Influence of NPK, Boron, Zinc and Sulphur Application on the Quality Parameters of Potato (Solanum tuberosum L.) cv. Kufri Khyati

[1] Amit Kumar Yadav, [2] Sanjay Kumar Vishwakarma, [3] Sanjeev Kumar
[1] Research scholar, [2] Assistant Professor, [3] Assistant Professor
[1,2,3] Department of Horticulture , Janta College Bakewar Etawah 206124 , Chhatrapati Shahu Ji Maharaj University Kanpur Uttar Pradesh , India

Corresponding Author: **Amit Kumar Yadav**

Abstract: An experiment was conducted at the Horticulture Research Farm, Janta College, Bake war, Etawah during Rabi season of 2023-24 and 2024-2025. The experimental site is located approximately 23 km east of the district headquarters in Etawah. The site is located at 26.661565°N, 79.170517°E at an elevation of 142 m above mean sea level and falls under the sub-tropical climate zone. The region gets an average of 1143 mm of rain every year. The experiment was laid out in a Randomized Block Design with seventeen treatments replicated thrice. The results revealed that in comparison with other given treatments T_{17} application of recommended dose of NPK through chemical fertilizer + Boron @ 2 kg/hac + Sulphur @ 30 kg/hac + Zinc @ 15 kg/ha to potato plants cv. Kufri Khyati under the UP conditions can relatively lead to enhanced quality in terms of Specific gravity, Starch content (%), Protein (%), TSS, Ascorbic acid content of the potato.

Key words: Zinc, Boron, Sulphur, Potato, tuber quality

Introduction

Potato (Solanum tuberosum L.) is one of the most important food crops worldwide and plays a crucial role in ensuring food and nutritional security, particularly in developing countries. Its high yield potential, short growing period, and adaptability to a wide range of agro-climatic conditions make it a vital component of global agriculture **(FAO, 2024).** However, potato productivity and quality are strongly influenced by balanced nutrient management. The crop is a heavy feeder of nutrients, especially nitrogen (N), phosphorus (P), and potassium (K), and requires adequate and timely application of fertilizers to achieve optimal growth and tuber yield **(Singh & Lal, 2019).**

Along with macronutrients, micronutrients such as boron (B), zinc (Zn), and secondary nutrients like sulphur (S) play essential roles in ensuring physiological and biochemical functions. Boron is vital for cell wall formation, membrane stability, and translocation of assimilates to developing tubers, ultimately influencing tuber size and quality (**Sharma et al., 2017**). Zinc is involved in enzymatic activities, hormone regulation, and protein synthesis; its deficiency can reduce plant vigor and limit tuber development (**Alloway, 2008**). Sulphur, an important component of amino acids and vitamins, improves starch synthesis, dry matter accumulation, and overall tuber quality (**Scherer, 2001**).

Recent studies indicate that integrated application of macronutrients with micronutrients significantly enhances growth attributes, yield components, marketable tuber yield, and quality parameters such as dry matter content, specific gravity, and nutrient composition (**Kumar & Pandey, 2021**). However, nutrient requirements vary widely among cultivars, and cultivar-specific recommendations are essential for maximizing productivity. Kufri Khyati, a relatively new and high-yielding potato cultivar, shows high responsiveness to balanced fertilization, yet limited research is available on its nutrient optimization under varying fertilizer regimes.

Therefore, evaluating the combined effects of NPK, boron, zinc, and sulphur fertilization on the growth, yield, and quality of potato cv. Kufri Khyati is essential to develop efficient nutrient management strategies. Such research could contribute to sustainable potato production, enhanced nutrient-use efficiency, and improved tuber quality.

Materials and Methods

Experimental site:

In the Rabi season of 2023–2024 and 2024–2025, the experiment was carried out in the Horticulture Research Farm, Janta College, Bakewar, Etawah. The trial location is approximately 23 kilometers east of Etawah's district headquarters.

Topography and climatic conditions:

The location, which is 142 meters above mean sea level and falls within the sub-tropical climate zone, is 26.661565°N, 79.170517°E. The area receives an average of 1143 mm of precipitation annually, primarily from the south-west monsoon from June to mid-October and from the north-east monsoon throughout the winter months.

Meteorological conditions during crop season:

The distribution of rainfall, high and low temperatures, relative humidity, wind speed, evaporation rate, and sunshine hours were all recorded during the crop period by the university's main campus meteorological observatory.

Details of treatments:

The experiment was laid out in a Randomized Block Design with seventeen treatments replicated t hrice.T_1Control(Application of recommended dose of NPK through chemical fertilizer (150-80-100) kg NPK/ha), T_2 Application of recommended dose of NPK through chemical fertilizer +Boron @ 1 Kg /ha,T_3 Application of recommended dose of NPK through chemical fertilizer + Boron @2 Kg /ha, T_4 Application of recommended dose of NPK through chemical fertilizer + Sulphur @ 15 kg/ha,T_5 Application of recommended dose of NPK through chemical fertilizer + Sulphur @ 30 kg/ha, T_6 Application of recommended dose of NPK through chemical fertilizer + Zinc @ 7.5 kg/ha, T_7 Application of recommended dose of NPKthrough chemical fertilizer + Zinc @ 15 kg/ha, T_8 Application of half dose of NPK through chemical fertilizer + Boron @ 1kg/ha, T_9 Application of half dose of NPK through chemical fertilizer + Boron @ 2 kg/ha, T_{10} Application of half dose of NPK through chemical fertilizer + Sulphur @ 15 kg/ha,T_{11} Application of half dose of NPK through chemical fertilizer + Sulphur @ 30 kg/ha, T_{12} Application of half dose of NPK through chemical fertilizer + Zinc @ 7.5 kg/ha, **T_{13}** Application of half dose of NPK through chemical fertilizer + Zinc @ 15 kg/ha, **T_{14}** Application of half dose of NPK through chemical fertilizer + Boron @ 1 kg/ha + Sulphur @ 15 kg/ha + Zinc @ 7.5 kg/ha, **T_{15}** Application of half dose of NPK through chemical fertilizer + Boron @ 2 kg/ha + Sulphur @ 30 kg/ha + Zinc @ 15 kg/ha, **T_{16}** Application of recommended dose of NPK through chemical fertilizer + Boron @ 1 kg/ha + Sulphur @ 15 kg/ha + Zinc @ 7.5 kg/ha, **T_{17}** Application of recommended dose of NPK through chemical fertilizer + Boron @ 2 kg/ha + Sulphur @ 30 kg/ha + Zinc @ 15 kg/ha

Observations Recorded

Specific gravity

Specific gravity of the tubers was estimated using the weight and volume of the potatoes. Weight of the tubers was taken and was divided with the volume of the tubers to get the specific gravity of the tubers and expressed as g/cc.

$$\text{Specific gravity (g/cc)} = \frac{\text{Weight of the tuber sample}}{\text{Volume of the tuber sample}}$$

Starch content (%)

The starch was extracted from low-grade potatoes using water steeping method (Torres et al. 2020). The potatoes were manually peeled and cut into small pieces (400 g), followed by blending with water (1:2 w/v) in a blender (Philips, Cucina Series, Shanghai, China). The slurry was agitated for 90 min at 200 rpm, followed by sieving consecutively through 150 μm and 80 μm pore size sieves. The residual flesh on the sieves was further washed with water to drag the remaining starch. The filtrate was left for 24 h at 4 °C to allow the starch sedimentation. The starch was separated by decantation and washed twice with water. Finally, the NS was dried in a hot air oven at 40 °C for 48 h. The dried starch was stored in zip-lock bags for further analysis.

Protein (%)

Nitrogen was estimated by Kjeldahl's digestion and distillation method (Jackson 1967). Nitrogen content of tuber was multiplied by factor 6.25 to get the crude protein.

Protein Content (%) = Nitrogen content (%) × 6.25 (Factor)

T.S.S.

TSS of potato tubers was estimated by using a Hand Refractometer (0–32^{o} brix range) Erma make. Potato juice was extracted using a blender and then sieving the same. Two drops of the same were taken on the measurement glass of the hand refractometer and held against a source of light. The reading corresponding to the refractive pane of the hand refractometer were recorded and expressed as TSS of the sample.

Ascorbic acid content

The standard method using 2, 6-Dichlorophenol indophenols (0.04 %) was followed. A known quantity of sample (10 ml) was made to 100 ml with 0.4 % oxalic acid and filtered. A known volume of aliquot (10 ml) was mixed with 15 ml of oxalic acid (0.4%) and few drops of 0.1% phenolphthalein indicator was added and titrated against the standardized dye to a light pink colour persisting for at least 15 seconds (Ruck, 1969).

Statistical analysis

Observations recorded on different variables (parameters) during 2023-24 and 2024-24 were tabulated and pooled for statistical analysis using OPSTAT software. The significance of various treatments was evaluated using the F-test in two ways ANOVA (analysis of variance) at 0.05 significance level (α = 0.05).

Result

1. Specific gravity

During 2023-24, highest specific gravity (1.073) was recorded in T_{17}, followed closely T_{16} (1.063). Lower specific gravity in T_8 (0.010) indicates relatively lower dry matter content.

In 2024-25, highest values (1.08) for specific gravity were again associated with T_{17}, demonstrating consistency in performance across years. The pooled data revealed that the specific gravity ranged from 0.013 (T_8) to 1.076 (T_4, T_5, T_6, T_7, T_{16}, and T_{17}). Notably, T_5, T_{16}, and T_{17} consistently recorded the highest values in both years. On the contrary, T_8 persistently exhibited the lowest specific gravity (1.013 pooled), indicating a consistent drawback in dry matter accumulation, which may limit its acceptability for processing purposes.

2. Starch content (%)

In 2023-24, starch content ranged from 9.75 % (T_8) to 14.58 % (T_{17}). The highest starch percentage was recorded in T_{17} (14.58 %). The lowest starch content in T_8 (9.75 %) suggests poor dry matter accumulation.During 2024-25, highest values were recorded for T_{17} (14.65 %), T_{16} (14.46 %), T5 (14.43 %), T_4 (14.19 %), and T_7 (14.25 %). The lowest starch content was again observed in T_8 (9.29 %), followed by T_9 (10.15 %) and T_{12} (10.39 %).In the pooled data, treatments T_{17}, T_{16}, T_5, T_4, and T_7 consistently recorded starch values above 13.4%. Treatments T_8, T_9, and T_{12} recorded the lowest starch values (<10.5 %), indicating poor processing suitability.

3. Protein content of potato tubers

During 2023-24, highest values were observed in T_{17} (1.46 %), closely followed by T_{16} (1.40%), T_5 (1.39 %), and T_4 (1.35 %). On the lower end, T_8 (1.17 %) recorded the least protein content, followed by T_9 (1.18 %) and T_{13} (1.24 %). In 2024-25, highest value (1.49 %) in T_{17} was closely matched by T_{16} and T_5 (both 1.42% and 1.36 %). T_8 recorded the lowest protein (1.19 %), followed by T_9 (1.27 %) and T_{13} (1.28 %).The pooled analysis, treatments T_{17}, T_{16}, T_5, and T_4 consistently recorded protein contents above 1.36 %, identifying them as superior in nutritional quality. The lowest protein levels (<1.28 %) in T_8, T_9, and T_{12} highlight their comparatively weaker performance in enhancing protein accumulation.

4. Total soluble solids

In 2023-24, highest TSS was observed in T_{17} (5.24°Brix), followed closely by T_{16} (5.20 °Brix) and T_5 (5.12°Brix). The lowest TSS content was recorded in T_8 (3.85°Brix), followed by T_9 (3.95°Brix) and T_{12} (3.96°Brix).During 2024-25, the highest TSS value was again recorded in T_{17} (5.47°Brix), followed by T_{16} (5.37°Brix), T_5 (5.24°Brix), and T_4 (5.08°Brix). T_8 remained the lowest performer (3.62°Brix), followed by T_9 (3.81°Brix) and T_{12} (3.96°Brix), showing consistency with the previous year. Intermediate values were observed in T_{10} (3.70°Brix) and T_{14} (4.08°Brix). Pooled data across both years revealed highest pooled TSS values were found in T_{17}(5.35°Brix. Low TSS treatments such as T_8 (3.73°Brix), indicate relatively low sugar and dry matter levels.

5. Ascorbic acid content of potato tubers (mg/100 g)

In the 2023-24 cropping season, treatments T_{17} (27.89 mg/100 g), T_{16} (27.17 mg/100 g), and T_5 (26.84 mg/100 g) also exhibited markedly higher ascorbic acid concentrations, Conversely, the lowest ascorbic acid content recorded in T_8 (17.42 mg/100 g) and T_9 (19.46 mg/100 g).

In the year (2024-25), treatments T_{17} (29.11 mg/100 g), T_{16} (28.90 mg/100 g), and T5 (26.43 mg/100 g) remained the top performers whereas treatments T_8, T_9, and T_{12} continued to show relatively low values.The pooled mean values followed a similar ranking pattern across treatments, confirming the reproducibility and stability of treatment effects over years. The consistently high values in T_{17}, T_{16}, and T_5 suggest their potential recommendation for enhancing vitamin C content in tubers under similar agro-ecological conditions.

Discussion

The results of the experiment revealed that the treatment comprising the recommended dose of NPK through chemical fertilizers combined with boron @ 2 kg/ha, sulphur @ 30 kg/ha, and zinc @ 15 kg/ha produced the most favorable quality parameters of potato among all the nutrient management treatments evaluated. Specific gravity, starch content, protein content, total soluble solids (TSS), and ascorbic acid content were notably higher under this treatment compared to the others, which is in agreement with the findings of **Singh and Lal (2019)**, who reported that balanced macronutrient nutrition improves tuber biochemical composition. The improvement in quality parameters may be attributed to the adequate supply and synergistic interaction of nutrients, supporting better physiological and biochemical functioning, as suggested by **Sharma et al. (2017)** for boron and its role in assimilate translocation. Zinc application has been associated with improved enzymatic regulation and tuber development **(Alloway, 2008)**, while sulphur contributes to enhanced protein synthesis and dry matter accumulation **(Scherer, 2001).** Additionally, **Kumar and Pandey (2021)** emphasized that integrated macro- and micronutrient nutrition significantly improves tuber quality traits in potato. The combined application of nitrogen, phosphorus, potassium, boron, zinc, and sulphur thereby enhanced nutrient uptake, assimilate production, and translocation toward developing tubers, ultimately resulting in superior tuber quality compared to the other treatments under study.

Conclusion

In conclusion, it can be summarized that Kufri Khyati, a prominent and high yielding variety of potato has the potential of performing outstandingly provided right combination of macro and micro-nutrients are provided as essential inputs for best performance of the plants. In our study over two cropping seasons, it can be concluded based on the data analyzed that application of recommended dose of NPK through chemical fertilizer + Boron @ 2 kg/hac + Sulphur @ 30 kg/hac + Zinc @ 15 kg/ha to potato plants cv. Kufri Khyati under the UP conditions can relatively lead to enhanced tuber quality of the potato. The results obtained in this experimental study will help to standardize the integrated application dose of macro and micro nutrients in potato cv. KufriKhyati and can surely lead to profitable harvest for the farmers.

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Table no. 1 Effect of NPK, Boron, Zinc and Sulphur application on Specific gravity

Treatments	First Year	Second Year	Pooled
T_1 R.D.F. of NPK	1.010	1.000	1.005
T_2 R.D.F. of NPK + Boron @ 1 kg/ha	1.011	1.017	1.014
T_3 R.D.F. of NPK + Boron @ 2 kg/ha	1.017	1.007	1.012
T_4 R.D.F. of NPK + Sulphur @ 15 kg/ha	1.067	1.060	1.063
T_5 R.D.F. of NPK + Sulphur @ 30 kg/ha	1.060	1.057	1.058
T_6 R.D.F. of NPK + Zinc @ 7.5 kg/ha	1.057	1.053	1.055
T_7 R.D.F. of NPK + Zinc @ 15 kg/ha	1.063	1.057	1.060
T_8Half dose of NPK + Boron @ 1 kg/ha	1.010	1.017	1.013
T_9 Half dose of NPK + Boron @ 2 kg/ha	1.030	1.027	1.028
T_{10} Half dose of NPK + Sulphur @ 15 kg/ha	1.033	1.039	1.036
T_{11} Half dose of NPK + Sulphur @ 30 kg/ha	1.053	1.036	1.044
T_{12} Half dose of NPK + Zinc @ 7.5 kg/ha	1.043	1.030	1.036
T_{13} Half dose of NPK + Zinc @ 15 kg/ha	1.046	1.020	1.033
T_{14} Half dose of NPK + Boron @ 1 kg/ha+ Sulphur @ 15 kg/ha+ Zinc @ 7.5 kg/ha	1.029	1.035	1.032
T_{15} Half dose of NPK + Boron @ 2 kg/ha+ Sulphur @ 30 kg/ha+ Zinc @ 15 kg/ha	1.021	1.034	1.027

T_{16} R.D.F. of NPK + Boron @ 1 kg/ha+ Sulphur @ 15 kg/ha+ Zinc @ 7.5 kg/ha	1.063	1.073	1.068
T_{17} R.D.F. of NPK + Boron @ 2 kg/ha+ Sulphur @ 30 kg/ha+ Zinc @ 15 kg/ha	1.073	1.080	1.076
C.D. at 5%	0.035	0.047	0.041
SE(m)	0.012	0.016	0.014

Table no. 2 Effect of NPK, Boron, Zinc and Sulphur application on Starch content (%)

Treatments	First Year	Second Year	Pooled
T_1 R.D.F. of NPK	12.95	12.8	12.87
T_2 R.D.F. of NPK + Boron @ 1 kg/ha	13.22	12.97	13.05
T_3 R.D.F. of NPK + Boron @ 2 kg/ha	12.1	14.11	13.1
T_4 R.D.F. of NPK + Sulphur @ 15 kg/ha	13.89	14.19	14.05
T_5 R.D.F. of NPK + Sulphur @ 30 kg/ha	13.98	14.43	14.2
T_6 R.D.F. of NPK + Zinc @ 7.5 kg/ha	12.85	13.46	13.15
T_7 R.D.F. of NPK + Zinc @ 15 kg/ha	12.19	14.25	13.22
T_8Half dose of NPK + Boron @ 1 kg/ha	9.75	9.29	9.52
T_9 Half dose of NPK + Boron @ 2 kg/ha	9.4	10.15	9.77
T_{10} Half dose of NPK + Sulphur @ 15 kg/ha	10.18	10.34	10.26
T_{11} Half dose of NPK + Sulphur @ 30 kg/ha	11.14	10.17	10.65
T_{12} Half dose of NPK + Zinc @ 7.5 kg/ha	9.47	10.39	9.93
T_{13} Half dose of NPK + Zinc @ 15 kg/ha	9.82	10.25	10.03
T_{14} Half dose of NPK + Boron @ 1 kg/ha+ Sulphur @ 15 kg/ha+ Zinc @ 7.5 kg/ha	10.66	11.3	10.98
T_{15} Half dose of NPK + Boron @ 2 kg/ha+ Sulphur @ 30 kg/ha+ Zinc @ 15 kg/ha	11.22	11.7	11.46
T_{16} R.D.F. of NPK + Boron @ 1 kg/ha+ Sulphur @ 15 kg/ha+ Zinc @ 7.5 kg/ha	14.36	14.46	14.41
T_{17} R.D.F. of NPK + Boron @ 2 kg/ha+ Sulphur @ 30 kg/ha+ Zinc @ 15 kg/ha	14.58	14.65	14.61

C.D. at 5%	1.76	1.36	1.56
SE(m)	0.61	0.47	0.54

Table No. 3 Effect of NPK, Boron, Zinc and Sulphur application on Protein content of potato (%)

Treatments	First Year	Second Year	Pooled
T_1 R.D.F. of NPK	1.29	1.31	1.30
T_2 R.D.F. of NPK + Boron @ 1 kg/ha	1.28	1.34	1.31
T_3 R.D.F. of NPK + Boron @ 2 kg/ha	1.31	1.33	1.32
T_4 R.D.F. of NPK + Sulphur @ 15 kg/ha	1.35	1.38	1.36
T_5 R.D.F. of NPK + Sulphur @ 30 kg/ha	1.39	1.36	1.37
T_6 R.D.F. of NPK + Zinc @ 7.5 kg/ha	1.31	1.36	1.33
T_7 R.D.F. of NPK + Zinc @ 15 kg/ha	1.30	1.40	1.35
T_8Half dose of NPK + Boron @ 1 kg/ha	1.17	1.19	1.18
T_9 Half dose of NPK + Boron @ 2 kg/ha	1.18	1.27	1.22
T_{10} Half dose of NPK + Sulphur @ 15 kg/ha	1.26	1.28	1.27
T_{11} Half dose of NPK + Sulphur @ 30 kg/ha	1.27	1.29	1.28
T_{12} Half dose of NPK + Zinc @ 7.5 kg/ha	1.27	1.29	1.28
T_{13} Half dose of NPK + Zinc @ 15 kg/ha	1.24	1.28	1.26
T_{14} Half dose of NPK + Boron @ 1 kg/ha+ Sulphur @ 15 kg/ha+ Zinc @ 7.5 kg/ha	1.26	1.29	1.27
T_{15} Half dose of NPK + Boron @ 2 kg/ha+ Sulphur @ 30 kg/ha+ Zinc @ 15 kg/ha	1.26	1.33	1.29
T_{16} R.D.F. of NPK + Boron @ 1 kg/ha+ Sulphur @ 15 kg/ha+ Zinc @ 7.5 kg/ha	1.40	1.42	1.41
T_{17} R.D.F. of NPK + Boron @ 2 kg/ha+ Sulphur @ 30 kg/ha+ Zinc @ 15 kg/ha	1.46	1.49	1.47
C.D. at 5%	0.36	0.30	0.33
SE(m)	0.12	0.10	0.11

Table No. 4 Effect of NPK, Boron, Zinc and Sulphur application on Protein content of potato (%)

Treatments	First Year	Second Year	Pooled
T_1 R.D.F. of NPK	1.29	1.31	1.30
T_2 R.D.F. of NPK + Boron @ 1 kg/ha	1.28	1.34	1.31
T_3 R.D.F. of NPK + Boron @ 2 kg/ha	1.31	1.33	1.32
T_4 R.D.F. of NPK + Sulphur @ 15 kg/ha	1.35	1.38	1.36
T_5 R.D.F. of NPK + Sulphur @ 30 kg/ha	1.39	1.36	1.37
T_6 R.D.F. of NPK + Zinc @ 7.5 kg/ha	1.31	1.36	1.33
T_7 R.D.F. of NPK + Zinc @ 15 kg/ha	1.30	1.40	1.35
T_8Half dose of NPK + Boron @ 1 kg/ha	1.17	1.19	1.18
T_9 Half dose of NPK + Boron @ 2 kg/ha	1.18	1.27	1.22
T_{10} Half dose of NPK + Sulphur @ 15 kg/ha	1.26	1.28	1.27
T_{11} Half dose of NPK + Sulphur @ 30 kg/ha	1.27	1.29	1.28
T_{12} Half dose of NPK + Zinc @ 7.5 kg/ha	1.27	1.29	1.28
T_{13} Half dose of NPK + Zinc @ 15 kg/ha	1.24	1.28	1.26
T_{14} Half dose of NPK + Boron @ 1 kg/ha+ Sulphur @ 15 kg/ha+ Zinc @ 7.5 kg/ha	1.26	1.29	1.27
T_{15} Half dose of NPK + Boron @ 2 kg/ha+ Sulphur @ 30 kg/ha+ Zinc @ 15 kg/ha	1.26	1.33	1.29
T_{16} R.D.F. of NPK + Boron @ 1 kg/ha+ Sulphur @ 15 kg/ha+ Zinc @ 7.5 kg/ha	1.40	1.42	1.41
T_{17} R.D.F. of NPK + Boron @ 2 kg/ha+ Sulphur @ 30 kg/ha+ Zinc @ 15 kg/ha	1.46	1.49	1.47
C.D. at 5%	0.36	0.30	0.33
SE(m)	0.12	0.10	0.11

Table No. 5 Effect of NPK, Boron, Zinc and Sulphur application on T.S.S. content of potato

Treatments	First Year	Second Year	Pooled
T_1 R.D.F. of NPK	4.64	5.02	4.83
T_2 R.D.F. of NPK + Boron @ 1 kg/ha	5.07	5.10	5.08
T_3 R.D.F. of NPK + Boron @ 2 kg/ha	5.10	5.09	5.09
T_4 R.D.F. of NPK + Sulphur @ 15 kg/ha	5.16	5.08	5.12
T_5 R.D.F. of NPK + Sulphur @ 30 kg/ha	5.12	5.24	5.18
T_6 R.D.F. of NPK + Zinc @ 7.5 kg/ha	4.49	5.13	4.81
T_7 R.D.F. of NPK + Zinc @ 15 kg/ha	4.80	5.15	4.97
T_8Half dose of NPK + Boron @ 1 kg/ha	3.85	3.62	3.73
T_9 Half dose of NPK + Boron @ 2 kg/ha	3.95	3.81	3.88
T_{10} Half dose of NPK + Sulphur @ 15 kg/ha	4.08	3.70	3.89
T_{11} Half dose of NPK + Sulphur @ 30 kg/ha	4.11	3.86	3.98
T_{12} Half dose of NPK + Zinc @ 7.5 kg/ha	3.96	3.96	3.96
T_{13} Half dose of NPK + Zinc @ 15 kg/ha	3.95	3.83	3.89
T_{14} Half dose of NPK + Boron @ 1 kg/ha+ Sulphur @ 15 kg/ha+ Zinc @ 7.5 kg/ha	4.07	4.08	4.07
T_{15} Half dose of NPK + Boron @ 2 kg/ha+ Sulphur @ 30 kg/ha+ Zinc @ 15 kg/ha	4.12	3.85	3.98
T_{16} R.D.F. of NPK + Boron @ 1 kg/ha+ Sulphur @ 15 kg/ha+ Zinc @ 7.5 kg/ha	5.20	5.37	5.28
T_{17} R.D.F. of NPK + Boron @ 2 kg/ha+ Sulphur @ 30 kg/ha+ Zinc @ 15 kg/ha	5.24	5.47	5.35
C.D. at 5%	0.92	0.58	0.755
SE(m)	0.32	0.20	0.261

Table No. 5 Effect of NPK, Boron, Zinc and Sulphur application on Ascorbic acid content (mg/100 g) of potato

Treatments	First Year	Second Year	Pooled
T_1 R.D.F. of NPK	20.80	21.57	21.18
T_2 R.D.F. of NPK + Boron @ 1 kg/ha	22.74	22.43	22.58
T_3 R.D.F. of NPK + Boron @ 2 kg/ha	24.87	23.92	24.39
T_4 R.D.F. of NPK + Sulphur @ 15 kg/ha	23.52	24.31	23.91
T_5 R.D.F. of NPK + Sulphur @ 30 kg/ha	26.84	26.43	26.63
T_6 R.D.F. of NPK + Zinc @ 7.5 kg/ha	26.51	25.11	25.81
T_7 R.D.F. of NPK + Zinc @ 15 kg/ha	22.15	23.54	22.84
T_8Half dose of NPK + Boron @ 1 kg/ha	17.42	18.96	18.19
T_9 Half dose of NPK + Boron @ 2 kg/ha	19.46	19.13	19.29
T_{10} Half dose of NPK + Sulphur @ 15 kg/ha	20.79	19.26	20.02
T_{11} Half dose of NPK + Sulphur @ 30 kg/ha	20.04	20.53	20.28
T_{12} Half dose of NPK + Zinc @ 7.5 kg/ha	18.42	19.51	18.96
T_{13} Half dose of NPK + Zinc @ 15 kg/ha	20.21	22.58	21.39
T_{14} Half dose of NPK + Boron @ 1 kg/ha+ Sulphur @ 15 kg/ha+ Zinc @ 7.5 kg/ha	21.12	23.43	22.27
T_{15} Half dose of NPK + Boron @ 2 kg/ha+ Sulphur @ 30 kg/ha+ Zinc @ 15 kg/ha	20.50	19.67	20.08
T_{16} R.D.F. of NPK + Boron @ 1 kg/ha+ Sulphur @ 15 kg/ha+ Zinc @ 7.5 kg/ha	27.17	28.90	28.03
T_{17} R.D.F. of NPK + Boron @ 2 kg/ha+ Sulphur @ 30 kg/ha+ Zinc @ 15 kg/ha	27.89	29.11	28.50
C.D. at 5%	4.33	2.79	3.56
SE(m)	1.49	0.96	1.23