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Tissue Culture Mediated Seed Tuber Multiplication as Influenced by Potassium: A New Method for Quality Seed in Potato

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Opinion

Potato (*Solanum tuberosum L*) originated in the Andes near the border of Peru and Bolivia in South America. It was first domesticated in Southern Peru and North Western Bolivia between 8000 and 5000 BC. Spanish introduced the potato to Europe in the second half of the 16th century. Thereafter, it travelled to Asia and other countries throughout the world. Potato is now 3rd most important food crop of the world after rice and wheat. Portuguese brought potato in hill regions of the Indian sub- continent in 1675. Subsequently, varieties were developed for various agro climates and potato became popular in India. Potatoes are now important component of food and nutritional security in country. Potatoes are an exceptionally healthful, low calorie, high fiber food; rich in vitamins and minerals; give protection against cardiovascular disease; and help in lowering blood pressure. They are also good for dieters because of complex carbohydrates that make you feel fuller for a longer time.

Agriculture and allied sectors contributed 14.1% in GDP during 2011-12 while contribution of potato in agricultural GDP was 2.86% in India (3.7 times more than rice and 5.4 times higher than wheat). Demand of potato is expected to be 125MT by 2050 against production of 35.21MT from an area of about 1.82M Ha (2010) in India. About 85% of potato in country is produced in North Indian plains. On the contrary, climate change and variability are supposed to affect potato production and productivity. The yields are likely to fall by 19.65% (Karnataka) followed by Gujrat (18.23%) and Maharashtra (13.02%) with overall fall of 9.56% at National level.

Potato plays an important role in food and nutrition security in country. India is 2nd largest producer of potato in world. It produced 28.32Mt (2011-12) and record 48 Mt (2014-15). About 85% of potato in country was produced in North Indian plains. About 65% of potato production was used as fresh while 8.5% as seed during 2010. The UP, WB and Bihar are leading potato producing states in country. Productivity was recorded as high in WB followed by UP and Bihar. Demand of potato in country is expected to increase to 125MT by 2050 against production level of 35.21MT (2010). On the contrary, climate change and variability is likely to negatively impact potato productivity. As per estimates, yield is likely to fall by 9.56 % by 2020 and 16% by 2050 in absence of needed steps. To overcome this situation we need to develop new varieties and crop/seed production technologies for fast multiplication of new varieties.

NW Himalayan region and Indo-Gangetic Plains are best suited for potato seed crop. Punjab alone contributes significantly in meeting the nation's potato seed requirement. Around 2.96MT potato tubers were used as seed during 2010 in country while 90% of disease free seed potato was produced in Punjab. Innovative potato seed growers usually compliment tissue culture multiplied micro/mini tuber production with net house and field multiplied potato seed tubers. Current demand for potato seed tubers is over 6 MT which is likely to increase by 2050 with anticipated higher potato production. At present, there is huge deficit in demand and supply of disease free potato seed tubers. ICAR supplied breeder seed after two cycles of foundation and two cycles of certified seed meets 25 % of total requirement. We need to expand disease free quality seed tubers raised via tissue culture cycle that can also help increase potato productivity by 20-30%. The various steps in conventional tissue culture mediated disease free seed potato production are outlined as under:

Establishment of aseptic cultures and shoot initiation

The aseptic cultures can be established from emerging buds obtained from disease and virus free potato grown in Net house using solidified MS medium with different concentration and combination of hormones within 4 week. The success of programme is often dependent on the genotype, explants source and choice of plant growth regulators combination.

Maintenance/multiplication of shoots and rooting

The shoots initiated from emerging buds on solidified MS medium are sub-cultured on same or more often on liquid medium for obtaining multiple shoots in various cycles usually from March/April to September. The *in vitro* multiplied potato shoots can be used for production of micro or mini tubers or transplanted directly after hardening in Net houses. Normally, better production of micro tubers (number of tubers and weight) is observed on solid (agar) compared to liquid media under the 8 h photoperiod compared to no light.

Hardening: The *in vitro* multiplied potato shoots can be hardened and transplanted directly in field under Net houses for further multiplication in various cycles over seasons.

Field transfer: Field performance of *in vitro* multiplied potato shoots or micro tubers is highly dependent on genotype and potassium levels.

Net house multiplication: Subsequent multiplication in 2-3 cycles can be done in Insect proof Net Houses.

In our studies, better performance of tissue culture multiplied potato seed tubers (micro tubers) over conventional tubers was observed in both genotypes (Kufri Badshah and Kufri Pukhraj). Among genotypes, differences for most of the traits were found to be statistically significant. Micro tubers of tested cultivars performed well in the open field and performance was variety dependent, so were the responses to Potassium application in respect of mini or normal seed sized tuber production.

Data with respect to different K levels revealed that maximum mean average tuber weight (140.06g), polar diameter (70.30mm), equatorial diameter (100.37mm) was observed under higher dose of potassium (150kg/ha) and these values were statistically superior to results on other doses. However, these values were comparable with the next lower dose of potassium (120kg/ha) with exception of polar diameter.

It can be concluded that the progressive seed potato growers can use plant tissue culture mediated seed tuber multiplication through production of shoots, multiple shoot formation, micro or mini tubers production supplemented with insect proof net house multiplication of potato tubers using appropriate Potassium nutrition depending on genotype. This paper reports-a new method advocated for micropropagation mediated disease free potato seed production that can have commercial applications depending upon genotype used and potassium nutrition.

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