



Carrot Aid

Carrot growing in Ethiopia: the present and the possibilities

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Carrot Aid

Carrot Aid is a small private charity based in Denmark, comprising a board of 5 volunteers. Its aim is to assist with the promotion of carrot cultivation and domestic consumption in Ethiopia, as a means to improve nutrition standards and reduce the incidence of night blindness in mothers and children caused by vitamin-A deficiency. A recent (2010) nutritional survey of the country found that ca. 1% of children suffer night blindness in half of Ethiopia's provinces, and in one province up to 14% of mothers are affected².

This brief report follows a short visit by two of Carrot Aid's board members, Knud Vilby and Phil Clarke, to Ethiopia from the 4th to the 14th October 2011. During this time, projects funded by Carrot Aid in Merhabete and Mida Woromo Districts were visited and new contacts initiated with horticultural experts in Addis Ababa, Mekelle and Jimma. From these meetings a brief outline of the current situation regarding carrot cultivation in Ethiopia was gained.

History of Carrot Domestication

Neither the domesticated carrot *Daucus carota* nor its wild forms are native to Ethiopia; the root crop was first domesticated in Afghanistan about 5,000 years ago³. The original cultivars were purple or yellow in colour, and a large variety of other colours have since been developed, most notably red carrots in China

¹ Carrot Aid, Vilvordevej 8, 2920 Charlottenlund, Denmark – see www.carrotaid.org

² Demissie, T., Ali, A., Mekonen, Y., Haider, J. & Umeta, M. (2010). Magnitude and distribution of vitamin A deficiency in Ethiopia. *Food and Nutrition Bulletin* **31**: 234-241.

³ <http://www.carrotmuseum.co.uk/maroon.html>

(which now produces the largest number of carrots world-wide) and orange carrots in the Netherlands which have since spread around much of the globe.

Domesticated carrots are divided into two groups: (1) the "Eastern" (or Asian) carrots var. *atrorubens* with mainly yellow and purple⁴ roots (from which the red carrots are derived); and (2) the "Western carrots" var *sativus* with mainly orange roots. Hybrids between the two occur in Turkey, where the two groups grow in close proximity and hybridize naturally. Turkey is therefore a secondary centre of diversity after the primary centre of diversity in Afghanistan⁵.

The purple carrot has a short storage time and is therefore being partially displaced by the orange carrot⁶. Among these orange carrots, Nantes is popular for its high sugar content but is comparatively low in starch so doesn't store particularly well, while Chantenay is a better keeper⁷.

White *Daucus carota* carrots probably originated by mutation and have been used as animal fodder.

Ethiopia has an endemic relative to *Daucus carota* which occurs naturally in mountainous areas; *Daucus hochstetteri* is common in grassland on rocky hills and in valleys, and in open, often eroded areas in upland evergreen bushland from 1650 to 2700 m⁸. Shepherds use it as supplementary food but the white root is small and probably has minimal amounts of beta-carotene⁹.

Carrot seed production

Wild carrots are annuals; those in Europe have small white roots¹⁰, whereas those in Afghanistan have thin yellow or purple/black roots¹¹.

Domesticated carrots grown in the tropics are usually also annuals¹², while the domesticated western orange carrot var. *sativus* is a biennial, flowering and producing seed in its second year, which means that in practice most commercial farmers purchase their seeds rather than produce their own.

There has been interest in Ethiopia to produce carrot seeds in-country, as all carrot seeds are currently imported. Carrot seeds from the Nantes variety have been successfully produced above 4000 m altitude, but below that conditions are too warm in Ethiopia for effective seed production, as the carrot root dries out or splits, causing the plant to die before it can bolt¹³.

⁴ Sometimes referred to as black carrots, though these are in fact a very deep purple.

⁵ IPGRI (1998). *Descriptors for wild and cultivated Carrots (Daucus carota L.)*. Rome: International Plant Genetic Resources Institute.

⁶ In the mountains of Afghanistan, purple carrots can be stored all winter in a hole filled with sandy soil.

⁷ www.seedsofchange.com

⁸ *Flora of Ethiopia*

⁹ Information from Sue Edwards, Institute for Sustainable Development

¹⁰ <http://www.luontoportti.com/suomi/en/kukkakasvit/wild-carrot>

¹¹ Information from an Afghan agronomist living in Copenhagen.

¹² <http://www.carrotmuseum.co.uk/today.html>

¹³ Information from Dr. Mohammed Ali of the University of Jimma.

Carrot varieties grown in Ethiopia

A seed trade manager at the Piazza market of Addis Ababa reported that only two cultivars of carrots are currently grown in Ethiopia – Nantes and Chantenay. The seeds for both types are obtained from European seed producers based in France, the Netherlands and Denmark¹⁴. During our visit six shops were visited in the Piazza market, each of which sold seeds from a different supplier:

Supplier/producer	Country of origin	Importer	Price per 250 g	Viability
Monarch Seeds	Netherlands	EAR Private Ltd.	110 Birr	3 years
Harvest General Trade	France	Hortus, tel. 011 1570444	120 Birr	4 years
Service Plus	France	AJMU, tel. 011 551 1049	100 Birr	Not mentioned
Vikima	Denmark	AJMU, tel. 011 551 1049	100 Birr	2 years
Safety	France	Ethio Falcon Traders	110 Birr	5 years

15 years ago the Nantes and Chantenay varieties were grown in about equal quantities, but Nantes is now preferred as it has a good taste, germinates well and gives good results¹⁵; at the time of our visit only Nantes seeds were seen on sale in Addis Ababa. Two other carrot varieties have been recently registered in Ethiopia: Samson from France (a variety of Nantes that is tolerant to powdery mildew) and ?Store-Knud-Strong from Denmark¹⁶. All of these varieties are orange carrots of Dutch origin, which require two years to produce seed and therefore require a continuous supply of professionally produced (and imported) seeds.

Most of the customers who buy seeds at the Piazza market are commercial growers who sell their produce to urban markets. Some of the carrot seed suppliers were repackaging the seeds from the 250g tins into small packets of about 2g and containing about 7-800 seeds for small individual farmers. These were being sold to the farmers for 2 birr in Addis Ababa and 3 birr in Alem Ketema (without any information about age or sell-by-date).

About 3 Kg of carrot seed are required per hectare if spaced every 5cm in rows 15 cm apart. Double the amount would be needed if scattered by hand.

¹⁴ Vikima seeds of Denmark produce their carrot seeds in France, as carrots freeze to death in the Danish winter

¹⁵ Information from Meles Yebi; AJMU Import Export Trading Enterprise.

¹⁶ Information from Dr. Mohammed Yesuf of the EIAR.

Carrot cultivation in rural Ethiopia

Carrots are not a traditional crop in Ethiopia, but are now grown throughout the country, albeit sparsely in most areas. They are predominantly cultivated as a cash crop for sale to urban markets, incl. hotels and restaurants. Some carrots are consumed by farmers and their families, but the high levels of vitamin-A deficiency recorded throughout Ethiopia indicate that many people – even in rural areas – are not eating enough carrots or other vitamin-A rich vegetables.

Carrot Aid and DanChurch Aid have therefore supported carrot and vegetable growing projects in Merhabete and Mida Woromo districts of Shewa Province in Ethiopia since 2006. These were implemented through an Addis Ababa-based NGO, Nurture Education and Development (NED, formerly EHRCEPA). The pilot projects had the aim of encouraging the local farmers (mostly women) to grow a wider variety of vegetables, both to increase their consumption of vitamins, but also as additional cash crops to supplant their income.

A visit was made to Merhabete and Wida Woromo districts to see these projects and to gain an insight into the problems associated with carrot cultivation in rural Ethiopia. At the Saturday market in Alem Ketema, the district capital of Merhabete, it was clear that a very wide variety of vegetables are being grown locally¹⁷, although only a few women offered carrots for sale. These women were not participants in the carrot projects and had bought their seeds in a store in Alem Ketama, which was apparently the only place in the town where carrot seeds are commercially available. The District Agricultural Offices in Alem Ketama and Merayna do supply carrot seeds to some farmers, although coverage is low.

Meetings were held with the women who had participated in the carrot projects to get their feedback on the project and to make an initial assessment of its longer-term impact. All of the women had been happy to grow carrots, and their families had liked them, but they had nonetheless discontinued to cultivate them two years ago as no more seeds had been supplied during a break in project activity. This demonstrated the on-going dependence of the beneficiaries on a regular and reliable external supply of seeds.

The participants described how they had been able to grow three crops of carrots a year, the last crop requiring can-supplied irrigation during the dry season. Carrots take about 3 months to grow. The participants complained about a larva that attacks the carrots, though one group of participants mentioned that this was not a problem for the third (dry) season crop of carrots. This larva is the same that attacks onions, and appears to be a beetle larva. It can totally devastate the carrot leaves, causing the root to dry out.

Some of the participants' fields at Dim Dim village below the escarpment near Merayna¹⁸ were visited, and were being cultivated with onions, tomatoes, garlic, chillies and cabbages. It is notable that the farmers can produce seeds for most of these crops themselves; tomatoes and onions are for this reason widely cultivated in even the remotest locations in Africa, while garlic produces a clove that splits

¹⁷ We saw bananas, oranges, papaya, red onions, cabbage, limes, beetroot, garlic, water melon, potatoes, tomatoes, chillies, chard, maize, guava, carrots, kale, grapefruit, pomeloes, sweet potatoes, and khat.

¹⁸ Dim Dim is located at 10°13'00"N, 39°03'49"E.

allowing part to be replanted the following season. Garlic ('white onions') is the farmer's favourite cash crop because it sells for a high price¹⁹ and many can be grown per unit area. Cabbages and onions seedlings are sometimes bought from local people who establish nurseries near areas of good and regular water supply.

Promoting more widespread carrot cultivation and consumption in Ethiopia

All the experts we spoke to mentioned the problem of seed supply to remote communities, which reinforced the observations we had made in Merhabete and Mida Woromo. Although the free market economy should in theory be able to supply the demand for seeds, this does not seem to be effective even though seeds are cheap and occupy minimal weight and volume, so cost almost nothing to transport. Perhaps the low demand means that the hassle cost for a trader making the effort to get an extra product is greater than the potential profits earned from selling the seeds.

A further problem might lie in the psychological consequence of impoverished farmers having to buy seeds – carrots may then be primarily regarded as a cash crop, as there is a financial investment that has to be recouped. This would mean that only a small proportion would be consumed by the farmers and their families.

Both factors suggest that the possibility for farmers to produce their own seeds might be the key factor for ensuring that many more carrots are cultivated and consumed domestically in Ethiopia. The carrots that are currently available in the country are clearly unable to achieve this, as they cannot produce seed at mid and low altitudes. Furthermore they require two years to bolt and produce seeds, which means an opportunity cost through land being occupied by seed-producing carrots rather than another crop.

A few other varieties of carrots are currently being tested in Ethiopia, but the initiative for these is coming from the large-scale commercial farms that supply carrots to urban markets. Expanding carrot cultivation for home-consumption in Ethiopia requires other varieties with different qualities, where taste and appearance may be partially compromised for the ability to produce seeds within one year.

Any new variety of carrot that is introduced into Ethiopia must be high beta-carotene in order to achieve the aim of increasing vitamin-A uptake. Purple/black carrots are therefore the obvious choice as they contain even more beta-carotene than their orange cousins, as well as a range of anthocyanins that are good anti-inflammatory agents²⁰.

Purple carrots that produce seeds in a single year are cultivated in the mountains of Afghanistan and upland Turkey, where the climate of the Hindu Kush range or the Anatolian plateau at 600–1200 m is similar to that of upland Ethiopia (1200–

¹⁹ Garlic sells for 80 Birr/Kg compared to just 8 Birr/Kg for carrots, and is more expensive than tef. A large carrot can be sold in a local market for 1 Birr each, a 50 Kg sack sells for 150 Birr. Note 3 Birr = 1 DKK.

²⁰ www.carrotmuseum.co.uk/nutrition.html

2400 m). Carrots that thrive in Afghanistan or Turkey should therefore do the same in Ethiopia, and it would seem an obvious choice to source possible new seed varieties from these countries.

A further possibility is the new BetaSweet variety that has recently been released in the US in 1998, and which has 40% more carotene than orange carrots while having a sweet taste and easy to munch apple-like texture²¹. Another purple carrot variety called Deep Purple was launched in Tasmania in 2011²². These need to be checked that they are not sterile F1 hybrids.

Conclusion

Carrot Aid could render a useful service to the farmers of rural Ethiopia through:

- (1) sourcing the seeds of a potential carrot varieties that are high in beta carotene, taste good, suitable for the Ethiopian climate and allow farmers to produce non-hybrid (heirloom) open-pollinated seeds themselves,
- (2) setting up trial plots in Ethiopia that can be monitored by an agricultural institute to test for their suitability for wider cultivation in the country, to look into crop protection techniques, as well as post-harvest handling of the carrots (e.g. methods of storing them in soil),
- (3) testing the local market reaction to these new types of carrot.

Particular attention would need to be given for pests, diseases (such as mildew), and the potentially harmful effect of new introduced carrot varieties on Ethiopia's indigenous flora.

Once a suitable carrot variety has been identified and accepted by test growers and consumers, Carrot Aid can assist in trying to spread that variety throughout the country through targeted introductions in a number of locations. This would then need to be followed up by nutritional studies to check whether the carrots are succeeding in raising vitamin-A intake in rural communities.

A couple of the academics we spoke to suggested that Carrot Aid could fund a small study (2-3 weeks) by an Ethiopian researcher to gather all known information on carrot cultivation and research in Ethiopia. A further idea was for Carrot Aid to fund the writing and production of a short handbook in Amharic for farmers to inform them on techniques for growing, storing and eating carrots, and including advice on how to grow carrots in rotation with other vegetables.

²¹ www.carrotmuseum.co.uk/maroon.html

²² www.carrotmuseum.co.uk/maroon.html

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Landscape between Merayna and Alem Ketama



Carrots of the Nantes variety being sold at the Piazza market, Addis Ababa.



Street stall in Addis Ababa with Nantes Carrots.



Small bunch of carrots being sold at the Saturday market in Alem Ketama.



Mr. Meles Yebi of AJMU Import Export Trading Limited demonstrating seeds for sale.



Garlic seedlings grown beside a stream at Dim Dim village near Merayna.



Mr. Geto Aknew of NED explaining about the pests that can attack carrots.



Garlic and tomatoes growing in a vegetable plot in Dim Dim village near Merayna.



Cabbages and onions growing in a vegetable plot in Dim Dim village near Merayna.