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SOUTHERN AFRICAN EDIBLE VEGETABLES: GERMPLASM COLLECTION, EVALUATION AND BREEDING

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ABSTRACT

During the first six months of the project activity centered on the following aspects. Seed material was acquired from commercial sources in Kenya, Germany, South Africa, and the USA, from different gene banks, and from collections from the wild. Dr Chweya of the University of Nairobi spent three months at the Institutes for Applied Research and got aquainted with agrotechniques and field practices in Israel. The Israeli group began the study of some of the proposed species in the greenhouse and also started to develop techniques for evaluating genetic variations in different populations via isozyme variation. Finally, a survey of local agromanagement practices in Kenya was carried out.

Keywords: Vegetables, Cucurbitaceae, Turia, Karela, Kiwano, squashes, starch gels, fruit quality.

1) Seed and germplasm collection

Seeds of *Cucumis metuliferus* (kiwano, African jelly melon) were received from several sources and are currently grown in the greenhouse in order to prepare enough seed material for further studies.

Seeds of *Momordica charantia* L. (karela, bitter gourd) were acquired from Kenya, Japan, India, and China . The seeds were sown under quarantine conditions and those which germinated are currently grown for production of more seed material. Seeds of the commercial variety of *Luffa acutangula* (turia, ridge gourd) and of *Lagenaria siceraria* Mol (bottle gourd, dudhi) were acquired from various sources. Seeds collected in Botswana included those of *Coccinia sessilifolia* Sond (wild cucumber) and *Citrulus lanatus* Thumb (tsama melon). These seeds have been and sown under quarantine conditions.

2) Dr. Chweya's Visit to Israel

Dr. Chweya of the University of Nairobi spent the months of September to December 1988 in Beer-Sheva. During his visit the following aspects of the project were covered:

a) Further discussions on the proposed project were held

b) Dr. Chweya visited experimental sites in Israel where the candidate species will be grown (e.g., the research stations in the Arava valley and at Sha'ar Hanegev) in order to become acquainted with the local conditions in Israel.

c) Visits and discussions with farmers willing to collaborate in the project were held.

d) Dr Chweya was introduced to agrotechniques being used at the Institute for Agriculture & Applied Biology by visiting various experiments that are under way (salinity experiments, use of brackish and underground water, etc.).

3) Study of Some of the Proposed Species in the Greenhouse

Flowering patterns, fruit development, fruit quality and shelf life of turia, karela and kiwano were studied in the greenhouse. Two experiments, one in winter and the other in summer ,showed that short days and low night temperatures were associated with delayed inception of flowering and with a shorter flowering period. Optimal harvest dates were 10-13, 5-7, and 25 days from pollination for fruits of karela, turia and kiwano, respectively. Fruit constituents in the two experiments were similar, although fruits grown in summer had a higher sugar content. In experiments with different storage temperatures, karela exhibited a satisfactory shelf life of 19-25 days only in a cold storage room, i.e. at 4°C (the shelf life of fruits at the correct stage of ripening for the market being longer than that of fruits picked too early or too late). For turia a satisfactory shelf life of about 24 days was achieved by storing the fruit in a cold storage room maintained at 8°C.

4) Developing Techniques for Evaluating Genetic Variations in Different Populations

Techniques for evaluating genetic variations in different populations via isozyme variation were developed. Six lines of kiwano were studied in the aim of establishing genetic differences for future breeding programs. These accessions were: 67.868, 67.869 and 67.870 obtained from the Horticultural Botany University of Frankfurt am Main, 77.151 and 77.313 from South Africa and commercial variety obtained from New Zealand. Starch gels were used for analysis of enzymes and identifying differences in isozymes. It was found that among the lines 67.868, 67.869 and 67.870 the line 67.868 is distinct 77.151, 77.313 and the commercial line are all different from each other and from the former group.

5) **Survey of Current Production Practices**

Some of the candidate species currently being grown in Kenya include: *M. charantia* (karela), *L. acutangula* (turia), *L. cylindrica* galka) and *Lagenaria siceraria* (dudhi). In most cases, these species are grown separately on the same farm. Some farmers grow all or some of the four vegetable species. Important areas of production include the Kiboko and Kibwezi areas, along the Kiboko, Makindu, Kibwezi, Kambu, Mtito Andei, Athi and Tange rivers, in Machakos district, along the Athi river in the Kitui district, at Mwea Tebere in the Embu district and in Mombasa district at the coast. The survey showed that the cultural practices involved in the production of the vegetables are similar, in all the areas and advice is provided by the traders involved in the exporting of the vegetables.

Field preparation: At the end of the growing season (April/May), both primary and secondary cultivations are carried out and furrows/basins are prepared in readiness for planting. Land preparation is done by hand in all cases.

Planting: Most farmers make holes with a width of 60 cm, a length of 60 cm and a depth of 60 cm, but some farmers make bigger holes of 100 (lenth) x 100 (width) (depth). Each hole is refilled with soil mixed with upto 20 liters of farmyard manure obtained from sources cattle, goats, sheep or chickens). The spacing of the holes (and therefore of the plants) also differs with growing areas and ranges from 1.8 to 5.0 m between rows and from 1.0 to 4.0 m within rows. Both direct sowing and transplanting in the field (into already prepared holes) are practised. In the case of transplanting, seedlings are first raised in polythylene sleeves (about 10 cm in diameter and 15 cm deep) and are then transplanted at two months. The soil medium used in the sleeves is mainly top soil mixed with farmyard manure in a 1:1 ratio. At sowing or transplanting a handful of diammonium phosphate (DAP - 18% N, 46% P_2O_5) per planting hole may be used, but this is very rarely done.

Seed varieties

Seeds may be acquired from seed companies, although many farmers use their own seed from previous crop. It is not uncommon to find exporters supplying seed to farmers with whom they have contracted. Three types of Karela, i.e. short-curled, short-smooth, and long, and two species of *Luffa* , i.e. *L. acutangula* (turia, pusa masdar) and *L. cylindrica* (galka) and grown. The varieties cannot be pure, because most farmers use their own seed.

Weeding: Farmers make sure that their fields are weed free. Weeds are normally pulled out by hand, although some farmers use hoes for weeding. As soon as the plants cover the ground, no more weeding is done, since by this time weeds are smothered and their growth is inhibited.

Topdressing with N: This is a very rare practice, undertaken only by those farmers who have the financial means to do so. For a directly seeded crop, a handful of urea (46% N) is applied two months after sowing whereas for the transplanted plants, 100-150 g of DAP/plant is applied at the onset of planting. Some farmers topdress their plants at the onset of planting. This is done by mixing farmyard manure with the irrigation water (furrow irrigation is mostly used).

Irrigation: Most farmers irrigate their crops. Water is obtained from rivers pumping the water to higher elevations and then letting it flow into the fields or by gravity or by making channels directly from rivers to the fields. All farmers use furrow irrigation systems.

Training: All candidate species are supported on trellises. The trellises are made of posts (11/2 -2 m high) spaced 6 m apart along the plant rows, the posts being connected by two running along the plant rows and spaced at intervals of 30-45 cm up the posts. Plants are then trained on the wires. In some cases, such as for

karela, sisal twines or wires are formed into a netting on the tops of the posts and the plants are trained to form a roof from which fruits are harvested.

Rotation: Due to the high costs of making the trellises, farmers grow the candidate species on one field for two to four seasons. Some farmers grow the candidate species alternatively in one field for up to two years. The candidate species are rotated with other vegetables, such as*Solanum melongena* or *Capsicum annuum* , which are also grown for export.

Pests and diseases: Few farmers protect the candidate crops from pests and diseases. Common pests include melon flies, root-knot nematodes and cutworms and the common diseases are caused by downy and powdery mildews. Those farmers who are financially able control melon flies by spraying with Cypermethrine, and nematodes and cutworms by using Furadan or Aldrin at planting. The downy and powdery mildews are controlled by spraying regularly with Dithane M45, Antracol or Bayletron.

Harvesting: Harvesting may start three months after sowing and may continue for three months . Harvesting is carried out three days a week. Yields of upto 9 tons per ha are realized with good management.

Marketing: Exporters (or their agents) contract with or supply orders to the farmers. They collect the fruits on the day of harvesting and transport them directly to the airport for exporting. Prices paid to the farmers fluctuate with the availability of the fruits and are fixed by the exporters. However, there is a high demand for the fruits on overseas markets throughout the year. Some farmers have formed cooperatives to try to control price fluctuations and by inputs cheaply. It is not yet known whether this will be successful.