

Effect of calcium application on yield and post harvest qualities of potato

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ABSTRACT

Three years studies were conducted at Potato Research Station, SDAU, Deesa to study the effect of calcium application in the form of gypsum on yield and post harvest qualities of potato cv. Kufri Badshah. Results revealed that calcium application did not have significant influence on growth and yield of potato. However, application of 80 kg/ha calcium at the time of planting in the form of gypsum enhanced net returns, benefit-cost ratio and % dry matter of tubers over rest of treatments. Post harvest studies indicated that split application of 40 kg/ha calcium during planting and 40 kg/ha calcium at earthing up reduced tuber weight loss, number of sprouts and rotting of tubers during 90 days storage.

Key words : Calcium, gypsum, potato tuber

Calcium is of utmost importance in plant for maintaining cell membrane stability and wall structure and assists as a secondary messenger in various plant functions from nutrient uptake to changes in cell status to help the plant react to the impact of environmental and disease stresses (Allen and Schroeder, 2001). Deficiency of calcium in potato has been related with many disorders such as Brown Center, Internal Brown Spot, hollow heart, susceptibility to bacterial rot caused by *Erwinia caratovora* and internal defects of tubers (Karlsson *et al.*, 2001). Adequate calcium supply strengthens tuber skin imparting better resistance to many diseases and improving skin finish of tuber, leading to a brighter and more marketable product. Calcium plays an important role in tuberization *in vitro*. Balamani *et al.* (1986) observed inhibition of calcium uptake by potato plantlets *in vitro* experiment that resulted in the inhibition of tuberization, which was restored by adding Ca to the medium. Little information has been available regarding response of dose and timing of calcium application on potato. So, an experiment was planned to evaluate the effect of calcium application on tuber yield of potato and its post harvest qualities

like tuber weight loss, sprouting, healthy and rotting tuber during storage period.

MATERIALS AND METHODS

Field experiment was conducted at Potato Research Station, SDAU, Deesa (Gujarat) during *rabi* seasons of 2009-10, 2010-11 and 2011-12 to study the effect of calcium application on yield and post harvest qualities of potato variety Kufri Badshah. The soil was loamy sand in texture, low in organic carbon (0.33%), available nitrogen (178.12 kg/ha), medium in available phosphorus (15.20 kg P/ha) and available potassium (235.11 kg K₂O/ha). Source of calcium was gypsum. Seven treatments viz; 0 kg Ca/ha, 40 kg Ca/ha at planting, 20 kg Ca/ha at planting and 20 kg Ca/ha at earthing up, 80 kg Ca/ha at planting, 40 kg Ca/ha at planting and 40 kg Ca/ha at earthing up, 120 kg Ca/ha at planting, 60 kg Ca/ha at planting and 60 kg Ca/ha at earthing up were laid out in randomized block design and replicated four times. Biomertic observations viz., plant emergence at 30 days after planting (DAP), plant height, number of shoots and leaves/hill at 45 DAP were recorded. Total tuber yield was harvest from each net plot of size 3.0 m x 3.6 m, which was further grouped into marketable (more than 25 g tuber weight) and non-marketable tuber (0-25 g tuber weight) grades and then expressed in

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tonne/ha. Dry matter content was determined by chopping and mixing of tubers in to small pieces and drying of 100 gram sample in hot air oven at 80° C for first six hours and then at 65° C till constant weight was obtained (Kumar *et al.*, 2006). Net returns and benefit: cost ratio were estimated by using formulae

Net return (₹/ha) = Gross return (/ha) – Total cost of cultivation (/ha)

Benefit cost ratio (BCR) = Net return (/ha) / Total cost of cultivation (/ha)

Post harvest studies included storage studies at room temperature by keeping 5 kg potatoes from each plot in hessian bags for 90 days and recording tuber weight loss (g) at 30, 60 and 90 days during storage period. Number of sprouted tubers, weight of sprouts, healthy tubers and rotted tubers were recorded at 90 days of storage.

RESULTS AND DISCUSSION

Growth, yield and economics

Perusal of the data (Table 1) revealed that calcium application did not influence all the growth attributes (plant emergence at 30 DAP, plant height, number of shoots and number of leaves/hill at 45 DAP. Modisane (2007) also observed that there was no correlation between growth attributes of potato with calcium

application. Similarly, tuber yields of potato i.e; marketable, non-marketable and total yield were statistically unaffected by calcium application (Table 2). Sterrett and Henninger (1991) also reported that tuber yield was unaffected by increasing levels of gypsum application. On the contrary, El- Beltagy *et al.* (2002) found that increase the calcium dose upto medium level increased tuber yield. However, numerically lower non-marketable yield with higher marketable tuber yield and highest total tuber yield were registered under 80 kg Ca/ha at planting.

Application of calcium significantly improved % dry matter of tuber over the control (Table 2). Highest value of % dry matter (18.11%) was recorded under application of 40 kg Ca/ha at planting + 40 kg Ca/ha at earthing up. Steyn *et al.* (1992) reported increase in tuber dry mass with increasing level of calcium application. Modisane (2007) had similar observations but the result was non-significant. Highest net return (₹ 137577/ha) and BCR (1.64) were recorded under 80 kg Ca/ha at planting which was followed by application of 120 kg Ca/ha at planting. Higher tuber yield under 80 kg Ca/ha at planting might have resulted in higher net return and BCR.

Post harvest studies

It was evident from Table 3 that application of calcium reduced tuber weight loss, number of sprouted tubers and rotted tuber over no application of calcium. This

Table 1 Effect of calcium application on growth attributes of potato (pooled data of three years)

Treatments	Plant emergence (%) at 30 DAP	Plant height (cm) at 45 DAP	Number of shoots/plant at 45 DAP	Number of leaves/plant at 45 DAP
No application of calcium	97.39	52.50	2.78	32.85
40 kg Ca/ha (planting)	97.13	53.92	2.80	32.05
20 kg Ca/ha (planting) + 20 kg Ca/ha (earthing up)	97.25	54.77	3.00	34.93
80 kg Ca/ha (planting)	97.83	55.02	2.95	34.70
40 kg Ca/ha (planting) + 40 kg Ca/ha (earthing up)	97.47	52.37	2.98	33.15
120 kg Ca/ha (planting)	97.36	53.33	2.87	32.63
60 kg Ca/ha (planting) + 60 kg Ca/ha (earthing up)	96.88	53.55	2.82	32.28
SEm ±	0.42	0.89	0.11	0.87
CD (P = 0.05)	NS	NS	NS	NS
CV (%)	0.74	2.86	6.80	4.56

Table 2 Effect of calcium application on tuber yield, % dry matter, net return and BCR of potato (pooled data of three years)

Treatments	Non-marketable tuber yield (t/ha)	Marketable tuber yield (t/ha)	Total tuber yield (t/ha)	% dry matter	Net returns (₹/ha)	BCR
No application of calcium	1.17	41.73	42.90	17.52	131294	1.58
40 kg Ca/ha (planting)	1.09	40.51	41.60	17.98	124534	1.49
20 kg Ca/ha (planting) + 20 kg Ca/ha (earthing up)	1.06	42.72	43.78	18.05	135430	1.62
80 kg Ca/ha (planting)	0.94	43.32	44.26	18.06	137577	1.64
40 kg Ca/ha (planting) + 40 kg Ca/ha (earthing up)	1.08	40.46	41.53	18.11	123930	1.48
120 kg Ca/ha (planting)	1.08	43.13	44.21	18.04	137056	1.63
60 kg Ca/ha (planting) + 60 kg Ca/ha (earthing up)	0.96	42.94	43.90	18.10	135489	1.61
SEm $\pm$	0.07	1.57	1.56	0.05	-	-
CD (P = 0.05)	NS	NS	NS	0.15	-	-
CV (%)	11.63	7.15	7.09	0.51	-	-

Table 3 Effect of calcium application on post harvest attributes of potato (Mean data of three years)

Treatments	Tuber weight loss (kg)			No. of sprouted tubers at 90 days of storage	Weight (kg) of at 90 days of storage		
	30 days	60 days	90 days		Sprouts	Healthy tubers	Rotted tubers
No application of calcium	0.71	1.27	2.06	6.67	0.00	2.86	0.85
40 kg Ca/ha (planting)	0.73	1.08	1.89	5.00	0.00	3.00	0.99
20 kg Ca/ha (planting) + 20 kg/ha (earthing up)	0.67	1.05	1.91	4.67	0.00	2.90	0.97
80 kg Ca/ha (planting)	0.71	1.06	1.96	6.00	0.00	3.01	0.69
40 kg Ca/ha (planting) + 40 kg/ha (earthing up)	0.31	0.93	1.69	4.33	0.00	3.22	0.78
120 kg Ca/ha (planting)	0.73	1.06	1.77	5.00	0.00	3.18	0.71
60 kg Ca/ha (planting) + 60 kg/ha (earthing up)	0.55	0.99	1.58	5.00	0.00	3.26	0.63

could be attributed to increased calcium uptake by tuber which strengthens cell wall and imparts resistance to stresses, which was supported by the findings of Kleinhenz and Palta (2002). Split application of calcium i.e; 40 kg Ca/ha at planting + 40 kg Ca/ha at earthing up minimized reduction in tuber weight and lesser number of sprouted tuber during the 90 days storage period. This resulted in higher weight of healthy tuber with lower rotted tubers than lower doses of calcium application.

CONCLUSION

From above findings it can be concluded that application of calcium @ 80 kg/ha in the form of gypsum at planting could achieve higher yield, % dry matter of tuber and economic returns with reduced losses during storage. However, for drawing a more concrete conclusion, we need to conduct more elaborate post harvest studies further.

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