



INTERACTIVE EFFECTS OF VARIETY AND POTASSIUM NUTRITION ON GROWTH, YIELD, AND FRUIT QUALITY OF TOMATO (*Solanum lycopersicum* L.)

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ABSTRACT

The study evaluated the effect of variety and potassium fertilizer rates on the growth, yield, and quality attributes of tomato during the 2017 and 2018 wet seasons under field conditions. The experiment was arranged in a 3 x 4 factorial randomized complete block design involving three tomato varieties (*Rio Grande*, *Roma VF*, and *Tima*) and four potassium fertilizer rates (0, 50, 100, and 150 kg K ha⁻¹). Data were collected on vegetative growth, yield, and fruit quality parameters and using standard agronomic protocols. Results revealed significant varietal variation in plant height, number of leaves, and yield traits, with *Roma VF* and *Tima* generally outperforming *Rio Grande*. Potassium fertilization positively influenced growth and yield, with the highest values recorded at 100-150 kg K ha⁻¹. Quality parameters such as ascorbic acid, titratable acidity, and total soluble solids (TSS) improved with increasing K rates, and a significant interaction between variety and potassium rate was observed for TSS in 2018, where 'Roma VF' recorded the highest value (3.03%) at 150 kg K ha⁻¹. Fruit phenolic and flavonoid contents were also enhanced at higher potassium rates. Overall, 'Roma VF' combined with 100-150 kg K ha⁻¹ produced superior growth, yield, and quality outcomes, underscoring the importance of genotype-specific potassium management for sustainable tomato production.

Keywords: Fertilization, Fruit, Potassium, Production and Yield.

INTRODUCTION

Tomato (*Solanum lycopersicum* L.) is one of the most widely cultivated and economically valuable horticultural crops worldwide, serving as a major source of vitamins, minerals, and antioxidants. However, global tomato production continues to face challenges in maintaining optimal fruit yield and quality due to soil nutrient depletion and inadequate fertilizer management. Among the essential macronutrients, potassium (K) plays a vital role in numerous physiological and biochemical processes, influencing photosynthesis, water regulation, enzyme activation, and fruit quality attributes such as color, firmness, and soluble solids content (Xu *et al.*, 2020; Ladikou *et al.*, 2025).

Potassium deficiency has been shown to significantly reduce yield and impair fruit quality in tomato, whereas optimal K fertilization enhances sugar accumulation, lycopene synthesis, and firmness (Islam *et al.*, 2025). Conversely, excessive K application may cause nutrient imbalances, reduced calcium uptake, and potential environmental contamination. In addition, several studies have reported that tomato varieties differ in their response to potassium supply, highlighting the need for fertilizer recommendations tailored to specific genotypes (Song *et al.*, 2025). Therefore, gaining a deeper understanding of the interaction between potassium fertilizer rate and tomato variety is essential for enhancing sustainable productivity and improving fruit quality.

Despite extensive research on tomato nutrition, there remains a lack of consensus regarding the optimal potassium fertilizer rates suitable for different tomato varieties under diverse agroecological conditions. Inappropriate potassium fertilization often leads to suboptimal yields, poor fruit quality, and economic losses for growers. Moreover, varietal responses to potassium vary substantially due to genetic differences in nutrient uptake and utilization efficiency (Wang *et al.*, 2021). This persistent knowledge gap underscores the need for systematic evaluation of both varietal and fertilizer rate effects on tomato growth and quality to establish precise nutrient management strategies.

Efficient potassium fertilizer management is fundamental for achieving high yields while maintaining the nutritional and market quality of tomatoes. Understanding how different tomato varieties respond to varying potassium rates will generate valuable insights into optimizing fertilizer use efficiency and minimizing environmental impacts. Furthermore, such findings will aid in developing site-specific nutrient recommendations that contribute to the sustainable intensification of tomato production systems (Temur *et al.*, 2023). The outcomes of this study are expected to benefit farmers, agronomists, and policymakers by enhancing tomato yield, quality, and profitability under balanced nutrient management practices. Thus, this experiment was conducted with the broad aim of evaluating the influence of tomato variety and potassium fertilizer rates on the growth, yield, and quality attributes of tomato (*Solanum lycopersicum* L.), While the Specific Objectives were to:

- i. determine the effect of different potassium fertilizer rates on the vegetative growth and physiological performance of selected tomato varieties.
- ii. evaluate potassium application rates influence on fruit quality parameters such as total soluble solids, titratable acidity, and lycopene content across varieties.

MATERIALS AND METHODS

Experimental Site

The study was conducted during the 2017 and 2018 wet seasons at the community-based Demonstration Farm in Tudun Wada Local Government Area of Kano State, Nigeria (latitude 11°28'N, longitude 8°59'E, and 475 m above sea level). The location lies within the Sudan savanna ecological zone of Nigeria.

The soil at the experimental site in both seasons was predominantly sandy loam in texture, with moderate water-holding capacity and slightly acidic pH (CaCl₂) of 6.88 and 6.77 in 2017 and 2018, respectively. The soil contained moderate organic carbon (0.56 and 0.50 g kg⁻¹), total nitrogen (3.71 and 0.18 g kg⁻¹), and available phosphorus (27.57 and 31.71 mg kg⁻¹) for 2017 and 2018, respectively. The exchangeable base cations for the 2017 season were 5.05 cmol kg⁻¹ Ca, 3.34 cmol kg⁻¹ Mg, and 0.46 cmol kg⁻¹ Na, with a cation exchange capacity (CEC) of 12.3 cmol kg⁻¹. Corresponding values for 2018 were 5.58 cmol kg⁻¹ Ca, 3.03 cmol kg⁻¹ Mg, 0.51 cmol kg⁻¹ Na, and CEC of 9.80 cmol kg⁻¹.

Treatments and Experimental Design

The experiment was arranged in a 3 × 4 factorial combinations comprising three tomato (*Solanum lycopersicum* L.) varieties (*Rio Grande*, *Roma VF*, and *Tima*) and four potassium fertilizer rates (0, 50, 100, and 150 kg K ha⁻¹). Treatments were laid out in a Randomized Complete Block Design (RCBD) with four replications.

Field Layout and Crop Husbandry

Prior to planting, the field was harrowed to a fine tilth, after which raised beds were constructed and the area was divided into plots and replications. Each gross plot measured 3.0 m × 4.5 m (13.5 m²), consisting of raised beds. The net plot area was 9.0 m², comprising the two central rows, while the outer rows served as borders for sampling. Plots and replications were separated by 0.5 m and 1.0 m alleys, respectively. Uniform agronomic practices such as weeding, pest, and disease control were carried out as required. Nitrogen and phosphorus were applied uniformly across all treatments at rates of 100 kg N ha⁻¹ (as urea) and 60 kg P₂O₅ ha⁻¹ (as single superphosphate). Potassium fertilizer was applied at the designated rates per treatment using muriate of potash (KCl).

Nursery and Field Transplanting

Tomato seeds were sown in nursery beds, drilled in rows 10 cm apart, and covered lightly with rice straw to maintain soil moisture and prevent seed displacement. Watering was done twice daily (morning and evening). Seedlings were raised for 30 days until they reached

8–10 cm in height. Vigorous seedlings were then transplanted manually onto the field at a spacing of 0.50 m between plants and 0.75 m between ridges, maintaining one plant per stand.

Data Collection

Data were collected from five randomly selected plants in each net plot at two-week intervals, beginning four weeks after transplanting (WAT). Growth parameters measured included plant height, number of leaves per plant, leaf area per plant (cm²), and number of days to 50% flowering. At harvest, yield parameters were recorded, including the number of fruits per plant and total fruit yield (t ha⁻¹). Quality attributes of tomato fruits were also assessed, such as total soluble solids (measured using a portable refractometer, Brixstix BX 100; Technique Corporation, Livermore, CA), titratable acidity, ascorbic acid (vitamin C) content, juice pH, total phenolic content as described by Thoo *et al.* (2010), and total flavonoids as described by Kaur and Modal (2014).

Data Analysis

All collected data were subjected to Analysis of Variance (ANOVA) using GenStat (17th Edition). Treatment means were compared using Tukey's Honest Significant Difference (HSD) test at a 5% probability level.

RESULTS AND DISCUSSION

Effect of Variety and Potassium Fertilizer Rate on Plant Height

Table 1 presents the effect of tomato variety and potassium fertilizer rate on plant height during the 2017 and 2018 wet seasons. Varietal differences were significant at 6 weeks after transplanting (WAT) in 2018, while potassium rate and variety × potassium interaction showed no significant impacts across most growth stages. Across both years, 'Tima' consistently recorded the tallest plants at all stages, followed by 'Roma VF' and 'Rio Grande'. The superior growth of 'Tima' (70.8 cm and 66.2 cm at 6 WAT in 2017 and 2018, respectively) reflects its inherent vigor and efficient nutrient utilization. Similar varietal differences in tomato growth potential have been linked to genotypic variation in potassium uptake and photosynthetic efficiency (Sardans & Peñuelas, 2021).

Table 1: Plant height of Tomato as Impacted by Varieties and Varied Potassium Fertilization During the 2017 and 2018 Wet Seasons

Treatment	2017				2018			
	Weeks after transplanting (WAT)							
	4	6	8	10	4	6	8	10
Variety (V)								
<i>Rio Grande</i>	42.90	58.10b	70.00	86.00	31.80	53.20	61.60	61.80
<i>Roma VF</i>	46.90	63.70ab	77.30	91.30	37.50	57.70	63.60	64.00
<i>Tima</i>	47.80	70.80a	80.70	94.10	39.50	66.20	71.60	72.00
F-Prob	0.116	0.052	0.087	0.069	0.154	0.014	0.052	0.052
SE±	5.31	4.98	5.930	5.920	3.930	4.080	4.070	4.800
Potassium (K) (kg ha ⁻¹)								
0	45.00	58.10	69.60	86.20	34.50	52.40	59.10	60.00
50	44.90	65.70	74.90	88.50	35.40	61.10	64.90	65.00
100	52.20	70.90	86.10	100.1	39.50	62.80	70.80	71.20
150	41.40	61.70	73.40	87.00	35.70	59.90	67.70	70.00
F-Prob	0.368	0.407	0.408	0.520	0.704	0.170	0.113	0.113
SE±	6.130	4.980	6.850	5.920	4.540	4.710	4.700	4.810
Interaction								
Vx K	0.423	0.667	0.383	0.425	0.083	0.494	0.567	0.581

Means having the same letter(s) within a column are not significantly different at 5% probability level using Tukey HSD test

Although not statistically significant, potassium application tended to enhance plant height, with 100 kg K ha⁻¹ producing the tallest plants in both seasons. This suggests that moderate potassium supply optimizes vegetative growth by supporting enzyme activation and photosynthesis, while excessive rates may cause nutrient imbalance (Ladikou *et al.*, 2025). Similar trends were reported by (Siddiqui *et al.*, 2025), who found optimal vegetative growth of tomato at moderate potassium levels. The non-significant ($p > 0.05$) variety $\times$ potassium interaction indicates uniform varietal response patterns to potassium rates, consistent with findings by Falodun and Adewunmi (2020). Seasonal differences, with taller plants in 2017, likely reflect better rainfall and soil nutrient conditions, enhancing potassium uptake and vegetative growth (Islam *et al.*, 2024).

Number of Leaves per Plant as Impacted by Variety and Potassium Fertilizer Rate

The impact of tomato variety and potassium fertilizer rate on the number of leaves per plant during the 2017 and 2018 wet seasons is shown in Table 2. Although differences were statistically non-significant, a clear trend was observed across both seasons, with ‘Tima’ producing the highest number of leaves at all stages, followed by *Roma VF* and *Rio Grande*. The relatively greater leaf production in *Tima* reflects its stronger vegetative vigor and photosynthetic potential, likely due to genotypic variation in nutrient uptake and assimilate allocation (Sardans & Peñuelas, 2021). Similar varietal responses have been reported by (Shu *et al.*, 2024), who attributed enhanced leaf formation to efficient potassium use and improved canopy development.

Potassium fertilization showed a positive but non-significant impact on leaf number, with higher means observed at 100–150 kg K ha⁻¹ in both years. This suggests that adequate potassium supply supports vegetative growth by improving osmotic balance and enzyme activation (Ladikou *et al.*, 2025). However, the absence of significant variation indicates that tomato plants may have reached a physiological threshold where additional potassium did not further enhance leaf formation, consistent with findings by (Temur *et al.*, 2023).

The non-significant ($p > 0.05$) V $\times$ K interaction suggests that varietal responses to potassium fertilization were similar across treatments, corroborating the stability in nutrient-use efficiency observed among genotypes under balanced nutrition (Abd El Lateef *et al.*, 2021). Seasonal variations, with relatively higher leaf counts in 2017, likely reflect more favorable rainfall and soil nutrient conditions that enhanced vegetative performance (Islam *et al.*, 2025).

Table 2: Number of leaves per plant of Tomato as Impacted by Varieties and Varied Potassium Fertilization During the 2017 and 2018 Wet Seasons

Treatment	2017				2018			
	Weeks after sowing (WAS)							
	4	6	8	10	4	6	8	10
Variety (V)								
<i>Rio Grande</i>	92.00	135.0	189.0	251.0	61.70	91.40	123.4	157.2
<i>Roma VF</i>	123.0	197.0	262.0	339.0	69.10	82.30	96.60	125.2
<i>Tima</i>	148.0	233.0	306.1	401.0	73.70	69.30	93.60	127.4
F-Prob	0.116	0.063	0.087	0.069	0.536	0.397	0.248	0.281
SE $\pm$	26.00	39.30	50.70	61.30	10.69	15.98	19.10	21.78
Potassium (K) (kg ha⁻¹)								
0	91.00	143.0	195.0	266.0	57.80	64.70	97.30	120.0
50	118.0	188.0	253.0	344.0	68.90	76.80	106.6	147.4
100	135.0	205.0	290.0	370.0	72.10	87.90	107.4	134.4
150	140.0	217.0	273.0	352.0	73.70	95.00	106.9	134.4
F-Prob	0.368	0.407	0.408	0.502	0.573	0.397	0.962	0.697
SE $\pm$	30.00	45.40	58.60	70.80	12.34	0.397	22.06	144.4
Interaction								
V $\times$ K	0.881	0.710	0.580	0.773	0.173	0.270	0.418	0.203

Means having the same letter(s) within a column are not significantly different at 5% probability level using Tukey HSD test

Leaf Area as Impacted by Variety and Potassium Fertilizer Rate

Table 3 shows the impact of tomato variety and potassium fertilizer rate on leaf area during the 2017 and 2018 wet seasons. Although varietal effects were not statistically significant, notable differences were observed across treatments and growth stages. Potassium application significantly ($p < 0.05$) influenced leaf area at 4 WAS in 2017, with 100 kg K ha⁻¹ producing the widest leaf area (17.63 cm²), while the control plots had the narrowest (12.79 cm²). This pattern suggests that moderate potassium fertilization enhances cell expansion and chlorophyll synthesis, which promote greater leaf surface development (Choudhary *et al.*, 2024). Beyond this rate, further increases in potassium did not improve leaf area, indicating a physiological optimum consistent with the nutrient response trends reported by (Lv & Lu, 2021). The lack of significant interaction between V × K indicates a similar pattern of response across genotypes, suggesting that potassium influenced leaf expansion uniformly. Comparable stability in varietal response to potassium has been noted under field conditions by (Xing *et al.*, 2023).

Table 3: Leaf area of Tomato as Impacted by Varieties and Varied Potassium Fertilization During the 2017 and 2018 Wet Seasons

Treatment	2017				2018			
	Weeks after sowing (WAS)							
	4	6	8	10	4	6	8	10
Variety (V)								
<i>Rio Grande</i>	13.71	16.86	19.27	24.12	15.03	16.86	19.12	19.12
<i>Roma VF</i>	15.98	19.28	22.27	25.24	15.98	19.28	17.13	17.13
<i>Tima</i>	14.97	17.16	20.00	23.94	14.97	17.16	19.80	19.80
F-Prob	0.301	0.274	0.178	0.773	0.772	0.274	0.312	0.312
SE±	1.652	0.274	1.617	1.955	1.572	1.590	1.288	1.288
Potassium (K) (kg ha⁻¹)								
0	12.79 ^b	16.84	19.66	22.14	12.79	16.84	17.13	17.14
50	15.79 ^{ab}	17.34	19.73	24.30	15.59	17.34	18.48	17.13
100	17.63 ^a	20.27	23.10	28.06	17.63	20.27	18.71	18.84
150	13.33 ^{ab}	16.60	19.56	28.06	15.10	16.16	14.87	18.71
F-Prob	0.027	0.194	0.194	2.257	0.092	0.194	17.07	0.852
SE±	1.652	1.835	1.867	23.23	1.815	1.835	0.852	1.487
Interaction								
V × K	0.955	0.900	0.848	0.791	0.630	0.900	0.788	0.108

Means having the same letter(s) within a column are not significantly different at 5% probability level using Tukey HSD test.

Number of Fruits per Plant and Fruit Yield as Impacted by Variety and Potassium Fertilizer Rate

The effect of tomato variety and potassium fertilization on the number of fruits per plant and total fruit yield during the 2017 and 2018 wet seasons is presented in Table 4. Varietal differences were significant for fruit yield in 2017 but not for fruit number or in 2018. Among the tested varieties, *Roma VF* and *Tima* generally outperformed *Rio Grande* in fruit yield, producing 27.7 and 26.3 t ha⁻¹, respectively, compared to 21.1 t ha⁻¹ for *Rio Grande*. The superior performance of *Roma VF* reflects its efficient assimilate partitioning and reproductive potential, consistent with genotypic variability in yield components reported by Das *et al.* (2025).

Potassium fertilization significantly affect fruit formation and yield, particularly at higher application rates. The highest fruit number (42.3 fruits plant⁻¹) and yield (27.8 t ha⁻¹) were achieved at 150 kg K ha⁻¹, whereas the control plots recorded the lowest values. This trend underscores potassium's essential role in improving flower retention, fruit set, and translocation of photosynthates to developing fruits, as noted by Ardiansyahi *et al.* (2025). However, the marginal yield improvement between 100 and 150 kg K ha⁻¹ suggests a

diminishing response beyond the physiological optimum, in line with findings by Rufa'i *et al.* (2024). The non-significant ($p > 0.05$) $V \times K$ interaction indicates that the positive response to potassium fertilization was consistent across varieties, implying similar nutrient utilization efficiency under the given agroecological conditions.

Table 4: Number of Fruits per Plant and Fruit Yield of Tomato as Impacted by Varieties and Varied Potassium Fertilization During the 2017 and 2018 Wet Seasons

Treatment	Number of Fruits per Plant		Fruit yield (t ha ⁻¹)	
	2017	2018	2017	2018
Variety (V)				
<i>Rio Grande</i>	29.80	29.20	21.10 ^b	23.70
<i>Roma VF</i>	35.50	31.00	27.70 ^b	22.80
<i>Tima</i>	34.20	26.10	26.30 ^{ab}	25.80
F-Prob	0.531	0.414	0.041	0.631
SE±	5.25	3.650	4.650	3.090
Potassium (K) (kg ha⁻¹)				
0	21.30 ^b	26.50	22.99	17.40 ^b
50	32.40 ^{ab}	27.10	23.60	24.70 ^{ab}
100	36.60 ^{ab}	30.40	31.56	26.50 ^{ab}
150	42.30 ^a	31.00	30.04	27.80 ^a
F-Prob	0.016	0.627	0.291	0.037
SE±	6.060	4.210	5.370	3.570
Interaction				
V x K	0.934	0.0930	0.064	0.813

Means having the same letter(s) within a column are not significantly different at 5% probability level using Tukey HSD test.

Fruit Quality Attributes as Impacted by Variety and Potassium Fertilizer Rate

Tomato fruit quality parameters such as ascorbic acid, pH, titratable acidity (TA), and total soluble solids (TSS) were moderately influenced by variety and potassium fertilizer rate during both seasons (Table 5). Although varietal differences were statistically non-significant, *Roma VF* consistently exhibited slightly higher ascorbic acid and titratable acidity values, indicating superior metabolic activity and enhanced antioxidant potential compared to *Tima* and *Rio Grande*. Such varietal trends are often associated with genotypic variation in nutrient utilization efficiency and fruit biochemical composition, as noted by Cruz-Chamorro *et al.* (2024).

Across potassium levels, fruit quality parameters improved progressively with increasing K supply, with 100 kg K ha⁻¹ and 150 kg K ha⁻¹ producing the highest mean ascorbic acid and TSS contents. This aligns with findings by Bello *et al.* (2024), who reported that adequate potassium enhances sugar synthesis, vitamin C concentration, and titratable acidity by improving osmotic regulation, enzyme activation, and carbohydrate translocation. However, the limited differences beyond optimal levels suggest that excessive K application confers minimal additional benefit, consistent with Das *et al.* (2025).

A significant interaction between variety and potassium rate was observed for TSS during the 2018 season (Table 6), indicating that tomato varieties responded differently to potassium fertilization in terms of sugar accumulation. *Roma VF* recorded the highest TSS (3.03%) at 150 kg K ha⁻¹, followed by *Tima* (2.67%) and *Rio Grande* (2.33%), while all varieties exhibited notably lower TSS at 0 kg K ha⁻¹. This interaction highlights genotype-specific efficiency in carbohydrate metabolism and translocation, with *Roma VF* showing superior responsiveness to elevated potassium input. Such genotype-dependent responses corroborate the findings of Ebaid *et al.* (2025), who reported that varieties with greater sink strength and enzymatic activity tend to accumulate more soluble sugars under optimal potassium nutrition.



Table 5: Fruit Qualities of Tomato as Impacted by Varieties and Varied Potassium Fertilization During the 2017 and 2018 Wet Seasons

Treatment	2017				2018			
	Ascorbic Acid	pH of Fruit Juice	Titratable Acidity (%)	Total Soluble Solid (%)	Ascorbic Acid	pH of Fruit Juice	Titratable Acidity (%)	Total Soluble Solid (%)
Variety (V)								
<i>Rio Grande</i>	32.50	5.60	0.54	2.05	44.60	5.54	1.50	2.17
<i>Roma VF</i>	34.60	5.76	0.60	2.35	47.80	5.47	1.64	2.06
<i>Tima</i>	26.20	5.62	0.65	2.03	50.70	5.75	1.56	1.98
F-Prob	0.054	0.976	0.760	0.235	0.548	0.849	0.938	0.869
SE±	7.400	0.782	0.139	0.200	6.440	0.516	0.388	0.358
Potassium (K) (kg ha⁻¹)								
0	22.40	4.07b	0.33c	1.43b	23.60b	2.78c	0.91	1.78
50	24.00	5.50ab	0.59ab	2.10a	49.70a	5.35b	1.58	2.35
100	33.60	6.26ab	0.87a	2.37a	56.50a	7.05a	1.65	1.85
150	44.90	6.790a	0.60ab	2.67a	59.70a	7.17a	2.12	2.30
F-Prob	0.508	0.034	0.022	<0.001	<0.001	<0.001	0.090	0.400
SE±	8.550	0.903	0.160	0.231	7.430	0.596	0.448	0.414
Interaction								
V x K	0.929	0.727	0.635	0.757	0.713	0.098	0.579	0.020

Means having the same letter(s) within a column are not significantly different at 5% probability level using Tukey HSD test.

The superior performance of *Roma VF* can further be attributed to intrinsic genotypic differences in assimilate partitioning, antioxidant metabolism, and sugar transport efficiency, a trend similarly observed by Raza *et al.* (2022).

Table 6: Interaction of Variety and Varied Potassium Fertilization on Total Soluble Solid of Tomato during 2018 Wet Season

Treatment	Potassium levels (Kg ha ⁻¹)			
	0	50	100	150
Variety				
<i>Rio Grande</i>	1.533b	2.033	2.300ab	2.333ab
<i>Roma VF</i>	1.433b	2.200ab	2.720ab	3.030a
<i>Tima</i>	1.33b	2.067ab	2.067ab	2.667ab
SE±		0.409		

Means having the same letter(s) within a column are not statistically different at 5% probability level using Tukey HSD test.

Fruit Metabolites Content

The results in Table 7 show that tomato fruit phenolic and flavonoid contents were influenced by both variety and potassium fertilization during the 2017 and 2018 wet seasons. Among the varieties, *Rio Grande* and *Roma VF* exhibited significantly ($p < 0.05$) higher phenolic content in 2017, while *Tima* recorded comparatively higher flavonoid concentrations across both seasons, though varietal differences were not statistically significant ($p > 0.05$). The elevated phenolic accumulation in *Rio Grande* suggests stronger antioxidative capacity and stress tolerance potential, which may be linked to inherent genotypic traits influencing secondary metabolite synthesis (Raza *et al.*, 2022). Across potassium treatments, phenolic and flavonoid contents increased progressively with higher K rates, peaking at 150 kg K ha⁻¹ during both seasons.

Table 7: Fruit Metabolites Content of Tomato as Impacted by Varieties and Varied Potassium Fertilization During the 2017 and 2018 Wet Seasons

Treatment	2017		2018	
	Fruit Phenolic Content	Fruits Flavonoids Content	Fruit Phenolic Content	Fruits Flavonoids Content
Variety (V)				
<i>Rio Grande</i>	27.30a	13.10	29.60	10.20
<i>Roma VF</i>	26.50a	14.40	24.80	14.20
<i>Tima</i>	23.20b	19.40	27.70	16.20
F-Prob	<0.001	0.214	0.341	0.208
SE±	2.930	4.260	3.200	3.830
Potassium (K) (kg ha⁻¹)				
0	17.50	12.20	18.10c	5.800b
50	22.20	12.50	23.60bc	13.60ab
100	29.80	18.90	31.10ab	19.30a
150	33.10	19.00	36.70a	15.60ab
F-Prob	0.248	0.218	<001	0.014
SE±	2.540	3.690	3.700	3.320
Interaction				
V x K	0.306	0.748	0.536	0.554

Means having the same letter(s) within a column are not statistically different at 5% probability level using Tukey HSD test.

The marked improvement in phenolic compounds and flavonoids at moderate-to-high potassium levels (100-150 kg K ha⁻¹) indicates that potassium enhances the biosynthesis of secondary metabolites by stimulating enzyme activity and improving carbohydrate metabolism



(Bello *et al.*, 2024; Das *et al.*, 2025). Similar trends have been reported by Hu *et al.* (2022) and Chen *et al.* (2023), who observed that optimal potassium supply promotes phenolic and flavonoid synthesis, thereby improving fruit antioxidant quality. Although the variety $\times$ potassium interaction was not significant ($p > 0.05$), the consistent rise in metabolite concentration across increasing K levels emphasizes potassium's regulatory role in enhancing antioxidant potential and nutritional quality of tomato fruits. These findings corroborate earlier evidence that sufficient potassium availability not only boosts yield and TSS but also fortifies fruit biochemical composition strengthening tomato's functional and health-promoting value (Rufa'i *et al.*, 2025).

CONCLUSION AND RECOMMENDATIONS

The study demonstrated that both varietal differences and potassium fertilization influenced the growth, yield, and quality attributes of tomato (*Solanum lycopersicum* L.), with notable genotype-specific responses. Among the tested varieties, 'Roma VF' exhibited superior performance in yield and quality traits, particularly in total soluble solids and antioxidant composition, indicating enhanced assimilate partitioning and nutrient utilization efficiency under higher potassium supply. Moderate to high potassium rates (100-150 kg K ha⁻¹) generally promoted leaf expansion, fruit development, and biochemical enrichment without significant yield penalties, suggesting this range as optimal for balanced productivity and quality enhancement. It is therefore recommended that tomato cultivation in similar agro-ecological zones adopt *Roma VF* variety fertilized with 100-150 kg K ha⁻¹ for optimal yield and fruit quality. Further studies integrating soil potassium dynamics, genotype $\times$ environment interactions, and advanced nutrient management strategies are encouraged to refine site-specific recommendations and improve tomato nutritional quality and resource use efficiency.

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