

Can smallholders be supplied with quality tree seed through commercial distribution of tree seed in small bags?

by

Iben Nathan and Kirsten Thomsen

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Danida Forest Seed Centre
Krogerupvej 21
DK - 30950 Humlebaek · Denmark

Telephone	+45 49190500
Fax	+45 49160258
Email	ina@sns.dk dfsc@sns.dk
Homepage	www.dfsc.dk

Can smallholders be supplied with quality tree seed through commercial distribution of tree seed in small bags?

A discussion paper with reference to Tanzania

Iben Nathan (Ina@sns.dk) and Kirsten Thomsen (Email: Kth@sns.dk)

Danida Forest Seed Centre

1. Introduction and background

This paper discusses the possibility for retail sale of small quantities of tree seed to smallholders through private enterprises already dealing with horticultural and agricultural seed. It is suggested that the private enterprises purchase tree seed at national tree seed programmes, pack the seed in small bags and distribute and sell the bags through their networks of local seed dealers. A picture of the tree will be printed on the front of the bag, and guidelines for using the seed will be printed on the back. The aim is to increase smallholders' access to high quality tree seed. The discussion will focus on seed-physiological, genetic and financial aspects.¹

1.1. Why is it important to reach smallholders with high quality tree seed?

It has been stated that the future of trees is on-farm (Simons, 1997). This statement is likely to hold true both in the perspective of actual trends indicating that tree-planting on-farm is increasing, and in the perspective of considerations about the role trees ought to play on-farm in the future.

- In the first place, it has been estimated that small farmers actually constitute a majority of tree planters, that the number of trees on-farm exceeds the number of trees in plantations, and that this gap tends to increase (Simons, 1997; FAO, 1997).
- Secondly, worldwide deforestation has been estimated at 12.6 mill ha or 0.7 % of the total forested area annually (FAO, 1997). Deforestation, forest degradation and additional loss of woodlands result in a dramatic loss of present and, as biodiversity is lost, future options for use of trees.² This represents a serious problem at the global level but in particular to the millions of rural poor in tropical countries who are dependent on trees. Trees provide important products such as building material, fuel wood, food (nutrition from fruits) and fodder. Moreover, trees provide important services such as shade, shelter, erosion control, watershed protection and soil enrichment. As other sources disappear or are being depleted, rural people will increasingly have to plant trees on their own holdings to cover their needs for these products and services in the future.
- Thirdly, it has been argued that increased adoption of agroforestry innovations can become an important contribution to a development towards increased agricultural production on a sustainable basis and hence towards improving food security for rural people. (ICRAF, 2000). In that perspective, rural people would benefit from planting more trees.

¹ The authors invite any comments on this discussion paper.

² Biodiversity consists of variation at many levels: biodiversity between ecosystems, species and genes. Lost diversity at any of these levels is lost options for future use (for further details, see Kjær and Nathan, 2000)

At present lack of seed, seedlings and other planting material constitutes a serious constraint for smallholders to fully utilise the benefit of trees (e.g. Simons, 1997; ICRAF, 2000; Johansson and Westman, 1992). To the extent that planting material is available it is often insufficient with regard to genetic and physiological quality as well as choice of species.

It is important to use high quality tree planting material for several reasons. First, the physiological quality of the seed and seedlings affects the success of establishment and the subsequent growth rate of the plant. Second, genetic quality is important. The chosen material should be selected to suit local conditions and should be of sufficient genetically broad origin to ensure stability, e.g. resistance against pests and diseases of the planted trees. Using high quality plant material is one important avenue to ensure that farmers and other tree planters will gain from planting trees. Improvements, even marginal improvements, in the survival rate and productivity of trees will often be of great importance to subsistence farmers who decide to invest some of their scarce resources in planting trees as well as to other tree planters.³

Looking to the future, the choice of plant material is decisive to the success and quality of future generations of trees. Moreover, if plant material in general is not carefully selected to represent and maintain variation within and between species, future options for use will be lost.

Rural people's lack of access to sufficient amounts of a varied tree planting material of high quality therefore leads to concern about their livelihoods (sustainable and increased agricultural productivity and returns from tree plantings) in the short as well as the long term. Thus, there is a need to reach smallholders with quality tree seed and other planting material.⁴

1.2. National tree seed programmes: is there a need for new approaches?

National tree seed programmes exist in almost all countries where significant tree planting activities take place. Their main objectives have usually been to ensure that tree planters get access to high quality tree planting material. However, these tree seed programmes have rarely aimed directly at small-scale tree planters. During the seventies and eighties, centralised national tree seed programmes supplied seed and training mainly for large-scale industrial plantations, government planting programmes, and/or donor-supported development projects.

Although the importance of small-scale tree planters is increasingly becoming acknowledged and the emphasis of some of the national tree seed programmes is changing towards smallholders (DFSC, 2000), many of these programmes still tend to be top-down structures focusing on the technical aspects of ensuring (improved) quality plant material. So far, the tree seed centres have not reached a significant number of smallholders.

In general, farmers' dependence on relatively inefficient public and/or private sectors has often ended in disappointment. For these reasons there is a call for new systems to operationalise effective tree seed distribution in a range of locations (ICRAF, 2000). Such systems must include organisation of tree seed production and/or collection, ways to cope with technical

³ Calculations of the gain in value of trees by using improved tree seed have been made by, e.g. Foster, Jones and Kjaer, 1995.

⁴ "It is essential that a tree seed programme is not only concentrated on procuring a required amount of viable seed but that due consideration should be given to the genetic constitution, and that tree improvement and conservation of forest genetic resources are taken into account as necessary elements to form a whole. On the other hand, it is important that genetic research and development is only applied to the extent justified from an overall point of view of objectives, priorities and resources", cf. Ditlevsen, 1992.

and quality aspects of seed during seed handling and storage, and different ways of distributing seed to farmers.⁵

While there certainly is a need for new models and solutions of how to overcome bottlenecks causing farmers' lack of access to high quality tree planting material, this should, on the other hand, not lead to a complete rejection of and detachment from existing systems. It is important to carefully study the experience of operating tree seed programmes as well as other relevant institutional structures not only in terms of their weaknesses but also in terms of their strengths. Wherever feasible, it is important to build on these structures. Otherwise, seed procurement easily becomes a football between changing development fashions.

1.3. What are the main advantages of distributing tree seed in small bags on a commercial basis?

One of the main strengths of national tree seed programmes such as the NTSP in Tanzania is their ability to produce large amounts of tree seed of a sufficient quality and of known origin. Another strength is that they have worked up much knowledge and expertise on tree seed. One of the main weaknesses is their lack of ability to reach small-scale tree planters with seed and knowledge (e.g. Aalbæk, 1997, Nathan, 2000).

Both in Tanzania and Kenya, there are private enterprises dealing with horticultural and agricultural seed. This seed is sold to small-scale planters through networks of local seed selling agents. However, these enterprises have little or no experience with selling tree seed.

The suggested method of distributing tree seed produced by national tree seed centres, packed in small bags and sold by private enterprises has the advantage of drawing on the combined strengths of two different already existing systems. Apart from this there are, at least in theory, other obvious advantages related to the method both from the smallholders' point of view and from the producers' and distributors' points of view.

- Seen from the small-holders' point of view, the method has the advantage of giving women as well as men the opportunity to decide for themselves whether to plant or not to plant trees, and to make their own choice between different species. This implies that smallholders can plant trees according to own needs and capabilities. Problems of lack of knowledge about how to handle the seed can be solved by including the information on the back of the seed packet.⁶
- Seen from the producers' and the distributors' point of view, the main advantage of the method is its potential for generating profit. Furthermore, it is an advantage that, as the method is based on existing production and distribution systems, it does not require heavy new investments.
- Finally, it is an advantage to all the mentioned stakeholders that local sales agents can give immediate feed back to seed distributors and producers about farmers' changing demands for species and information. At the same time, the local agents can inform farmers about available species thus giving them a wider choice and provide them with more information

⁵ With the increased emphasis on farmers' access to plant material, decentralisation has often been recommended as a solution to the problem of ensuring seed distribution to smallholders. Decentralisation has been recommended by e.g. Place and Kindt (1997), Moestrup and Graudal, (1994), and ICRAF (2000).

⁶ "All you need to know to produce a successful crop of vegetables or flowers in most years is written on the back of the seed packet" (Palmer, Harwood and van Wyk, 2000). The same could be stated with regard to many tree species, if the seed was packed in small bags.

than can be included on the seed bags about how to handle the seed. This may require brochures or posters for display containing the additional information for the agents.

2. Is tree seed suited for retail sale to smallholders?

First, we will address the question whether it is possible to distribute tree seed in small bags seen from a seed physiological perspective. Second, we will discuss what are the genetic implications of the distribution method. Third, we will discuss whether the method is financially viable.

2. 1. Is it safe to distribute tree seed in small bags from a seed physiological perspective?

Seen from a physiological perspective it is definitely possible to distribute tree seed in small bags on a commercial basis. However, there are the following considerations to be made.

The most important seed characteristic with regard to retail sale is the durability of the seed as it is obvious that seeds must to be able to germinate when the customer buys them. It is therefore necessary to take into account the storage physiology of the seed. Some types of seeds can be kept viable for years if they are dried and ideally also kept at refrigerated temperatures, these are usually called orthodox seeds. Other seeds are very sensitive to desiccation and should be maintained in a humid environment, in which they will either germinate fast or die; these are called recalcitrant seeds. In between these two types are found intermediate types, which may be dried to varying degrees and which generally have shorter viability.

Vegetable and flower seed distributed in small bags are usually characterised by being small and dry (orthodox), and therefore very suitable for this kind of distribution. Tree seeds are very variable with regard to both storage physiology and size, but most orthodox seeds will be of a size where it is possible to pack the seeds in small bags. With regard to physiology, the tree seeds selected for this type of distribution will, at least initially, have to be seeds with a high initial quality and the ability to stay germinable for at least a year.

Some of the orthodox species have hard seedcoats that need to be scarified before the seed can germinate. Scarification can involve boiling water, acid and mechanical treatments that disrupt the seed coat and allow imbibition of water. To ensure successful germination it can be considered to sell mechanically scarified (pre-treated) seeds, but the advantages should be weighed against higher costs and shorter durability of the seeds. National tree seed programmes usually have the facilities and the expertise to pre-treat tree seed.

The seeds should be correctly handled during collection and processing to ensure high physiological quality, and before packing, germination ability, purity, seed weight and seed moisture content should be tested. Only freshly collected and processed seedlots with a high quality should be used. For species where e.g. insect infestation is a problem, it may be necessary to sort the seeds by hand. National tree seed programmes usually also have the facilities and the expertise to handle seed correctly.

During transport and display in the shop, the seeds should be kept dry. If high air humidity is anticipated, the seeds could be packed in a waterproof material to avoid that they absorb moisture from the air. Whenever possible, the seeds should also be kept cool, as this will prolong their durability.

The bags should be marked with a seedlot identity number with reference to seed source and collection time. Storage conditions and expiry date should also be given, e.g. 'Store in a dry

place. Should be used before April 2002'. Furthermore, information about how to germinate and grow the tree should be on the bag, e.g. whether and how the seed should be pre-treated, germination conditions and how long time it takes the seed to germinate, as well as basic nursery information. This information should be given in the simplest form possible, preferably by illustrations.

Selecting the most useful information and providing it in a form that cannot be misunderstood by the users may require a thorough process of preparation. It is essential that such a process will be based on a close dialogue between users, tree seed experts, and distributors, as well as on observations of how the users handle the seed in practice. Moreover, relevant feedback from users could lead to changes in information when new bags are printed.

Information about the uses of the species is also important. To keep down the amount of information on the bags, a small brochure with a table on choice of species depending on growth conditions, use etc. could be handed out together with the seeds, and perhaps also appear on a poster for display in the shops.

2.2. What are the genetic implications of distributing tree seed in small bags?

The initial choice of species and seed sources for sale should be carefully considered as it may have genetic implications. Seed physiology will have a significant influence on the choice of species and e.g. exclude recalcitrant species. Furthermore, there will be a bias towards already known and utilised species because the seed physiology of many indigenous species is poorly investigated, and because it will probably be easiest to market already known species, including exotics. It can be hoped that the 'easy species' will pave the way for a more diverse marketing of tree planting material in the long run. But it implies that the seed producer and distributor actively work for the introduction of more species in the assortment. Some species may be in demand from the customers and thereby motivate that they are marketed, but a large number of (potentially interesting) species may not be known to the customers.

Feedback from the customers on physiological quality will be fast and can therefore act as an inherent quality control. Feedback concerning the genetic quality will take much longer time. If the seeds do not germinate, the loss for the customer is still relatively small, but if all the trees in one village of one particularly species die from a disease after five years, or the trees develop poorly, the loss is much larger. Is very important for the customer to get the right genetic material, although he/she may not always be aware of it.

Firstly, the genetic origin of the seedlot should be documented and the seeds should be collected from a sufficiently high number of trees to ensure the diversity of the seedlot. Secondly the right species (seed sources) should be matched with the planting site in question. Different seed sources may have to be used in different parts of a country to reduce the risk of planting maladapted trees.

Without a control system, documentation of the seedlot is left to the seed producer and distributor and is a matter of having high ethics and the trust of the customers. If it is found that a particular governmental control systems is too bureaucratic or inefficient, an alternative could be some sort of voluntary collaboration between a governmental or non-governmental institute (e.g. a national tree seed programme) having the right expertise and a good reputation and a seed dealer to ensure sale of the right material. The seed dealer could benefit from the collaboration when marketing the seed.

Matching the right plant material to use and location implies that information about this is made available to the dealers selling the seed as well as to the customers. Brochures, as described in section 2.1, may ensure that at least the literate get this information. If possible, governmental extension systems in collaboration with research institutions and NGOs could be used to get the information out. The seed companies have self-interest in market the right material. If the customers know which species and seed sources to demand, it will put further pressure on the seed companies to market the right material.

If more tree-seed is available on the market, it will be impossible to control where it ends up. Some customers may sell excess seedlings that they have produced from the seed, and will probably do so without 'genetic counselling', and the seed will probably also move outside the targeted area. If the bags are printed with information about which seed zones the seed are suited for, this could limit such movements. This information could be illustrated, for instance, by providing the bags with printings of small maps highlighting the areas where the species can best be grown.

2.3. Is it economically and financially viable to sell tree seed in small bags?

It has already been argued that, independently of distribution method, it is important to increase smallholders' access to high quality tree planting material seen from the perspective of national economies. This is because lack of good plant material constitutes a major bottleneck for increased tree planting and for increased value of tree planting, and because smallholders constitute an increasing majority of tree planters.

It has also been argued that it is financially important for farmers to get constant access to high quality tree planting material because this is decisive to the success and quality of their tree plantings and therefore to their returns. This requires that the improved plant material is available at a price and/or effort that is affordable for smallholders and that is in reasonable relationship to the increased value of the tree planting.

The question then remains whether it is financially viable (profitable) for producers and distributors to sell tree seed in small bags at a price which is affordable for smallholders. In the following, we will first look at how tree seed in small bags should be priced in order to generate a profit for the producer as well as for the distributor in the case of NTSP in Tanzania. Then we will discuss whether farmers in Tanzania are able and willing to pay the price for tree seed in small bags.

2.3.1. How much should tree seed in small bags cost in order to generate a profit for the producer and the distributor? The case of NTSP in Tanzania.

NTSP's seed prices are listed in catalogues, and can also be found via the Internet at the programme's home page. It is difficult, however, to find information about actual seed procurement costs. This is probably so because national tree seed programmes, which are usually receiving financial support by national governments and/or foreign development agencies, produce seed based more on national economic than on financial considerations. It is therefore not possible to assess whether the prices stated in the catalogues actually generate a profit for the tree seed programmes.

In the case of NTSP, seed procurement costs have been calculated for some species. These calculations indicate that the prices stated in the seed catalogue cover costs directly related to collecting seed as well as a profit (NTSP/DFSC, 1999). On the other hand, although the programme has increased its rate of self-financing considerably during its lifetime (67 per cent in

the first half of 1999), it has not yet been able to produce a nominal revenue which exceeds expenditure (Msanga and Kinunu, 1999). However, the problems of the programme trying to become financially self-sustainable, can be partly explained by the high level of expenses related to maintenance of an expensive set-up (prestigious buildings established by the donor, highly qualified staff), and by the fact that it previously undertook non-profitable activities in the interest of society e.g. gene conservation.

For the time being, NTSP is in a process of transformation. If the programme succeeds in cutting excessive costs and, as is the plan, in becoming a seed selling enterprise focusing only on income generating activities, there is a good chance that NTSP can become financially self-sustainable in the future. Increased incomes from sale of seed to private enterprises distributing tree seed in small bags would contribute to this. At present, Government of Tanzania provides financial support to the programme. This financial support could continue if NTSP was to continue non-profitable activities in the common interest of the public. Based on these considerations, it is not unlikely that the prices stated in NTSP's seed catalogue can become sufficient for generating a profit for the programme in the future.

A simple calculation based on the seed prices on NTSP's homepage (May 2001) indicates that one US\$ will buy between 50 and 1500 living seeds, and for many species around 300 living seeds. This implies that the distributor can purchase 10 - 20 living tree seed purchased by private distributors for a price between 0.007 - 0.2 USD, and, for many species around 0,03 US\$. If seed bags containing seed enough for 10-20 trees are sold at a price of between 0.1-0.6 US\$ (corresponds to the price of one seedling in Tanzania, cf. below) it should be possible to generate a profit for the seed distributor. How attractive this profit is, will depend on the size of the market. In the case of Tanzania, there are approximately 4 million farm families (World Bank, 1994) and the costs related to printing, packing and on distributing and marketing of seed in small bags are not known to the authors of this paper.

2.3.2. Are farmers able and willing to pay for tree seed in small bags?

Experiments with beans in the Great Lakes Region of Africa (Rwanda, Burundi and Eastern Zaire) have shown that when beans are sold in small amounts 'farmers are willing to pay for new varieties at two times the going market price for local seed, and merchants, particularly shop keepers, find profits in handling the sales'. An important reason is that 'small quantities allow farmers to explore new varieties with limited risk and expense' (Sperling, Scheidegger and Buruchara, 1996).

As far as the authors are informed, the method of selling small bags has not been systematically tested with tree seed. In the case of NTSP (Tanzania) it was decided at a very early point of time that not only would it be impractical for NTSP to sell seed to small farmers all over Tanzania, it would also be non-profitable (e.g. Danida, 1994). One of the arguments was that small farmers cannot afford to pay for tree seed produced by NTSP. NTSP's planners therefore decided for a strategy of directing its seed sales towards customers 'who can pay'. These customers included large-scale industrial plantations, government institutions, and donor-supported development projects.

In 1995, a marketing study was carried out for NTSP. This study recognised that farmers constitute the majority of tree planters in Tanzania and therefore constitute an important market segment for tree seed. Nevertheless, NTSP was recommended to continue its present strategy and to neglect the 'mass segment' of farmers. The reason stated was that, being in a phase of transition into marketing orientation, and therefore sensitive to failures in implementing a new

marketing strategy, NTSP should concentrate its resources into well-defined areas (Christensen, 1995). NTSP followed these recommendations. The argument that small farmers cannot afford to buy tree seed was therefore never tested in practice.

During a visit to Tanzania in 1999, qualitative interviews were carried out with 50 farmers from villages located in six different regions (Iringa, Dodoma, Morogoro, Tanga, Arusha and Kilimanjaro). Interviews were also carried out with several customers to NTSP including the managers of four donor-supported development projects distributing tree seed to farmers⁷. During the interviews, the customers and farmers were asked about their opinion with regard to NTSP's seed prices as stated in the catalogue.

At first glance, the argument that small farmers cannot afford to pay for NTSP's tree seed seemed to be confirmed by the reactions of farmers. Most of them considered NTSP's seed "very expensive". During the discussions with the farmers, it turned out that in reality they were reacting not against the price, but against the amount of money required to buy 1 kg of seed as stated in the domestic seed catalogue. The small farmers, who had seen the catalogue had noticed that, for instance, 1 kg *Grevillea robusta* seed costs about 40,000 TSH. The farmers were not aware of, or just did not think of, how many trees can be grown from 1 kg, namely around 40,000. This means that for sowing, say, 10 *Grevillea robusta* trees (which were in high demand among the interviewed farmers) a farmer would, in principle, need 0.25 - 0.50 g of seed at a total cost of 0.25 - 0.50 TSH. The few interviewed farmers who had actually tried to buy seed at NTSP had not been aware of the possibility to buy small amounts.⁸

When introduced to small bags with 50 and 100 grams of seed from tree species, and having been informed that the content of the bags would be enough for growing 25 trees or more, the consulted farmers did not find that 100 - 200 and even up to 500 TSH per bag was expensive. In comparison, they pay between 50 - 500 TSH for one seedling at the market depending on species. A Coca-Cola costs 150 TSH. As cash is often a problem for smallholders, the price difference between seed and seedlings is an important argument in favour of, as far as possible, buying tree planting material in the form of seed as a supplement to seedlings.

The interviewed farmers expressed their interest in getting access to different kinds of tree seed in small bags even if they had to buy it at the mentioned price. Some of them requested seed for fruit trees (Dodoma), others requested seed for ornamentals (Kilimanjaro). It was a condition that they could buy small amounts, that it was seed of species they could not easily collect themselves, and that they could buy the seed at locations close by.

Some of the farmers pointed out that access to planting material was not the only constraint to their planting trees. Lack of access to polythene bags (small plastic tubes in which seeds are sown) was considered a constraint to tree planting by farmers in all regions. The interviewed farmers in the dry region of Dodoma considered lack of water a major problem. In relation to selling tree seed in small bags, the problem of lack of access to polythene bags can be solved either by selling small numbers of these bags together with the tree seed or, better, by adding information on the seed bags about feasible alternatives such as using banana leaves, bamboo cups, or direct seeding.⁹ The problem of water is not solved as easily. However, it may be ex-

⁷ For a full account of this study, see Nathan, 2001.

⁸ For instance, the owner of a small private nursery in Morogoro, who is also the secretary of a co-operative growing seedlings, and who has been the accountant of the district forest office in Morogoro for ten years, informed that she had bought 1 kg of seed from NTSP twice. Although she had distributed seed to family members and friends, she had not been able to use all of it. Moreover, she had problems with germination, probably because she had stored the seed for too long. Even she was not aware of the possibility of buying smaller amounts of seed before this enquiry.

⁹ For a discussion of the advantages of direct seeding, see Ochsner, 2001.

pected that if farmers invest cash money in tree seed, watering seedlings will have high priority.

With regard to the interviewed managers of development projects, they too considered NTSP's seed 'very expensive'. When introduced to the small bags, however, they did not find them expensive. During the interview it turned out that the real problem at least for some of the projects was that their restricted budgets allowed them to cover only part of farmers' total demand. This was because seed was distributed free-of-charge. One of the managers reported that his project purchased large amounts of seed at NTSP and had to divide the seed into small portions before distributing it to the farmers.

If projects could get access to tree seed packed in small bags, it would make distribution easier. Furthermore, it would make it easier for the projects to sell the seed either at a full or at a subsidised price instead of distributing them free of charge. This again would make it possible for the projects to cover a larger part of farmers' demands.

It is a common experience that free distribution of tree planting material is not a good idea. It has been shown that purchased tree seedlings, as opposed to those received free of charge, have a greater chance of survival as a result of greater care by farmers and that free distribution of seedlings has a disruptive effect on nursery markets. It has therefore been suggested that organisations should be discouraged from distributing tree planting material free-of-charge (e.g. Nieuwenhuis and O'Connor, 2000).

The above quoted interviews indicate that farmers are willing to pay for tree seed. Just as with beans, this requires, however, that tree seed be sold in small quantities, which allow farmers to plant trees with limited risk and expense. Apart from this, it must be assumed that farmers' willingness to buy tree seed in small bags among other things depends on price not per gram but per tree. Second, farmers' ability and willingness will depend on the bags being sold at locations close to them and preferably at the same locations as other agricultural inputs.¹⁰ Third, it will depend on the species offered: are they useful, can they be easily collected in the locality?¹¹ In the long-term, farmers' willingness to buy tree seed in small bags is likely to depend also on their experience with the seed: did it germinate, did it result in healthy trees, did it produce the required end use?

It is not possible on the basis of the above calculations and quoted interviews to conclude anything definite with regard to the financial viability for the producer and distributor of distributing tree seed in small bags. Such a conclusion can probably be drawn only on the basis of testing the method in practice. The calculations and interviews indicate, however, that there are good reasons for initiating such a test. Also in favour of a test are that production facilities are already there and that many kinds of tree seed can be handled in the same way as vegetable and flower seed. Packing and selling tree seed in small bags will therefore not require heavy investments for a company already dealing with horticultural and agricultural seed.

¹⁰ For smallholders, there is no point in travelling to many different places to get hold of the small amounts of different inputs needed. At present, seed for fruit trees is not available at the same places as seed for forestry species, and many farmers have to go to yet other places for different other inputs for agriculture. Many of the interviewed farmers 'went to town' less than once a year.

¹¹ Some farmers collect their own material in the form of seed, cuttings, or wildlings or they procure plant material locally from other farmers, from local markets, and nurseries (Edwards and Schreckenberg, 1997). However, farmers' access to plant material can vary considerably even within a country. For instance, in Dodoma, which is a dry region in mid-Tanzania, plant material is scarce compared to Lushoto, which is a temperate mountainous part of the Tanga region in Northern Tanzania where trees and tree species are more plentiful.

3. Summary and conclusion: the need for testing the method.

There are no serious technical problems associated with distribution of orthodox tree seeds in small bags, and it seems that there is a good chance that sale of tree seeds this way can become financially viable. If genetic considerations are met in order for the right material to reach the customers, and if the guidelines on the bags on how to germinate the seed and grow the plant are clear enough to ensure that trees are actually produced from the seeds, retail sale of tree seeds may be a very efficient way to provide smallholders with planting material of a good quality.

The distribution method has several advantages when it comes to making high quality planting material available to smallholders. First, seed distribution will continue without need for support from donors or government as long as there is a market. Second, the rate of success in utilising and caring for the seeds and seedlings is likely to increase if people have to pay for the material, and finally, existing agricultural seed dealers have the network to actually reach the customers with seed produced by existing tree seed programmes. The method of distribution can also be combined with other production systems. If these systems are very decentralised, other types of problems will arise such as quality control, extra costs of transportation if packing of seed takes place at a central level, etc.

Naturally, there are challenges to be met concerning use of the right material, quality insurance and perhaps particularly concerning how to convey 'directions for use' of the seeds to smallholders who are often illiterate. These are areas where extension services, NGOs, research institutes etc. could contribute with expertise and resources in the initial phase. The directions for use printed on the seed bags must be elaborated on the basis of a close dialogue between users, tree seed experts and distributors, on the basis of observations of user practices, and, later, on relevant feed-back from customers.

There are other challenges that have not been touched upon in this paper. These include the risk of declining turnovers when tree planting increases. Furthermore, initiation of marketing of tree seeds in collaboration with selected seed dealers will imply competition for existing tree seed dealers. But hopefully, the market will be large enough for more dealers and the competition will work in favour of the customers with regard to price and quality. It is difficult to know how small nurseries will be affected, but nursery owners may benefit from having access to better and more varied seed material and could perhaps also act as seed selling agents. Nurseries could also specialise in production of seedlings of attractive species which are difficult to raise, combined with seed sale of the 'easy species'.

We find that the identified challenges are not insurmountable, and that there are many arguments in favour of testing the approach. Quoting Sperling *et al.* (1996), we will therefore conclude, 'the beauty of the small seed packet technique is at once its simplicity and its impressive potential for impact'.

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