

## ABSTRACT

This study was designed to address some of the problems that characterize traditional yam (*Dioscorea* sp.) production methods (such as the inefficient, edible tuber dependent mode of propagation, unavailability of "clean" planting materials, carry over of diseases from crop to crop and poor storageability of traditionally derived tubers) through the use of *in vitro* technology to produce planting materials for farmers' use.

*In vitro* yam plantlets were produced using standard procedures and an effective postflask acclimatization process was developed in this study. The developed process is simple and inexpensive with an efficiency level of 95%. The hardening setup involved the postflask transfer of the *in vitro* plantlets to a 1:1 sand/soil mixture in seedling bags, covered with plastic disposable cups in a shaded house. The developed protocol was used to harden plantlets initiated from meristem-tip cultures so as to produce disease free planting materials for field studies.

Growth assessment and a number of biochemical parameters were studied during the acclimatization process which included, invertase, peroxidase, acid phosphatase, polyphenol oxidase and the cell wall enzymes (pectin methylesterase and polygalacturonase) activities. Invertase was found to be an ideal biochemical index for assessing the efficacy of the acclimatization process.

Plantlets hardened using the developed method had 95-100% survival on transfer to the field in a pilot field study conducted, with resultant tubers weighing between 0.2 - 1.0 Kg. The smaller tubers served as "seed yams" and the larger ones as ware tubers. The field experimentation was extended to include farmers' participation at the grass-root level. A survival rate of 87% was observed from the farmers' trials with tubers weighing up to 1 Kg from first generation planting.

Field experimentation also highlighted the inappropriate use of inorganic fertilizers by local farmers and suggests the use of "bioganic," an organic fertilizer.

*In vitro* derived tubers were studied for storage characteristics. It was found that intact tubers from *in vitro* derived planting materials stored longer than traditionally produced tubers from "yam heads". Intact tubers from *in vitro* derived planting materials remained dormant for up to six months, in comparison with traditionally produced tubers that sprouted after three months. Cut *in vitro* derived tubers also stored better than cut traditionally produced tubers. Studies of the biochemical parameters, pectin methylesterase, polygalacturonase and cellulase activities revealed interesting changes in the cell wall properties of the yam tuber during storage.

*In vitro* techniques were also used to produce salt tolerant yam plantlets for salt challenged environments. The molecular basis of salt tolerance was analysed through some enzyme activity studies and Reverse Transcriptase Polymerase Chain Reaction (RT-PCR). Two genes of sizes 0.35 kb and 1 kb were found to play roles in the development of salt tolerance in *in vitro* yam plantlets.

For the purpose of value added products development, the influence of the section of tubers used for minisetts on the resultant tubers was assessed with respect to a number of biochemical parameters namely, invertase, peroxidase, acid phosphatase, polyphenol oxidase, total starch and total sugar contents. It was found that sectional differences and biochemical variations along the length of the parent tuber used for planting, influence the biochemical parameters of resultant tubers. Middle-derived tubers had elevated levels of most of the biochemical parameters studied.

The bridging of the gap between the lab and the field through the developed acclimatization process enables a number of problems affecting traditional yam production to be addressed. Among them are the availability and production of disease free planting materials, improved shelf life of the harvested tubers and promise of increased utilization of salt challenged environments.