

Analysis of Soil Parameters after the Full Growth of The Kufari Bahar Cultivar of *Solanum Tuberosum*

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Abstract

The soil samples were collected for growth of the Kufari Bahar cultivar of the Solanum tuberosum. The samples were taken from different places/fields with a depth of five to six inches below surface and measured for their pH value and other essential micronutrient and macronutrient. After the essential testing of these nutrients, a total ten sets were finalised. The pots study was preferred over the hydroponic growth. The soil mixed with the manure to supplement for better growth and fulfilment of the nitrogen requirement. The externally added nutrient for the growth were provided in the Hogland's solution. The potassium and phosphate requirements of the soil were also given through Hogland's solution. The treatments include 0.5mM cd., 1mM cd., 2mM cd., of cadmium, 50 mM, 100mM, 150mM of NaCl and 0.5mMcd+50mM NaCl, 1mM cd.+100mM NaCl, 2mM cd.+150mM NaCl of combined stress. The photoperiods for growth were supplied by the cool fluorescent light into the plant growth chamber. The control was not supplemented with any stress. The soil was tested just after the growth of the plant (after one month). The stress of cadmium also known to change the protein expression of Solanum tuberosum plants (Folgado R, Panis B, Sergeant K, Renaut J, Swennen R and Hausman J-F, 2013). The soil parameters reports found that the nitrogen was plentiful in the soil of all the three samples. The trace of salt below 1 ppm were also been reported in samples but its level was also low than the cadmium containing samples and somewhat higher than salt samples.

Keywords: Hogland's solution; NaCl; Cadmium; soil samples etc

Introduction

Soil salinity is a major restraint to vegetable crops as it decrease annual crop production and restricts use of land previously uncultivated. The ionic form of NaCl is toxic to plant (Amtmann, A. and Sanders, D. 1999). The manure was mixed with the soil samples to fulfil the NPK (nitrogen, Phosphorous and Potassium) requirement by the plant as potato is a highly nutrient sucking plant. The growth was continued for four weeks and the parameter like root/shoot length, fresh/dry weight etc. were measured. The cadmium also effect the antioxidant enzymes (Dinakar N, Nagajyothi P C, Suresh S, Damodharam T & Suresh C, 2009). The plants were taken out from the pots and the soil samples were collected again from each set. Then each sample of soil was tested again for nutrients and pH scale.

Materials and Methods

Collection of Plant Material and Soil

The prescribed cultivars were purchased from Central Potato Research Institute (CPRI), Kufari, Shimla. The same were also taken from the cold storage. The field soil samples were collected from different locations in local area.

Sterilisation of Tubers

The tubers were taken out of the freeze and kept at least 24 hours at room temperature.

Then tubers were washed with 2% mercuric chloride (HgCl₂) solution. These were soaked for ten minutes in this washing solution. The tubes again washed with tap water. After drying these tubers, these were planted into the soil in pots.

Preparation of Soil for Pots

The pots were first washed with the tal water and dried. The soil was first dropped into the pots and then, simple distil water was added. After three days, the soil was turned into the pots and the cultivars were digged into the soil at least five to six inches into the soil. The hogland's solution continued time to time with essential nutrients.

Growth and Harvesting of Plants

The plants were supplied the continuous stresses of salt and cadmium in dissolved form through Hogland's solution. The roots and shoots were harvested at the first, second, third and fourth week of growth (Figure No.1). Soon after this harvesting, the soil samples were collected from each pots.



Figure No.1 Showing the growth of the *Solanum tuberosum* plant indoor in lab.

Analysis of the Soil Samples

The collected samples were sent to Karishi Vigyan Kendra, Rohtak and the final report was taken.

Results and Discussion

The following data was analysed from the report:

Table No.1 Soil samples collected from different places were measured for different parameters before the growth

Soil Sample sr. number	pH Value	Salt (ppm)	Phosphorous (P) in ppm	Potassium Kg/ hectare	Nitrogen in ppm
Sample no.1	7.90	0.90	1.10	12	130
Sample no. 2	7.50	0.70	0.90	15	120
Sample no.3	8.00	0.80	0.70	9	130

The soil contained similar concentration of nitrogen in sample no 1 and sample no.3 but slightly less in sample no. 2. Additionally, the sample no. three has shown the alkalinity in soil and two other samples were also alkaline. Then, after the full growth of the plant, the soil samples again tested for nutrient parameters. (Table No.2,3,4,5)

Table No. 2 Showing the different parameters control (without stresses).

Control	pH value	Salt (PPM)	Phosphorous (PPM)	Potassium (Kg/Hec.)	Nitrogen(PPM)	Soil Type
No stress	7.4	0.7	0.45	20	135	Loam

Table No.3 Showing the different parameters in cadmium samples.

Cadmium stresses	pH value	Salt (PPM)	Phosphorous (PPM)	Potassium (Kg/Hec.)	Nitrogen(PPM)	Soil Type
0.5 mM cd	7.5	0.3	0.3	18	140	Slit mixed with Loam
1 mM cd	7.9	0.9	0.2	9	135	Loam
2 mM cd	7.4	0.4	0.18	2	200	Loam

The 1mM and 2mM cadmium concentration contains the loam soil suitable for the growth of the plant. The nitrate uptake was also low in higher stress regimen of cadmium stress.

Table No.4 Indicating the different parameters of salt stresses

Salt stress	pH value	Salt (PPM)	Phosphorous (PPM)	Potassium (Kg/Hec.)	Nitrogen(PPM)	Soil Type
50 mM NaCl	7.6	0.20	0.3	15	120	Loam
100 mM NaCl	7.8	0.65	0.2	20	90	Clay mixed with Loam
150 mM NaCl	7	0.45	0.47	18	120	Loam

The low (50mM) and higher stress of salt (150mM) showed the reduced uptake of nitrogen and shown the neutrality in soil but the soils were purely loam while the medium concentration of soil (100mM) stimulated the nitrogen uptake.

Table No. 5 Showing the different parameters in combined stresses of Cd and NaCl

Combined stresses	pH value	Salt (PPM)	Phosphorous (PPM)	Potassium (Kg/Hec.)	Nitrogen(PPM)	Soil Type
0.5 cd mM + NaCl 50 mM	7.9	0.7	0.3	10	20	Loam mixed with Clay
1mM cd+ 100 mM NaCl	7.85	0.5	0.25	15	70	Loam mixed with Slit
2 mM cd+ 150 mM NaCl	7.8	0.4	0.25	16	40	Loam

The nitrates were consumed more in combined stresses. The pH was found to be almost in similar range of 7-8. The higher regimen of combined stress (2mM cd.+ 150mM NaCl) contained purely loam soil ideal for the growth of plant and supported the survival of plant during the whole growth. The antioxidants defence and cadmium uptake in plants also differs in plant cadmium tolerance (Tiryakioglu M, Eker S, Ozkutlu F, Husted S and Cakmak I, 2006).

Conclusion

The salt stressed samples showed increased in salt contents than other as externally added NaCl stress also promoted its concentration in soil. The salt stress also known to induce the physiological changes in *Solanum tuberosum* plat (Evers D, Hemmer K and Hausman J-F, 1998). A low level of cadmium stress also promoted the potassium concentration in soil and more consumption of nitrogen whil higher stress of cd. (2mM) reduced the nitrogen uptake in plant. The cadmium also alters the physiology of the plants (Vitoria AP, Lea PJ and Azevedo RA, 2001). The control ithout any stress maintained its normal parametes in soil after full growth and concluded that stresses of Cd and NaCl effect the plant growth and soil nutrient profile.

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