



Response of potato (*Solanum tuberosum* L.) Cultivar Kufri Himsona of nitrogen and zinc on growth and yield.

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ABSTRACT

A field experiment was conducted on hilly areas of Dehradun during rabi season of 2015-16 on sandy loamy soil of Main Agronomy Research Station, Doon (P.G.) Collage of Agriculture Science and Technology, Rampur, Selaqui, Dehradun, Uttarakhand to study the response of nitrogen and zinc on growth and yield of potato (*Solanum tuberosum* L.) cultivar Kufri Himsona. Testing the experiment in normal pH and EC, Medium Organic carbon, low in available N, high in available P and medium available K, low in available Zn. The experiment was laid out in split-plot design with four Nitrogen levels viz. 0, 150, 200 and 250 kg ha⁻¹ in main plot in Combination with twelve nutrient treatments (T1: N0+Zn5, T2: N0+ Zn10, T3: N0 + Zn15, T4: N150 + Zn5, T5: N150 + Zn10, T6: N150 + Zn15, T7: N200 + Zn5, T8: N200 + Zn10, T9: N200 + Zn15, T10: N250 + Zn5, T11: N250 + Zn10 and T12: N250 + Zn15) in the sub-plots with three replication. Result show that 200 kg ha⁻¹ nitrogen levels recorded the highest growth and yield components, Tuber yield which were significantly better than N0, N150 and N250 kg ha⁻¹. Among the treatments of nutrient management, the best treatment was T9: N200 + Zn15, which caused increased Plant emergence, days taken to tuber initiation, number of stem, plant height, LAI and culminating in enhanced tuber yield. Tuber yield significantly increased from (192.0 q ha⁻¹ in control to 418.3 q ha⁻¹ in T9: N200 + Zn15).

Key Word: Kufri Himsona, Nitrogen, Zinc, leaf area index, Potato, Quality, Yield.

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INTRODUCTION

Potatoes are the main food crops in the world, containing high protein, starch, vitamins and nutrients (AL- Farhan, 2001), Potatoes are useful crops that have nutritional value, economic, and they are high content of carbohydrates and a vital value because they contain a high content of protein (Mohamad, 2000). Potato crop has a role in food security and their must been increase attention for this feeding crop and its quality through the use of foliar application, that have proven successful in the plant for the needs of the necessary food nutrients and its impact on increasing both quantitatively and qualitatively, Matloob *et al.*, (2000) gave a significant increase in yield tuber and its components and attributes of quality when he used Nitrogen and Zinc fertilization. Industries required 40-80 mm size of potatoes, high in dry weight and low reducing sugar for quality processing. Nitrogen plays an important role in tuber size development but overdose of nitrogen lowers the tuber dry matter (Zelalem *et al.* 2009). Potato cultivation under acidic soil of Meghalaya increased plant height significantly up to 120 kg n-1 (Singh and Sharma 1987). Acc to (Khushwah *et al.* 1989) potatoes plant height and number of stem increased up to 180 kg N ha⁻¹). On the other hand, zinc act as binding agent in enzymatic reaction. In this way it is important in protecting proteins from denaturing. Therefore, zinc has a major role to play in nitrogen metabolism and its deficiency results in lower level of protein which may led to higher level of free amino acids which reacts with reducing sugars and produced bitter taste and undesirably dark colour of fried potato products (Shallen berger *et al.* 1959). Further, nitrogen increased the NO₃ level in tubers which is not considered safe from human health point of view and it is reported that zinc application decrease NO₃ in potato tubers. Moreover, many peoples are applying zinc worldwide and

dietary zinc intake can be increased by producing crops with higher concentrations of zinc their edible portion. This can be achieved by applying enhanced zinc fertilizers to crops (White *et al.* 2012).

MATERIAL AND METHODS

Before sowing, bulk composite surface soil samples (0–15 and 15–30 cm depth) were collected from research field of the main Agronomy research station, Doon (P.G.) College of Agriculture Science and Technology, Selaqui, Deharadun, Uttarakhand. Representing the sandy loamy soil, situated at 30° 20, 20.78" N latitude and 77° 52'27.08" E longitude and at an altitude of 515 meters above mean sea level. The air-dried soil was ground to pass through a 2.0-mm sieve, and a sub-sample of the sieved soil was analysed for various mechanical and physico-chemical properties. Soil texture was sandy loam (sand 45.8 %, silt 28.3 % and clay 26.5 %) as determined by International pipette method. Soil pH (6.5) was determined by pH meter of Jackson and Prihar. Electrical conductivity of the saturated soil paste was low (0.38 dsm-1) as determined by Jackson's salt bridge method. Soil organic carbon (0.52 %) was medium, as determined by Walkley and Black's rapid titration method. Soil having available nitrogen (220.9 kg ha-1), available phosphorous (27.3 kg ha-1), available potassium (195.6 kg ha-1) and available zinc (0.44 ppm) in the soil samples were determined by the standardized procedures.

The experiment was laid out in the split-plot design with four Nitrogen levels viz. control 0, 150, 200 and 250 kg N ha⁻¹ in main plot in combination with twelve nutrient treatments (T1: N0+Zn5, T2: N0+ Zn10, T3: N0 + Zn15, T4: N150 + Zn5, T5: N150 + Zn10, T6: N150 + Zn15, T7: N200 + Zn5, T8: N200 + Zn10, T9: N200 + Zn15, T10: N250 + Zn5, T11: N250 + Zn10 and T12: N250 + Zn15

in the sub-plots with three replication. Kufri Himsona varieties were sown on 7 October, 2015. Fertilizers (Urea, Single Super Phosphate, Murate of Potash, and Zinc sulphate) were applied according to treatment. Half of the N and full dose of P, K and Zn was applied at planting and other half at the time of earthing up (30 DAS) according to treatment.

RESULTS AND DISCUSSION

Growth characters:

Uniform emergence of any crop is an important factor for determining the plant stand/population and hence is the most important yield attributing parameter of a crop. It is evident that days taken to tuber emergence and days taken for tuber initiation of potato were not affected to the levels of nitrogen and zinc. The minimum number of Days taken for tuber emergence and Days taken for tuber initiation taken by treatment N200 (15.1 days) followed by N250 (15.2 days) and N0 (15.2 days), respec-

tively. In sub treatment, minimum number of days were taken by treatment Zn15 (15.3 days) followed by Zn10 (15.2 days) and Zn5 (15.1 days), respectively. Plant height is a reliable index determining growth and development of plant. This parameter is directly related to plant yield as a taller plant supports more number of branches and leaves and hence more plant food was manufactured which results in more yield. Leaf area index Leaf area index is an important growth index determining the capacity of plant in trapping solar energy for photosynthesis. If leaf area index is above the optimum limits, there is mutual shading of leaves, causing lower leaves to be parasitic. Number of stems per meter row length Number of stems per plant or per unit area is an index of growth and adaptability of the plant to the soil and climate condition. It is the most important parameter which has direct bearing on development of tuber and tuber yield. Maximum plant height, LAI, Number of stems per meter row length was recorded with treatment N250 being statistically at par with N200 showed significantly highest than N0 and N150. In sub treatment, highest plant height, LAI, Number of stems per meter row length was observed under Zn15 which was statistically at par with Zn10 and significantly superior to control Zn5. The interaction between N and Zn was found non-significant to each other.

Tuber yield:

The ultimate objective in almost all the agronomy studies is obtain the optimum yield of a crop. Tuber yield increased significantly up to treatment N200. However, treatments N200 was at par with N250. Highest tuber yield recorded with treatment N200 which is significantly superior to other nitrogen levels in all aspects. Highest tuber yield was observed with treatment Zn15 which was statistically at par with Zn10 and significantly higher than control. Whereas the interaction effect on tuber yield of potato plants were not significant.

Treatment	Plant Emergence	Days taken to tuber initiation	Plant height	No. of stem per plant	LAI	Tuber yield
Nitrogen levels (kg ha⁻¹)						
0 (N0)	15.4	25.5	24.8	14.7	1.75	194.0
150 (N150)	15.2	25.4	39.1	15.8	2.73	371.0
200 (N200)	15.1	25.2	43.8	17.6	3.20	418.3
250 (N250)	15.2	25.3	45.5	19.7	3.26	402.3
CD (5%)	NS	NS	3.84	2.54	0.25	18.8
Zinc levels (kg ha⁻¹)						
5	15.1	25.1	35.1	16.8	2.65	319.9
10	15.2	25.4	39.3	16.9	2.73	354.6
15	15.3	25.5	40.4	17.1	2.83	364.2
CD (5%)	NS	NS	3.14	1.86	0.15	17.8
Intreecton	NS	NS	NS	NS	NS	NS

CONCLUSION

According to the results of this experiment it seems that the Nitrogen and Zinc are more efficient in terms of growth and development as compared to the others under the regional conditions of this experiment. Moreover it is concluded that application of zinc and complete nitrogen in potato plants, improve the crop growth and development which subsequently may result in high productivity and performance of the plant.

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