Microtuber: A Source of Germplasm Conservation

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Introduction:

Potato can supplements the food needs of the country in a substantial way. It produces dry matter food, well-balanced protein and more calories from unit area of land and times then other major food crops. It contains practically all the essential dietary constituents like cereals, carbohydrates which are the major constituents of potato. Besides it contains essential nutrients as proteins and minerals like calcium, phosphorus, iron and vitamins: B1, B2, B6 and C (Thamburaj and Singh, 2001). The rising population and per capita income are pushing up the demand for food, which needs to be met through enhanced productivity per unit area and time. In this context, importance of potato is noteworthy for several reasons. Firstly, potato crop produces more edible energy and protein per unit area and time than other food crops. Secondly, for the small and marginal farmers, potato fits well into multiple cropping systems prevalent in tropical and subtropical agro-climatic conditions. Thirdly, the high profitability of potato as a cash crop has made it a viable commercial enterprise and lastly, rapid technological advances in varietal improvement, agro-techniques, plant protection, storage and processing and likely have led to expansion of potato production even in non-traditional environments (Pandey *et al.*, 2006). [Report and Opinion. 2009;1(3):69-71]. (ISSN: 1553-9873).

Problems in traditional cultivation methods:

Conventional propagation of potato is done vegetatively using seed tubers and ensures uniformity of the crop in terms of growth and yield, but results in degeneration of the crop due to virus infection, the rate of degeneration 398 varying from place to place and from cropping season to cropping season (Biniam, 2008). The viruses are transmitted through different ways including through planting infected tubers. If the seed stock is not maintained well or frequently replaced with fresh ones, the virus infiltration can reach up to 100% in 3 - 4 successive crop seasons resulting in almost half or one third yields (Khurana *et al.*, 2001). This is the major problem faced by seed producers. Successful cultivation of seed potato depends upon the availability of disease free seed, soil, moisture, plant protection measures, low temperature, short days conditions during tuberization phase, resulting rapid bulking rate. Potato plant is very sensitive to ecological factor such as temperature, rainfall and photoperiod (Singh, 2002).

Seed tuber quality is an extremely important factor for potato yield. Since it is a vegetatively propagated plant, fungal, bacterial and, particularly viral disease, agents are easily transmitted through the tubers (Truta, 1997). Viral diseases are, for the most part, responsible for degeneration, characterized by a decrease in vigor, productivity, and resistance to diseases of potato cultivars after successive cultivation from the same lot of tubers (Silberschmidt, 1937; Sangar *et al.*, 1988).

New Approaches:

In India, the systematic work on potato tissue and cell culture was initiated in 1972 at the Central Potato Research Institute, Shimla. Varietal improvement programme at CPRI over the past more than 50 years has been largely instrumental in nearly thirteen-fold increase in total production and three-fold increase in yield in the country. Further, the development of short duration varieties the Kufri Chandramukhi, K. Ashoka, K. Jawahar, K. Pukhraj and K. Lauvkar has contributed towards higher cropping intensity and higher returns to farmers. This technique was developed in 1970s to enable healthy seed potato production in sub-tropical Indian plains under low aphid period. A range of techniques, including tissue culture and *in vitro* rapid multiplication have been used by 26 national programs in Africa, Asia, and Latin America to clean, maintain, and reproduce basic stocks of seed potatoes for later

multiplication and used by farmers (Horton and Sawyer, 1985). This technique aided by biotechnological approaches for virus elimination, micropropagation and effective viral diagnostics has sustained the National Potato Seed Production Programme by producing about 2600 tonnes of breeder's seed annually. This breeder seed is needed to be multiplied to about 4, 32,000 tonnes of certified seed by the State Department of Agriculture/Horticulture to meet the seed potato requirements of our farmers (Pandey *et al.* 2006).

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Almost half a century has passed since in vitro tubers (microtubers) were first described in potato, but their adoption as a seed propagule has been uneven globally. Consensus is lacking regarding optimal production practices for microtubers and their relative productivity in relation to other propagules for minituber production. There is significant uncertainty regarding the utility of microtubers for evaluation of agronomic characters. However, the application of microtubers in germplasm conservation is widely accepted. Microtubers are produced in vitro in a plethora of different growing systems with varying environment, media constituents, and storage intervals. Many of the interactions between growth parameters in vitro and subsequent productivity appear to be genotype-specific.

Accordingly, microtubers come in different sizes, have different dormancy requirements, and differ widely in relative growth potential and productivity. Despite these differences, there is evidence for strong analogies in growth responses between field-grown tubers and microtubers. The use of microtuber technology in seed tuber production, breeding programs, germplasm conservation, and research appears to have enormous potential. Microtubers are utilized for minituber (small tubers produced from in-vitro-produced propagules) production in greenhouses or screenhouses and, less commonly, are directly field-planted. Wherever microtuber and minituber production technologies have been implemented, they have halved the field time necessary to supply commercial growers (3 or 4 years compared with 7 or more years), and greatly improved seed tuber quality (fewer viral, bacterial, fungal problems) (Donnelly, *et al.*, 2003). Production of mini-tubers as a source for seed potato was investigated by growing in soil micropropagated plants and micro-tubers produced from micropropagated plants. Micropropagated plants produced mini-tubers in glasshouse after 70–115 days of growth in soil. A large proportion of the mini-tubers produced were between 9 and 15 mm diameter. Several factors, e.g., explant number, duration of *in vitro* culture and genotype influenced mini-tubers production (Ahloowalia, 1994).

In all potato growing regions the availability of high quality clean seed tuber has been the most limiting owing to the conventional clonal propagation that favors disease build-up that drastically reduces yield. Potato seed production programmes in many countries have been boosted by using these techniques. In recent years the first multiplication steps in seed production programmes are speeded up by using in vitro plantlets, Microtubers (Bizarri and Ranalli, 1995) or mini tubers (Hussey and Stacey, 1981).

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