Print ISSN : 0972-8813
e-ISSN : 2582-2780

[Vol. 21(1) January-April 2023]

Pantnagar Journal of Research

(Formerly International Journal of Basic and Applied Agricultural Research ISSN : 2349-8765)

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PANTNAGAR JOURNAL OF RESEARCH

Vol. 21(1) January-April 2023

CONTENTS

A study on potato mini-tuber and first-generation seed production using micro-plants of Kufri girdhari and K. giriraj

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ABSTRACT: Micro-plants of potato of two varieties (Kufri girdhari & K. giriraj) were produced through micropropagation using virus free cultures. For mini-tuber production, micro-plants were transplanted in the poly-house in the month of January and harvested after 150 days. Weight of mini-tuber (G0) ranged 2.73 – 20.83 & 4.55 – 24.04g in K. girdhari and K. giriraj respectively. The relationship between number and weight of G0 tubers showed positive linear correlation in both the varieties. For the first generation (G1) seed production, G0 was divided in to five categories on the basis of tuber weight and sowing was done in the open field. Highest yield was recorded in K. girdhari in the first category (161.8 q/ha) whereas lowest was in K. giriraj in the fifth category (22.20 q/ha). In the second category yield was at par in both the varieties (114.00 – 111.00 q/ha). Though K. giriraj showed lower yield but highest per cent increase in average tuber weight was recorded in category fourth and fifth as compared to K. girdhari.

Key words: G0 &G1, Kufri girdhari, K. Giriraj, mini-tuber, micro-plant, potato

Production and multiplication of potato tubers for seed has a number of disadvantages like low rate of multiplication and high risk of various diseases. As an emerging technology, the plant tissue culture techniques are used as an alternative means for vegetative propagation. This technique has a great impact on both agriculture and industry by providing large number of plants to meet the world demand (Mohapatra and Batra, 2017). This indispensable tool plays very important role in modern agriculture by creating large number of clones from a single seed or explant. Besides this, desirable traits can be selected and many diseases can be eliminated through careful selection. Tissue culture covers wide range of techniques including *in vitro* culture of organs.

According to reports, some viruses can decrease the yield of potato by 40% singly and 90% in combination with other viruses ((Mohapatra and Batra, 2017). Virus free clones of potato with meristem culture technique through micropropagation for micro-plants production can be developed (Nagib *et al.*, 2003). Mini-tubers are produced by planting hardened micro-plants inside a net or polyhouse. Mini-tubers are used for further production of seed tubers in three subsequent generations (G1, G2 & G3) before supplying to farmers to be used as seed (NAAS, 2021). Department of Biotechnology, Government of India has initiated a National Certification System for tissue culture raised plants and created a scheme for successful implementation of potato tissue culture raised mini-tuber (PTCMT) to be used as breeder seed. As per the scheme, mini-tuber produced from micro-plants under either net-house or poly-house can be multiplied a maximum of three times (foundation 1 & 2 and certified) for certified seed production (NAAS, 2021).

Brazillion territory also follows the similar rules for the production of seed potatoes in various categories i.e., genetic seed potatoes; basic seed potatoes (G0, G1, G2 & G3); certified seed potato of first and second generation (C1 & C2). The basic seed potato G0 is obtained from the genetic seed or basic potato seedling (Morais *et al.*, 2018).

Present study was conducted to produce mini-tubers (G0) from micro-plants of two species of potato i.e. Kufri girdhari and K. giriraj in the polyhouse and first generation (G1) seed in the open field condition.

Correlation between number and weight of mini-tubers per plant and increase in yield and size of first generation (G1) seed was analysed.

MATERIALS AND METHODS

The study reported in this manuscript was conducted from January 2021 to January 2022. Place of work was at Agriculture Research Station, Majhera, situated in Nainital district of Uttarakhand state of India. Micro plants of two varieties (Kufri girdhari and K. giriraj) of potato were produced using micropropagation. Aseptic cultures of both the varieties were procured from Central Potato Research Institute, Shimla and multiplied *in vitro* using the protocol standardized by Agarwal and Purwar (2013). Acclimatized plants were transplanted in the polyhouse for mini-tuber seed production i.e., G0 seed. After 150 days of transplanting G0 seed was harvested and stored for three months for further sowing. For G1 seed, the stored (G0) seed was sown in the month of September in the open field. G0 seed was divided in to five categories on the basis of weight of tubers (Table 1). Category 1 to 5 was of largest to smallest respectively. This was 120 days duration and G1 seed was harvested in January, 2022. For mini-tuber production (G0) trial was planned on the basis of number of plants transplanted i.e. 90 plants each of both the varieties were transplanted so that each replication was of 30 plants. For another trial in which G1 seed was produced trial consisted 6 rows of 2.0 m length for each seed category in both the varieties. So each replication was of two rows with a spacing of 50 X 20 cm. Both the trials consisted three replications each. Standard agronomic practices were followed during the experiment (CPRI, 2000).

RESULTS AND DISCUSSION

Correlation study between weight and number of mini-tubers (G0) produced from micro-plants in the poly-house along with performance of G0 seed in the field in terms of yield of G1 seed and other parameters were analyzed. The relationship between number and weight of mini-tubers indicated positive linear correlation in both the varieties. The equation Y= 6.4535X (where Y = weight of tubers and X = number of tubers per plant) explained 59.29 per cent variation in K. girdhari (Figure 1). Similarly, in K. giriraj variation observed was 40.24 per cent (Figure 2). Though, comparison of per mini-tuber weight of K. girdhari and K. giriraj showed no definite trend but mostly K. giriraj mini-tuber weight was more than K. girdhari (Figure 3). Mini-tuber weight in K. giriraj ranged from 0.64 to 36.2g whereas in K. girdhari it was 0.72 to 32.54g as per the actual values but on the basis of overall average it was from 4.55 to 24.04g in K. giriraj and 2.73 to 20.83g K. girdhari. In a previous study, comparison among K. himalini and K. giriraj showed higher yield in K. giriraj but tuber size was smaller as compared to K. himalini (Agarwal *et al.*, 2016). Per cent increase in tuber weight from G0 to G1 was calculated on the basis of average of all the replications in all the five categories in both the varieties (Table 2). Highest per cent increase was noted in K. giriraj in category 4 and 5 i.e. 613.01 and 880.00 respectively. But interestingly, lowest increase was also in K. giriraj in category 1 due to more weight of mini-tuber used for G1 seed production, which indicates use of bigger size seed tuber, does not add much as far as weight per tuber is concerned. In both the varieties highest per cent increase in weight of tuber was in the fifth category. K. girdhari showed more increase in weight of tuber in the first category but less in all the other

Table 1: Average and range of G0 seed weight of five categories of tubers used for G1 seed production of K. girdhari and K. giriraj

Variety	Category wise average and range of tuber weight (g)									
	1		2		3		4		5	
	Average	Range	Average	Range	Average	Range	Average	Range	Average	Range
K. girdhari	25.53	18.68 – 32.54	13.59	11.5 – 16.65	6.67	5.2 – 8.25	2.66	1.86 – 3.52	1.33	0.72–1.70
K. giriraj	29.01	22.96 - 32.66	11.75	7.62 – 17.14	6.39	3.23 – 9.3	2.23	1.36 – 2.53	1.00	0.64 – 1.36

Table 2: Per cent increase in weight of tuber from G0 to G1 in K. girdhari and K. giriraj

Category	Per cent increase in tuber wt.	
	K. girdhari	K. giriraj
1	62.59	27.19
2	79.02	186.81
3	130.89	258.37
4	351.13	613.01
5	561.54	880.00

Table 3: Category wise yield of G1 seed in K. girdhari and K. giriraj

Category	Yield (q/ha)	
	K. girdhari	K. giriraj
1	161.8	139.00
2	114.0	111.00
3	51.80	65.30
4	35.90	48.60
5	32.40	22.20

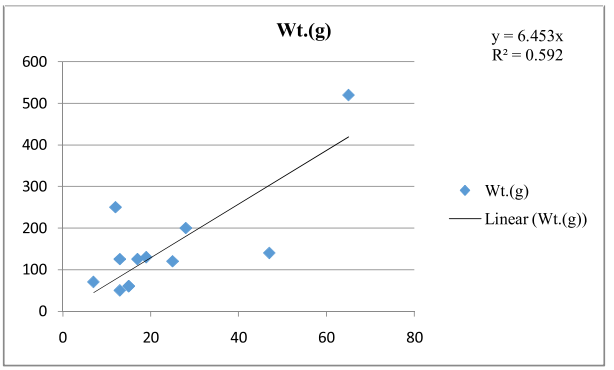

Fig.1: Relationship between number and weight of tubers (per plant) of G0 seed in K. girdhari

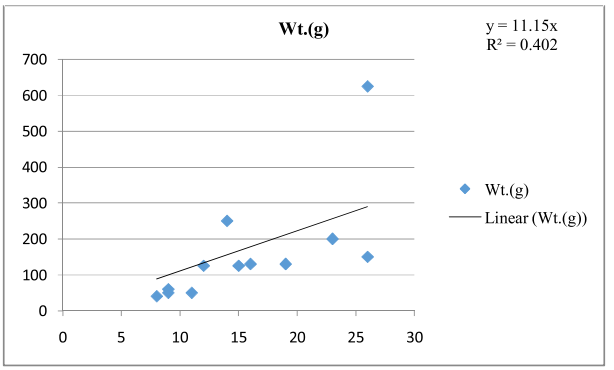

Fig.2: Relationship between number and weight of tubers (per plant) of G0 seed in K. giriraj

four categories as compared to K. giriraj. However, overall yield was recorded highest in K. girdhari (161.8 q/ha) in the first category (average weight of

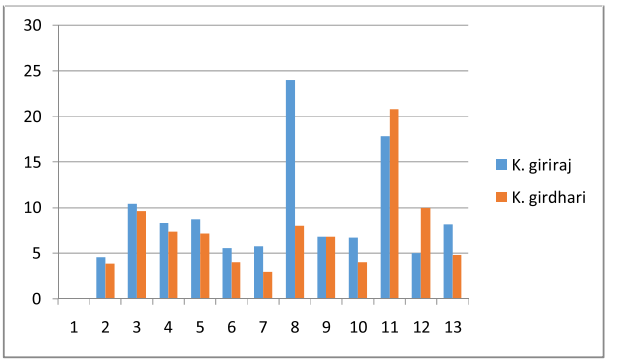

Fig. 3: Comparison of per tuber weight (g) of K. girdhari and K. giriraj in mini-tuber seed (G0)

mini-tuber used was 25.53g) and lowest was in K. giriraj in the fifth category i.e. 22.20 q/ha (average weight of mini-tuber used was 1.00g). Agarwal *et al.* (2014) also reported more yield obtained when large sized (Â 40g) tubers were used for seed as compared to smaller size. Total yield in the second category was at par in both the varieties i.e., 114.0 and 111.0 q/ha respectively (Table 3). Similar finding has been reported by Altoveros *et al.* (1994) that higher potential yield and number of tubers were obtained from regular sized tubers (30-60g) than small (15-30g) and marble size (Ã15g).

CONCLUSION

Findings of this study indicate that weight of mini-tuber produced from the micro-plant may vary from correct seed size to very small or marble size best yield of G1 seed is obtained using the normal size mini-tuber, though the marble size can be multiplied further to get the right size in the next generation.

ACKNOWLEDGEMENTS

Author is thankful to Director, Experiment station for providing financial assistance through Hill Research Promotion Fund and necessary facilities.

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Received: April 26, 2023
Accepted: April 30, 2023