"Impact of standardizing macro-nutrient (Nitrogen) requirement in newly released potato (*Solanum tuberosum* L.) var. Kufri Neelkanth"

ABSTRACT

Present experiment was conducted during the *rabi* season at the Centre for vegetable excellence, department of vegetable science, Chandrashekhar Azad University of Agriculture and Technology, Kanpur. The experiment was carried out under in factorial randomized block design with three replications. The experiment encompassed seven treatments including a control: T_1 - Nitrogen 00 kg/ha, T_2 - Nitrogen 50 kg/ha, T_3 - Nitrogen 100 kg/ha, T_4 - Nitrogen 150 kg/ha, T_5 - Nitrogen 200 kg/ha, T_6 - Nitrogen 250 kg/ha, and T_7 - Nitrogen 300 kg/ha, each replicated three times. Various growth characteristics were evaluated, including plant Emergence (%), plant height (cm) at 25, 50, and 75 days after planting , the number of shoots per plant at 75 days after planting , the number of compound leaves per plant at 75 days after planting, the number of tubers of different grades, Total tuber yield, and tuber dry matter content. The results demonstrated that applying nitrogen at a rate of 200 kg/ha (T_5) significantly increases the plant emergence (%) *viz.* 96.61, tuber number of different grades *viz.* 320 (0-25 g), 402 (25-75 g), 297 (>75 g) and total tuber yield *viz.* 71.49 (kg/plot) and 372.34 (q/ha), while applying nitrogen at a rate of 300 kg/ha (T_7) significantly increases the plant height (cm) at different days DAP *viz.* 23.28 (25 DAP), 52.32 (50 DAP), 63.93 (75 DAP), No. of shoots and leaves *viz.* 5.92 and 37.91 at 75 DAP respectively, Fresh and dry haulm yield (kg/plot) *viz.* 34.46 and 4.89 respectively, while Tuber dry matter content (%) *viz.* 18.74 was found highest in the contol *i.e.* T_1 having no nitrogen application.

Keywords: Potato, Nitrogen, Growth, Yield and Dry matter

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INTRODUCTON

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Potato (*Solanum tuberosum* L.), belonging to the *solanaceae* family, is among the most crucial vegetable crops, originating from South America. Potato is auto-tetraploid with a chromosome count of 2n=48. Distinguished from other crops, potato store food materials in underground stem parts known as tubers. This tuber crop significantly contributes to global food security, ranking fourth after rice, wheat, and maize (Rana, 2008). Economically, potatoes provide low-cost energy and are rich in starch, vitamins especially B and C and minerals (Kumar *et al.*, 2013). The edible part of potatoes is a modified stem that grows underground, known as a "tuber". Tubers hold significant importance in our daily diet and are a major source of carbohydrates and starch. As per Das's analysis in 1999, the typical composition of a 100 g edible portion of potato tubers includes: moisture (74.7 g), protein (1.6 g), fat (0.1 g), carbohydrates (22.6 g), energy (97 kcal), calcium (10 mg), phosphorus (40 mg), iron (0.70 mg), carotene (24µg), thiamine (0.10 mg), riboflavin (0.01 mg), and vitamin

C (17 mg). Potatoes, as highlighted by Mehdi *et al*. (2008), are a nutritious food with low energy content and excellent nutritional quality, providing essential vitamins, minerals, and trace elements. Purine-pyrimidines, crucial for RNA and DNA synthesis essential for photosynthesis, contain nitrogen as a vital component. Nitrogen binds to the chlorophyll porphyrin ring and is essential for cell elongation and multiplication.

Nitrogen application profoundly influences crop growth and development, augmenting both the size and number of tubers, thus enhancing overall yield. However, excessive nitrogen can prolong vegetative growth, delaying tuber development and resulting in poor quality and reduced yield. Conversely, insufficient nitrogen application at any growth stage can lead to decreased tuber yield and profitability. Nitrogen, being a mobile nutrient in soil, is susceptible to losses via leaching and surface runoff. Thus, determining the appropriate nitrogen rate is crucial for successful white potato production (Phillips *et al*., 2004). Nitrogen deficiency adversely affects plant growth and development, underscoring its vital role in potato production. Numerous studies have investigated the impact of nitrogen fertilizer rates on the yield of potato cultivars. Here the purpose of the study was that to know how different levels of nitrogen dose can affect the growth and yield of potato variety. Keeping the above points in mind present experiment was conducted to standardize macro-nutrient (nitrogen) requirement in newly released potato (*Solanum tuberosum* L.) var. Kufri Neelkanth"

MATERIALS AND METHODS

The present investigation is conducted during Rabi season of 2023 at Centre for vegetable excellence, Department of vegetable science, Chandrashekhar Azad University of Agriculture and Technology, Nawabganj, Kanpur. The Gross plot size is 4.8 × 4.0 m^2 and net plot size is 3.6 × 3.6 m^2. The spacing is kept 60cm × 20cm between and within rows. The recommended dose of fertiliser is 180:80:100 of NPK in kg/ha. The experiments were analyzed at Randomized Block Design. The experiment laid down in 3 replication and consisted 7 treatments *viz.* T_1 - Nitrogen 00 kg/ha, T_2 - Nitrogen 50 kg/ha, T_3 - Nitrogen 100 kg/ha, T_4 - Nitrogen 150 kg/ha, T_5 - Nitrogen 200 kg/ha, T_6 - Nitrogen 250 kg/ha, and T_7 - Nitrogen 300 kg/ha. Standard cultural practices recommended were followed uniformly in all experiments.

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RESULT AND DISCUSSION

Growth parameters

Plant emergence (%)

In present investigation under different treatments of nitrogen the plant emergence was found to be in the range of 93.43 to 96.95%. The nitrogen level and variety of potato had non significant effect on plant emergence at 30 days after sowing. which might be due to the already stored food material inside the tuber which provided an initial boost to the emerging shoots, not the applied nitrogen since the seed tuber did not develop a root system to absorb the applied nitrogen before the shoot and root emergence. Adhikari (2009) and chongtham *et.*

al.(2015) also noticed that different nitrogen levels did not significantly influence the percent emergence which corroborate with the results of present investigation,**(Table-1).**

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Plant height (cm)

The maximum height of plant at 25, 50 and 75 DAP was found in treatment T7 (Nitrogen 300 kg/ha), (23.28, 52.32 and 63.93 cm), while the minimum height of plant was found in Control T_1 (Nitrogen 00 kg/ha), (18.07, 46.73 and 57.87 cm). Plant height increased gradually as nitrogen dosages were increased to as high as 300 kg/ha. The results of Kushwah (1989) and Malik *et al.* (1999) support the idea that plants grow taller as their nitrogen dose increases,**(Table-1).**

Number of shoots per plant

It was evident from the data that the treatment T7 was found the best treatment for influencing the number of shoots per plant and it gave the maximum number of shoots per plant (5.92) at 75 DAP, while the minimum number of shoots per plant (3.12) at 75 DAP, were observed in treatment T1, among in all nitrogen levels. It was also demonstrated by Nandekar *et al.*, (1991) and Sharma and Singh (1988) that no amount of nutrients could drastically and appreciably alter the number of shoots,**(Table-1).**

Number of compound leaves per plant

It was evident from the data that the treatment T7 was found the best treatment for influencing the number of compound leaves in potato and it gave the maximum number of compound leaves per plant (37.91) at 75 DAP, while the minimum number of compound leaves per plant (28.45) at 75 DAP, were observed in treatment T1, among in all nitrogen levels. Similarly, nitrogen content in potato foliage was twice as high as that in tubers and continuously increased with the N amount applied, (Anoton Ruza *et al.* 2013),**(Table-1).**

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Number of tubers of different grades

The data also depict that the different nitrogen levels in potato significantly affected the number of tubers in grade 0-25g, 25-75g and >75 g per plot, which was recorded in the range of 215-320, 231-402 and 157-297, respectively with significantly highest values under the treatment T5 where nitrogen was applied at the rate of 200 kg/ha closely followed by T6, nitrogen dose of 250 kg/ha. The results of present study corroborate the findings of Sahu *et al*. (2016), (Abdella *et al*., 1995) who also noted the highest number of 25-75g grade tubers per plot with the application of nitrogen 200kg/ha,**(Table-1).**

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Yield-attributing characters

Total tuber yield (q/ha)

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Result showed that maximum tuber yield was observed in treatment T5, where nitrogen was applied at the rate of 200 kg/ha i.e. 372.34 q/ha, which is closely followed by T6, nitrogen dose of 250 kg/ha i.e. 360.36 q/ha. The minimum tuber yield was observerd in treatment T1, where no nitrogen is applied i.e. 184.24 q/ha. Chongtham *et al.* (2015) found that the increased levels of nitrogen significantly influenced the potato tuber yield but upto a limit after that the total tuber yield is adversely affected,**(Table-1).**

Tuber dry matter content (%)

It was evident from this experiment that by increasing the nitrogen level, the dry matter content (%) of tuber is decreasing slightly. The maximum dry matter content (18.74 %) of tubers was observed in treatment T1, whereas, the minimum dry matter content (16.12 %) was found in tubers was recorded in treatment T7. These results are harmonious with the results obtained by Pandey *et al.,* (2017),**(Table-1).**

Total tuber yield (kg/plot)

Result showed that maximum tuber yield was observed in treatment T5, where nitrogen was applied at the rate of 200 kg/ha i.e. 71.49 kg/ha, which is closely followed by T6, nitrogen dose of 250 kg/ha i.e. 69.19 kg/ha. The minimum tuber yield was observerd in treatment T1, where no nitrogen is applied i.e. 35.38 kg/ha. The findings of present investigation are in line with the findings of Banjare *et al.* (2014) ,**(Table-1).**

Fresh haulm yield (kg/plot)

The perusal of data in revealed that the fresh yield weight was influenced significantly due to nitrogen levels. The fresh haulm weight ranges from 24.35 – 34.46 kg. The highest yield was observed in T8 having 300 kg N/ha while lowest is in control T1 having no nitrogen. Theseresults are in line with the findings of Sharma, P.K. *et al.* (2015),**(Table-1).**

Dry haulm yield (kg/plot)

Application of nitrogen levels only exerted significant influence upon this parameter. Accordingly, the maximum dry haulm yield noted (4.89 kg) from N300, followed by N250 (4.75 kg) and then N200 (4.49 kg). The significantly lowest yield (2.62 kg) was noted from control N00. The range of dry haulm yield lies between 2.62 – 4.89 kg/ha. Similar results were found by Sharma, U.C. *et al.*(1991) ,**(Table-1).**

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Table-1: Response of nitrogen on growth and yield parameters of potato crop

TREATMENTS	PLANT EMERGENCE (%) AT 30 DAP	PLANT HEIGHT (cm)			NO. OF SHOOTS AT 75 DAP	NO. OF COMPOUND LEAVES AT 75 DAP	NO. OF TUBERS			TOTAL TUBER YIELD (kg/plot)	TOTAL TUBER YIELD (q/ha)	FRESH HAULM YIELD (kg/plot)	DRY HAULM YIELD (kg/plot)	TUBER DRY MATTER CONTENT (%)
		25 DAP	50 DAP	75 DAP			0-25 g	25-75 g	> 75 g					
T1 (0:80:100)	93.43	18.07	46.73	57.87	3.12	28.45	215	231	157	35.38	184.27	24.35	2.62	18.74
T2 (50:80:100)	94.14	19.47	47.93	58.40	3.74	29.58	227	275	196	43.84	228.33	28.87	2.86	18.46
T3 (100:80:100)	95.09	20.87	48.13	59.93	4.25	31.14	268	303	219	54.24	282.5	30.49	3.47	18.14
T4 (150:80:100)	95.58	21.35	49.12	61.20	5.43	34.56	289	333	260	64.76	337.29	31.16	4.12	17.97
T5 (200:80:100)	96.61	22.63	51.59	62.34	5.61	36.94	320	402	297	71.49	372.34	32.3	4.49	17.69
T6 (250:80:100)	96.08	23.14	52.21	63.67	5.73	37.52	304	391	290	69.19	360.36	33.76	4.75	16.54
T7 (300:80:100)	95.45	23.28	52.32	63.93	5.92	37.91	287	383	288	65.79	342.65	34.46	4.89	16.12
S.Em +	0.46	0.216	0.625	0.682	0.084	0.415	2.83	4.526	3.457	0.58	2.893	0.574	0.061	0.266
CD at 5%	1.434	0.673	1.946	2.126	0.26	1.294	8.817	14.101	10.769	1.807	9.012	1.787	0.191	0.829

Fig 1 : Response of nitrogen on tuber yield per plot (kg) and per hectare(q/ha)

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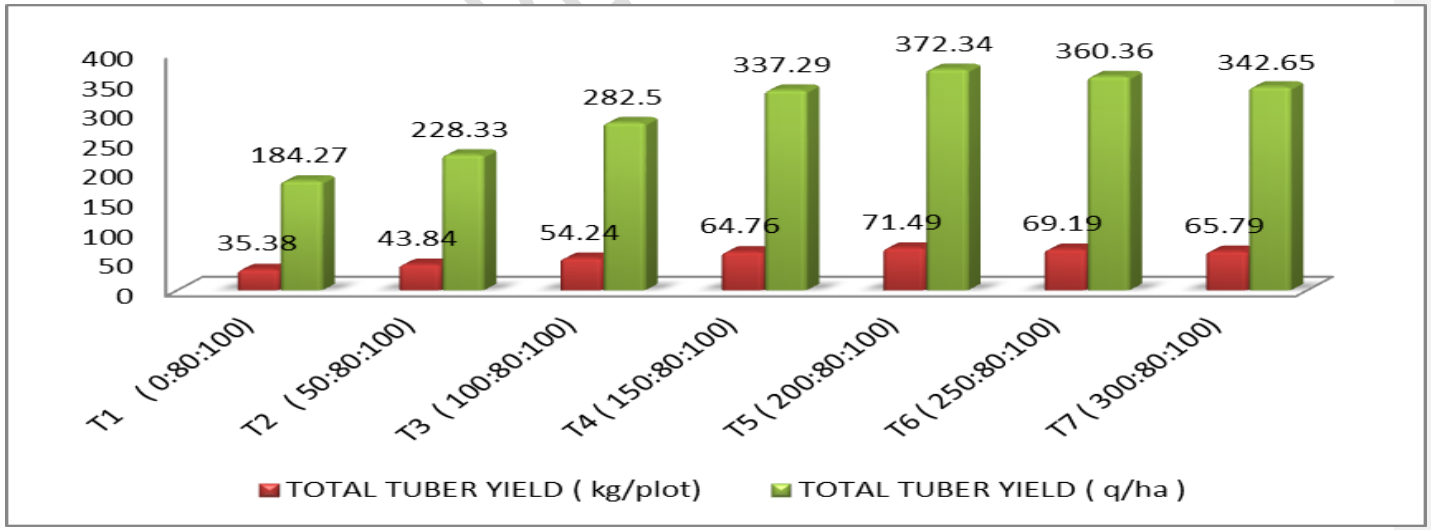

CONCLUSION

Presented results depict a clear cut idea about the better potato cultivation scenario in the *Indo-gangatic* alluvial region of Uttar Pradesh. Based on the experimental results, it is concluded that amongst the nitrogen levels, 200 kg N/ha recorded almost significantly higher growth and yield-attributing parameters and tuber yield from potato var. Kufri Neelkanth. Thus 200 kg N/ha recorded maximum tuber yield (372.34 q/ha) while tuber dry matter content (17.69%) is recorded in this. Similarly, 200 kg N/ha application recorded the maximum tuber number (402) of grade 25-75g alongwith the maximum total tuber number (1019) of all the three grades.

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