SHORT COMMUNICATION

EFFECT OF CALCIUM IN THE FORM OF GYPSUM ON STORAGE QUALITY AND ECONOMICS OF POTATO

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Abstract: The experiment was carried out at Horticulture Farm, Department of Horticulture, Indira Gandhi KrishVishwavidyalaya, Raipur (Chhattisgarh) during the *rabi* 2010-2011.The skin damaged tuber yield per hectare and skin damaged tuber number was found significant lowest in under T_5-80 kg ha^{-1} FDG. Under the treatment combinations T_4- 60 kg ha^{-1} FDG, T_6- 100 kg ha^{-1} FDG, T_{11}-50 kg ha^{-1} SDG and T_{10}- 40 kg ha-^{1} split dose of gypsum at planting and earthing up performs better regards storage quality, yields attributes and vegetative parameters. In T_5-80 kg ha^{-1} FDG given better response related to during storage at 30, 60, and 90 days after harvest found that lowest rotted tuber, tuber weight loss and skin damaged tuber number and weight.

The treatment combination 5 (T_5-80 kg ha^{-1} FDG) and with recommended NPK @ 150:100:100 found remarkably superior to all the other treatment combinations as regards to all morphological traits, yields attributes and storage quality parameters.The results indicated that the highest gross return (Rs. 212000 $ha^{-1)}$, net return (Rs. 141671 ha^{-1}) and benefit: cost ratio (Rs. 2.01) was obtained under T_5-80 kg ha^{-1} FDG and with recommended NPK.

Keywords: Calcium Gypsum, Horticulture, Potato

INTRODUCTION

Potato (*Solanum tuberosum* L.) is one of the most important vegetable cum starch supplying crop believed to be originated in South America. Potato has high production per unit area per unit time. It can substitute the cereals for human consumption to a greater extent. Potato can be grown in winter as well as in rainy season depending upon the climatic situation. Although it is a temperate crop but can be grown successfully in sub-tropical regions. It is one of the most remunerative and profitable crop for the growers due to its higher yield potential within a limited time. Potato is a short duration crop, which is highly responsive to high inputs and capable to produce high yield under wide range of soils and climatic conditions. Low calcium concentration often occurs in organs with low rates of transpiration, such as potato tubers. There are many potato disorders, such as brown center, hollow heart, that were thought to be related to tuber calcium level. Application of optimum level of calcium had also been suggested for management of disorders and increase growth, yield and quality of potato.

Calcium also plays vital role in plant membrane structure and function, it also protects the cell membrane and gives strength to the cell walls, and thus plays significant role in tuber quality and plant growth when plants are subjected to abiotic and biotic stresses. Applying additional calcium can increase calcium content of the tubers and result in improved quality.India is the second largest producer of potato in the world after China. The area under potato cultivation in India is about 1.96 million hectare with production of 44.42 million tonnes and average productivity of 22.76 t/ha (NHB 2012). In Chhattisgarh potatoes are mainly cultivated in Surguja, Jashpur, Raigarh, Bilaspur, Bastar and Raipur districts during *Rabi* season except in Mainpat and Samaripat hills of Surguja district.The area under potato in Chhattisgarh state is 43.34 thousand hectare with annual production of 648 thousand tonnes (DOH ,CG,2012) with the average productivity (14.96)

MATERIAL AND METHOD

The experiment was carried out in 2010-11 atHorticulture Farm, Department of Horticulture, IndiraGandhi Krishi Vishwavidyalaya, Raipur (Chhattigarh) during the *rabi* 2010-2011. The soil of experimental field was clay in texture containing 0.58% organic matter with *p*H 7.4. The potato cultivar was used Kufri Pukhraj.The experiment was laid out in randomized complete block design with eleven treatments each replicated thrice (Gomez and Gomez 1984). Application of manure and fertilizers in treatment wise T_1-control, T_2-20, T_3-40, T_4-60, T_5-80, T_6-100, kg/ha full dose of gypsum with recommended dose of NPK @ 150:100:100 at planting and T_7-10, T_8-20, T_9-30, T_{10}-40, T_{11}-50 kg/ha along with recommended dose of NPK @ 150:100:100 half dose at time planting and half dose earthing up (30 DAP) 250 q/ha of FYM are also applied at time of field preparation Therefore, full dose of phosphorus and potassium @ 100 kg ha-1 each was applied through single super phosphate and muarate of potash respectively at the time of planting, whereas, nitrogen was applied in each plot into two split doses. Basal dose of nitrogen @ 75 kg ha^{-1} was applied through urea and remaining dose of nitrogen i e 75 kg ha^{-1} through urea (30 DAP). The pre emergence irrigation was provided at one day after planting at regular interval of 10 days. Irrigation was given by ridge and furrow method (number of irrigation 6) and spraying of monocrotophos was done 50 day after planting and Dithan-M-45 at 60 days after planting to protect the crop from aphids and blights respectively. The

observations of different growth parameters and yield parameters were recorded on five randomly selected competitive plants from each plot in each replication. Percent emergence was observed by counting the emerged plant up to 30 days after planting. The observations on growth attributes namely plant height, number of shoot plant-1 number of leaves plant^{-1} fresh weight of plant^{-1} recorded at 60 DAP and yield attributes namely number of tuber grade wise (0-25g, 25-50g, 50-75g, and >75g) plot-1 yield of tuber grade wise(0-25g, 25-50g,50-75g, and >75g) plot^{-1}, skin damage tuber plot-1, total potato yield, total number of tubers, skin damage during storage at 30, 60, 90, days after harvest were recorded. Grade tuber yield were recorded after digging of tuber on net plot basis in each replication at the time of harvest.

RESULT AND DISCUSSION

Taking 5 kg tubers of random size and weight stored in room temperature and data was recorded at 30, 60, and 90 days after harvest and data presented in Table No. 1

At 30 days after harvest the data of storage parameter just like skin damaged tuber number and weight indicated that the lowest skin damaged tuber number (7) and weight (0.39 kg) was obtained under the T5 where as the highest skin damaged tuber number (19) and weight (0.83 kg) was recorded in T_1-control.

At 60 days after harvest the lowest skin damaged tubers numbers (3) and weight (0.21 kg) observed under T5 and highest skin damaged tuber number (7) and weight (0.42 kg) found in T1-Control and T5 better than other Treatment combination related to skin damaged tuber number and weight.

At 90 days after harvest, T5 showed that lowest skin damaged tuber number (5) and weight (0.45 kg) and showed superiority over rest of Treatment combination followed. However T1- control exhibited the highest skin damaged tuber number (11) and weight (0.86 kg).

The data of other skin damaged storage parameter, tuber weight loss (kg) at 30, 60 and 90 days after harvest, sprouted tuber numbers and weight are presented in Table-1

In case of tuber weight loss was recorded lowest under the T5 at 30 and 60 (0.14g and 0.25g) in case 90 days after harvest tuber weight loss higher (0.31 kg) in under T5 compare to 30 and 90 days after harvest.

In case of sprout, healthy and rotted tuber which was related to storage parameter the data presented in Table No. 1.

The data showed that sprout tuber (0.002 kg) and rotted tuber (0.65 kg) was recorded lowest in T5 and healthy tuber was recorded highest also in T5 (4.35 kg)

Above results is better due to the application of different dose of gypsum with recommended dose of NPK because of that calcium is important for enhancing the membrane structural stability and maintaining the cell wall rigidity.

Calcium also important in increasing plant tissue resistance due to application of gypsum as increase calcium content in tuber therefore reduced the internal brown spot disorder which is associated with calcium deficiency, and improves storage quality of potato. The present result was in confirmity with the finding obtained by Spillman (2003) reported that preplant strip application of gypsum in the sandy soil resulted in improved tuber grade and size due to increased periderm calcium concentration in tuber and Bangerth (1979) found that application of optimum level of calcium for management of disorders (IBS) and increase quality of potato.

The economics of treatment per hectare are given in Table 2. The input cost per hectare varied from Rs. 68961 to Rs. 72421 under different treatments. The input cost maximum in treatment combination T_{11}-50 kg SDG (72421Rs/ha), T_{10}-40 kg SDG(72079 Rs/ha), T_9-30 kg SDG (71737 Rs/ha), T_8-20 kg SDG (71395 Rs/ha)), T_7-10 kg SDG (71053 Rs/ha) and lowest cost of input was found in treatments combinationsT_2- 20 kg FDG (69303 Rs/ha) T_3-40 kg FDG (69645 Rs/ha), T_4-60 kg (69987 Rs/ha) , T_5- 80 kg FGD (70329 Rs/ha) , and T_6- 100 kg FDG (70671 Rs/ha).

The net income/ha ranged from Rs/ha 41679 to Rs. 141671. Thus, the maximum income (both gross and net) were obtained with T_5- 80 kg full dose gypsum (212000 and 141671 Rs/ha) and lowest income (both gross and net) were obtained with T1- no application of gypsum (110640 and 41679 Rs/ha).

The benefit cost ratio ranged from 0.60 to 2.01 depending on different treatments. It was found to be highest 2.01 under T_5- 80 kg full dose gypsum and lowest 0.60 under T1- no application of gypsum. Above finding under the study are in close proximity with the finding Anon (2009).

Table 1. Damaged tuber during 30, 60 and 90 days after harvest in store at room temperature

	Skin damage during storage						Tuber wt loss (kg)			Sprouted tuber at 90 days		Wt (kg)		
Treatments	**30 Days**		**60 days**		**90 days**									
	Wt (kg)	**No. of tuber**	**Wt (kg)**	**No. of tuber**	**Wt (kg)**	**No. of tuber**	**30 days**	**60 days**	**90 days**	**No.**	**Wt (kg)**	**sprout**	**Healthy tuber**	**Rotted tuber**
T_1- control	0.83	19	0.42	7	0.95	6	0.17	0.31	0.37	9	0.17	0.009	2.01	1.47
T_2-20 kg FDG	0.61	8	0.27	5	0.75	8	0.26	0.20	0.34	6	0.15	0.006	3.91	0.69
T_3 -40 kg FDG	0.51	9	0.25	4	0.72	7	0.15	0.37	0.33	5	0.22	0.009	4.12	0.70
T_4 -60 kg FDG	0.42	10	0.25	3	0.65	7	0.19	0.24	0.29	3	0.18	0.007	4.21	0.68
T_5-80 kg FDG	0.39	7	0.21	3	0.45	5	0.14	0.31	0.25	3	0.14	0.002	4.35	0.65

T_6-100 kg FDG	0.45	11	0.27	4	0.67	6	0.16	0.25	0.30	5	0.20	0.005	4.14	0.72
T_7 -10 kg SDG	0.55	11	0.30	4	0.80	9	0.25	0.22	0.38	5	0.16	0.005	3.00	0.75
T_8-20 kg SDG	0.65	13	0.32	6	0.82	9	0.28	0.32	0.41	6	0.18	0.006	3.20	0.76
T_9 -30 kg SDG	0.69	12	0.33	5	0.84	8	0.29	0.29	0.39	6	0.17	0.008	3.57	0.78
T_{10} -40 kg SDG	0.72	11	0.36	5	0.86	11	0.32	0.34	0.42	7	0.15	0.003	3.78	0.80
T_{11}-50 kg SDG	0.80	14	0.38	6	0.92	10	0.35	0.37	0.41	8	0.16	0.004	4.0	0.90

Table 2: Economics and net returns of different treatments

Treatments	**Yield (t/ha)**	**Cost of cultivation (Rs/ha)**			**Cost (Rs/ha)**		**Sale price (Rs/q)**	**Net returns* (Rs/ha)**	***Benefit cost ratio***
		Seed	**Fertilizer**	**Cultivation**	**Inputs**	**Produce**			
T1	13.83	40000	5211	23750	68961	110640	800	41679	0.60
T_2-20	19.00	40000	5553	23750	69303	152000	800	82697	1.19
T_3 -40	21.43	40000	5895	23750	69645	171440	800	101795	1.46
T_4 -60	25.34	40000	6237	23750	69987	202720	800	132733	1.90
T_5 -80	26.50	40000	6579	23750	70329	212000	800	141671	2.01
T_6-100	24.31	40000	6921	23750	70671	194480	800	123809	1.75
T_7-10	15.52	40000	5553	25500	71053	124160	800	53107	0.75
T_8-20	17.10	40000	5895	25500	71395	136800	800	65405	0.92
T_9-30	16.71	40000	6237	25500	71737	133680	800	61943	0.86
T_{10}-40	21.39	40000	6579	25500	72079	171120	800	99041	1.37
T_{11}-50	22.09	40000	6921	25500	72421	176720	800	104299	1.44

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