major lesson from other fruit producing areas in East Africa is, that serious marketing efforts are usually initiated too late, when surplus production of the wrong fruits or cultivars at an inappropriate time lead to overproduction and loss of fruits and potential income.

Farmers clearly see temperate fruits as an untapped source of income. To meet this expectation, markets for fresh and processed products have to be identified and developed.

One fact is clearly shown in currently available information on fruit marketing in Uganda and on fruit import / export: there is no reliable information[5]. A deliberate effort to compile data on fruit trade within and outside Uganda is lacking and the information available is incomplete and at times clearly incorrect.

While this information is crucial for advanced work in temperate fruit development (see 6.1), the short-term target for work on temperate fruits will be home consumption and local trade. This period will lay the foundation for national, regional and international trade and has to be used to undertake the relevant research.

Reliable information on fruit marketing in Uganda will have to be generated and documented.

5.1 Short- medium and long-term marketing targets

Current customs-registered volume of apple import into Uganda is 130,000 US $ (Ssemwanga, pers. Comm.). At a price of 1.20 US$/kg this amounts to less than 110 tonnes per year. To substitute these imports, a total of 11.000 apple trees would be required. Compared to the 1.7 million trees estimated to be required for home consumption and moderate national marketing (see chapter 3.4.2) current imports are negligible. Even if one assumes a ten time higher figure for real imports, emphasis for the initial development of temperate fruit production will be placed on home consumption and local / national marketing. However, substituting current imports would still be an attractive income opportunity.

5.1.1 Home consumption and local marketing

Five temperate fruit trees near the homestead, say 2 apples, 1 plum, 1 pear and 1 nectarine will under moderate management provide 300 fruits over a period of 2 months. That's 5 fruits per day. Less than one fruit per household member per day. Hence, even without any market development, the estimate on seedling demand for home consumption in chapter 3.4.2 is reasonable.

Encouraging home consumption through nutritional education is an important aspect of the work. Of course, home consumption will compete with local marketing and soon national marketing. Local marketing will be the "experimenting ground" where issues of quality, post-harvest handling and shelf-life can be explored.

Home production and consumption of temperate fruit should be stimulated through nutritional and production-oriented information on temperate fruits.

5.1.2 National and regional marketing

Although it may be possible under high management to produce temperate fruits in the lower lying areas of Uganda, highlands above 1500 m.a.s.l. are clearly the appropriate agro-ecological zones for their economic and ecologically appropriate production. The main national markets however are the urban centres along Lake Victoria[/5/]. Temperate fruit marketing will follow established channels that exist for the marketing of other highland crops, such as Irish potatoes. Similar channels also already exist for regional markets in the neighbouring countries. Appropriate packaging is however more crucial for fruits rather than potatoes to maintain their quality during transport.

To establish the potential for Ugandan fresh temperate fruits in regional markets, periods of low production in neighbouring countries should be explored.

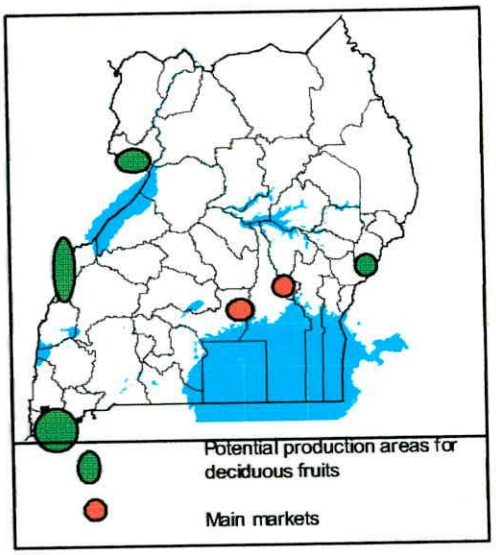


Figure 8: Suitable production areas for temperate fruits and main markets

Non-price information on preferred fruits, cultivars, quality and packaging would be important to develop the markets.
Regional information exchange may be enhanced through established regional bodies such as the ASARECA networks, Foodnet in particular.

For the next decade, the main markets for temperate fruits are within Uganda.

5.1.3 International markets

A recent study[/5/] undertakes first steps to explore the potential of temperate fruits in international markets and concludes that these markets are well developed with established trade channels and that a new producer in a landlocked country such as Uganda should rather concentrate on tropical fruit for international markets.

5.2 Concentrating efforts and farmer associations

National and regional marketing requires reasonable quantities of products in an area. Hence initial dissemination efforts should be concentrated in areas with suitable infrastructure (roads, markets). Collection points for fruits should be established or collection points for other agricultural products be expanded to cater for the needs of temperate fruit. Further, farmers will have to work together to produce attractive quantities of uniform, quality fruits. Functional farmer associations play an important role to enhance marketing of temperate fruit.

Development efforts for temperate fruits should concentrate on high-potential areas and promote collection points as well as farmer associations.

5.3 Cottage industry and Processing

An appropriate mix of cultivars and certain management measures can extend harvesting periods for temperate fruits. However, during peak periods surplus production will be available for cottage industry and processing. Juices, jams, squashes, fruit wine, dried fruit and other combined products such as fruit yoghurts could be produced locally in cottage industry and at national level through processing industries.

Adaptive research based on regional and international experiences with fruit processing and cottage industries for fruits should develop practical information for interested investors. Processors and cottage industry in other fields of agricultural products should be made aware about the upcoming opportunities.

Cottage industry and local processing need to be promoted.

5.4 Quality standards

Quality requirements for the various market levels (local, national, regional, international) need to be determined and quality standards should be set, e.g. by the farmers associations. Apart from appropriate tree management, grading of fruits for various outlets (i.e. best quality for export and supermarkets in urban centres, low quality for juice processing) will help to meet the required standards. Experience from the region shows that the main quality losses are usually encountered during post-harvest handling.

Appropriate quality standards for the various markets should be set by farmer associations.

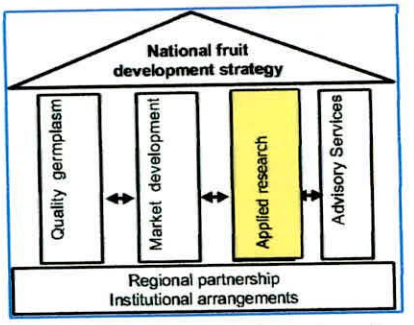
5.5 Enabling environment

Developing markets for temperate fruits requires support through an enabling environment provided or supported by the public sector. This includes:

- policies (customs regulations, appropriate and practical phytosanitary regulations, land tenure, etc.)
- advisory services
- roads
- storage facilities
- export promotion.

Like for all market development, favourable frame conditions need to be provided by national and local governments

6 Applied research



Considering that temperate fruits have been produced in tropical highlands for several decades, it is justifiable to conclude that all basic research on the topic has been conducted and that cultivar development is well advanced and established at various centres of excellence.

Temperate fruit development in Uganda however requires applied research to adjust findings of the basic research to the Ugandan biophysical and socio-economic conditions. Most of this research is interdisciplinary by nature and should be conducted by appropriate teams of scientists with relevant biophysical and socio-economic background. This research should be seen as a direct support to development and should take up clear development questions. To provide practical information to framers observations combined with good record keeping in the field are required.

Key for temperate fruit development however is market research.

Applied research on topics of practical importance to farmers, combined with good market research is required.

6.1 Market research

Market research is required at all scales from local to national, regional and international market opportunities. It should not restrict itself to fresh fruit but include all aspects of processed products.

Areas for continued market research include:

- Consumer preferences for fruits, cultivars and processed goods
- Niches in terms of fruits or products but also periods of the year with low supply
- Non-price-information on quality, packaging or special markets such as organically grown fruit
- Identifying existing and upcoming processing opportunities and appropriate technologies for Ugandan fruits.

6.2 Monitoring and socio – economic research

Identifying the appropriate farming systems and recommendation domains for temperate fruit production should be done through a rapid research process based on biophysical and socio-economic data. GIS tools will be useful to support the analysis and provide user-friendly maps on recommended areas for production. Such maps should help to guide governmental, nongovernmental and international initiatives to promote temperate fruit production in suitable areas.

Based on the information and maps produced constant monitoring of the development in temperate fruit production could be done and visualized. Such processed and edited data needs to be made available to government, public institutions and development initiatives as decision support information.

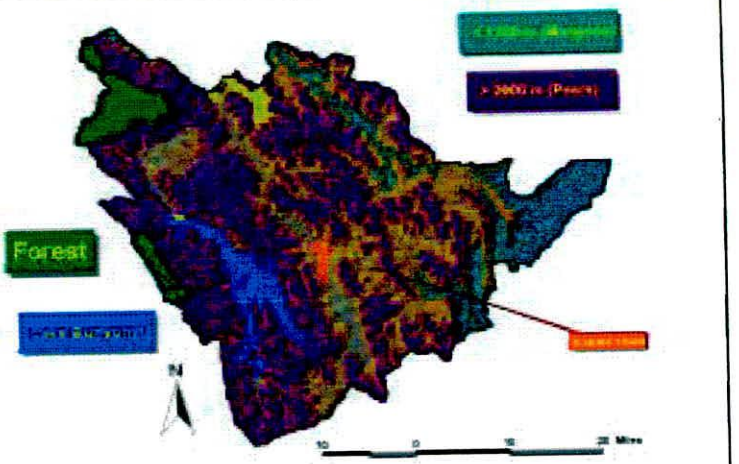


Figure 9: Example of a suitability map for fruit production in Kabale District

Profitability of fruit production needs to be monitored so that farmers can base their investment decisions on cost-benefit-analysis for the enterprise. To assess the impact of the work the effects of fruit production on farm families, rural dwellers and urban population should be monitored disaggregating the information by gender.

Beyond socio-economic monitoring, the impact of fruit production on the ecology (soil conservation, bio-diversity) of some selected areas could be assessed once fruit production has reached a reasonable size. However, base-line data would have to be collected at an early stage.

6.3 Biophysical research

The sites where temperate fruits were established early offer optimum opportunities for applied biophysical research. Simple but important information can easily be collected but requires stringent data and information management. Farmers require information such as:

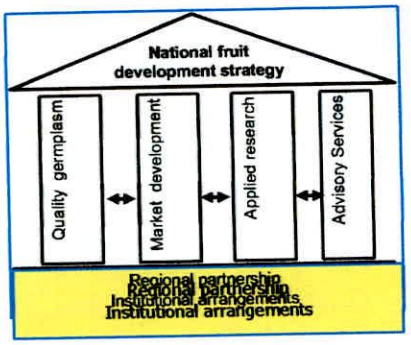
- Growth patterns of fruit species and cultivars
- Time to first harvest
- Expected yields per tree and area
- Common phytosanitary problems and recommended management practices
- Suitability maps for fruit species and cultivars
- Experiences with various management levels for various fruits and cultivars
- Adaptation of various rootstock material to agro-ecological zones

Further, research is required as a development support tool by responding rapidly to the upcoming issues from farmers and advisory services.

Some few areas require more technical research, such as developing tissue culture as a propagation tool for clean planting material and identifying its appropriate use. Research in the management of pests and diseases is a key area that needs to be supported by a functional and competent task force in the research system.

7 Institutional arrangements and regional partnership

Without allocating clear responsibilities, the strategy outlined in the previous chapters will hardly be implemented. At the end of the planning workshop (Kampala, February 2003) recommendations for the institutional set-up were discussed and accepted. The main aim is to have efficient working arrangements for the rapid implementation of the strategy. At the same time the arrangements should support joined implementation and a feeling of common ownership of the programme. Only with such joined efforts and involvement of key players the multi-facetted strategy stands a good chance to achieve its goals.



7.1 Players

Nursery operators, researchers, development specialists, marketers and politicians will have to work in a coordinated manner to make temperate fruit production an important element of Ugandans' welfare. As indicated in Table 2, all players should be acknowledged and be represented in a steering committee. To start activities, it is proposed that the chairman of UGADEN will take up coordination.

Table 2: Proposed institutional arrangements

Uganda	Region
Players: FORRI, KARI, NAADS, private sector, local governments, producers (farmer organizations), NGOs, MAAIF, ARDCs, UGADEN, ICRAF	**Players:** ICRAF, TOFNET, FOODNET and other relevant ASARECA networks, marketing organizations, private sector, NGOs
Committee: 1 representative from: Research, NAADS, NGOs, farmer groups, private sector, Uganda Local Authority Organization, Ministries of Finance, Agriculture, Trade&Industry	**Committee:** 1 representative per country, TOFNET, private sector representative
Coordinator: UGADEN chairman	**Coordinator:** ICRAF

Acknowledging the various important players in the development of temperate fruit industry in Uganda, a small working committee is proposed, coordinated by the chairman of UGADEN. At regional level a committee with one representative per country and representation of key players should be coordinated by ICRAF.

7.2 Process

The following process is considered appropriate for the working arrangements:

(1) Chairman UGADEN to invite the committee

(2) ICRAF to propose terms of reference (TOR)

(3) Organising committee to draft strategy

(4) Committee to discuss and possibly adopt strategy

(5) Committee to define rules of players

7.3 Regional aspects

At a regional scale, synergies need to be fully utilized to take advantage of the various experiences and strengths for all themes outlined in this strategy. The workshop with participants from all countries in the region (see chapter 8.3) proposed the following:

- Regional Agenda

  The agenda should include all aspects of temperate fruit production with an emphasis on: production, processing and marketing. ICRAF and TOFNET should consider providing a coordinating role.

  An inventory of the fruit sector in the region (germplasm, markets, resources) is required to provide the basis for regional fruit development.

- Regional information exchange

  Information is the key product from the regional partnerships. While there may be some cases with competition for markets, all other information should be freely exchanged. However, experience shows even that rather than competition for markets, regional cooperation is required to meet market demands for quantities, time and qualities.

- Tools for information exchange

  Given professionals as the target group for regional information exchange, electronic media can play a vital role. Apart from a website, electronic newsletter, exchange visits and workshops will play a vital role.

- Germplasm

  Exchange of germplasm is important to develop the temperate fruit sector in the region. On the other hand, exchanging germplasm, particularly vegetative material bears phytosanitary risks. Harmonized, efficient and practical regulations protecting the industry while at the same time facilitating rational exchange of materials is required. Regional institutions (ICRAF / TOFNET) could provide services of germplasm "brokers" who would inform about sources and demands for temperate fruit planting material within the region.

- Policy innovation and decision support

  Harmonization of policies and information on innovations within the region plays a vital role in the development of the fruit sector. Regional bodies should provide information as to decision support policy makers. In particular, strategic interventions identified to overcome constraints should be recommended.

Information exchange, joined development of markets, safe exchange of planting materials and policy research are important tasks for regional support to temperate fruit development in East and Central Africa.

8 Appendix

8.1 References

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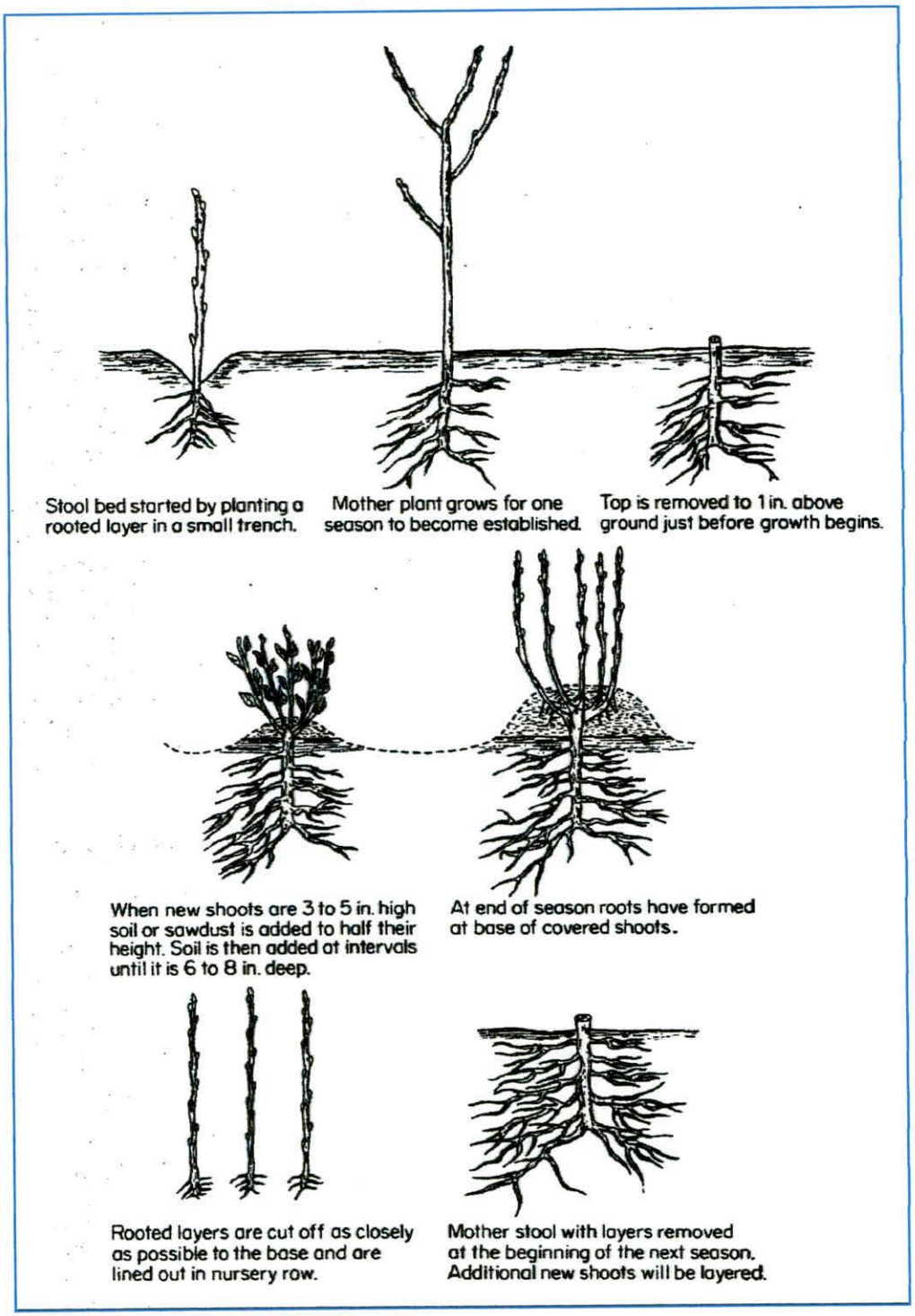
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8.2 Clonal multiplication of rootstocks for fruits [1]



8.3 Participants of the planning workshop

World Agroforestry Centre

UGADEN

NARO

