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GROWTH INDICES OF FINGER MILLET VARIETIES AS INFLUENCED BY GRADED NPK NUTRITION UNDER IRRIGATED CONDITION

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ABSTRACT

A field experiment was conducted during *Kharif* 2025 at V. C. Farm, Mandya, Karnataka, to evaluate the growth indices of finger millet varieties as influenced by graded NPK nutrition under irrigated condition. The experiment was laid out in a split-plot design with three replications, comprising four NPK levels and four varieties. Growth indices, *viz.*, crop growth rate (CGR), relative growth rate (RGR), absolute growth rate (AGR), net assimilation rate (NAR), leaf area index (LAI) and leaf area duration (LAD), were assessed at different crop growth intervals. Increasing NPK levels improved crop growth and canopy development, with 125% RDF (125:62.5:62.5 kg ha^{-1}) generally recording higher CGR, LAI and LAD, while remaining statistically at par with 100% RDF (100:50:50 kg ha^{-1}) for several parameters. Among the varieties, KMR-316 recorded higher AGR, LAI and LAD and was statistically on par with KMR-708during most of the growth periods. The interaction between NPK levels and varieties was significant for AGR and NAR. The study demonstrated that appropriate NPK nutrition combined with a responsive variety enhanced crop physiological growth and canopy development of finger millet under the Cauvery Command Area of Karnataka, India.

Key words : Finger millet, NPK levels, Varietal response, Growth indices.

Introduction

Finger millet (*Eleusine coracana* L.) is an important nutri-cereal of the semi-arid and rainfed regions of India, valued for its wider adaptability to low-fertility soils and variable moisture conditions. India is one of the major producers of finger millet, with Karnataka contributing a substantial share of the national production (Anonymous, 2024a). The crop is also nutritionally important owing to its appreciable contents of calcium, iron, phosphorus, potassium and dietary fibre, making it an important component of food and nutritional security (Devi *et al*., 2014; Anonymous, 2024b).

Productivity of finger millet is influenced by several agronomic factors, among which balanced nutrient supply and varietal selection are particularly important. Nitrogen promotes leaf development, chlorophyll formation and tillering, phosphorus supports root growth and energy metabolism, while potassium contributes to water regulation, enzyme activity and assimilate translocation. Imbalanced or inadequate NPK supply can therefore restrict vegetative growth, dry matter production and yield formation (Ghosh *et al*., 2016; Biradar *et al*., 2018; Babu *et al*., 2019). Conversely, appropriate nutrient management can improve canopy development, biomass accumulation and crop growth (Ravindran *et al*., 2017).

Varietal differences also play an important role in determining growth and nutrient response in finger millet. Genotypes differ in their growth duration, biomass production, canopy development and ability to utilize available nutrients. Improved varieties developed for

Karnataka, offer potential for enhanced productivity under favourable nutrient management conditions (Udupa *et al*., 2017). However, the magnitude of their response may vary with the level of nutrient supply and prevailing agro-climatic conditions (Manjunath *et al*., 2019).

Growth indices such as crop growth rate (CGR), relative growth rate (RGR), absolute growth rate (AGR), net assimilation rate (NAR), leaf area index (LAI) and leaf area duration (LAD) provide useful measures of crop growth, biomass accumulation, assimilatory efficiency and canopy development. Changes in these parameters with crop age and nutrient availability help explain differences in crop performance and yield formation. Hence, evaluating these indices across varieties and nutrient regimes can provide a better understanding of the physiological basis of varietal response to fertilizer application.

The Cauvery command area of Karnataka is an important finger millet-growing region, where efficient nutrient management is essential for sustaining crop productivity. However, information on the comparative growth response of finger millet varieties to graded NPK levels under this production environment is limited. Therefore, the present investigation was undertaken to evaluate the growth indices of finger millet varieties as influenced by graded NPK nutrition under irrigated condition, with particular emphasis on CGR, RGR, AGR, NAR, LAD, LAI and to identify suitable combinations of nutrient level and variety for improved crop growth and productivity.

Materials and Methods

Experimental site and season

A field experiment was conducted during *Kharif* 2025 at the Zonal Agricultural Research Station, V.C. Farm, Mandya, Karnataka, to evaluate the growth indices of finger millet varieties as influenced by graded NPK nutrition under irrigated condition. The experimental site is situated in Agro-Climatic Zone VI (Southern Dry Zone) of Karnataka at 12°33.6’ N latitude and 76°49.2’ E longitude, with an elevation of 695 m above mean sea level. The experimental soil was characterized by a pH of 7.48 and electrical conductivity of 0.20 dS m^{-1}. The soil had a low organic carbon content of 0.36 per cent.

Experimental design and treatments

The experiment was laid out in a split-plot design with three replications. Four NPK levels were assigned to the main plots, while four finger millet varieties were allotted to the sub-plots, resulting in 16 treatment combinations and 48 experimental plots. The main-plot treatments consisted of absolute control, 75% RDF, 100% RDF and 125% RDF. The corresponding N: P_2O_5: K_2O levels were 75:37.5:37.5, 100:50:50 and 125:62.5:62.5 kg ha^{-1}, respectively. The sub-plot treatments comprised four finger millet varieties, namely KMR-702, KMR-708, KMR-316 and KMR-301.The gross plot size was 4.0 m × 3.0 m = 12.00 m^2, while the net plot size was 2.8 m × 2.6 m = 7.28 m^2. The crop was planted at a spacing of 30 cm between rows and 10 cm between plants.

Fertilizer application and crop management

Nitrogen, phosphorus and potassium were supplied through urea, single super phosphate and muriate of potash, respectively. 50% of the recommended dose of nitrogen, along with the full recommended doses of phosphorus and potassium, were applied as basal doses through urea, single super phosphate and muriate of potash, respectively, at sowing. The remaining 50% of the recommended dose of nitrogen was applied at 45 days after sowing. The required quantities of fertilizers were calculated according to the respective nutrient treatments and applied to the crop as per the treatment schedule. The recommended package of practices was followed uniformly for all treatments, except for the imposed differences in NPK levels and varieties. Irrigation and plant protection measures were adopted uniformly across the experimental plots based on crop requirements.

Recording of observations

Growth observations were recorded at specified stages of crop growth. Five representative plants were selected randomly from each net plot and tagged for recording biometric observations. Plant height, number of tillers, leaf area and dry matter production were recorded at the respective crop growth stages (Sunil *et al*., 2023).

Physiological growth indices, namely crop growth rate (CGR), relative growth rate (RGR), absolute growth rate (AGR), net assimilation rate (NAR), leaf area index (LAI) and leaf area duration (LAD), were calculated from periodic observations of plant dry matter and leaf area recorded at 30, 60, 90 DAS and harvest. CGR was estimated from the increase in dry matter per unit ground area and time, whereas RGR represented the rate of increase in dry matter relative to the existing biomass. AGR was calculated from the absolute change in dry matter over each growth interval, while NAR was determined from dry matter accumulation in relation to leaf area over time. LAI was calculated as the ratio of total leaf area to the corresponding ground area occupied by the crop and LAD was estimated from the mean LAI

maintained during each growth interval. The growth indices were calculated for 30-60, 60-90 and 90 DAS-harvest and expressed in their respective units.

The equations used were:

Crop Growth Rate (CGR)

$$CGR = \frac{W_2 - W_1}{P(t_2 - t_1)}$$

where, W_1 and W_2 are plant dry weights at times t_1 and t_2, respectively: P is the ground area occupied by the plant: and $(t_2 - t_1)$ is the time interval in days (Watson, 1952).

Relative Growth Rate (RGR)

$$RGR = \frac{\ln W_2 - \ln W_1}{t_2 - t_1}$$

where, W_1 and W_2 represent plant dry weights at the beginning and end of the respective growth interval (Radford, 1967).

Absolute Growth Rate (AGR)

$$AGR = \frac{W_2 - W_1}{t_2 - t_1}$$

where, W_1 and W_2 are plant dry weights at the beginning and end of the growth interval, respectively (Radford, 1967).

Net Assimilation Rate (NAR)

$$NAR = \frac{W_2 - W_1}{t_2 - t_1} \times \frac{\ln L_2 - \ln L_1}{L_2 - L_1}$$

where, L_1 and L_2 are leaf areas at times t_1 and t_2, respectively. The calculated values were expressed as g m^{-2} leaf area day^{-1} (Yoshida, 1981).

Leaf Area Index (LAI)

$$LAI = \frac{\text{Total leaf area}}{\text{Ground area occupied by the crop}}$$

For the present spacing of 30 × 10 cm, the ground area occupied by one hill was 300 cm^2.

Leaf Area Duration (LAD)

$$LAD = \frac{LAI_1 + LAI_2}{2} \times (t_2 - t_1)$$

where, LAI_1 and LAI_2 are the leaf area indices at the beginning and end of the growth interval, respectively, and $(t_2 - t_1)$ is the duration in days.

At physiological maturity, the crop was harvested separately from each net plot. The harvested produce was processed separately for each treatment and grain yield was recorded and expressed on a hectare basis.

Statistical analysis

The experimental data were subjected to statistical analysis appropriate for a split-plot design. The significance of the main-plot effects, sub-plot effects and their interaction was tested at the 5 per cent level of significance. When the treatment effects were significant, the critical difference (CD) at 5 per cent probability was used for comparison of treatment means (Gomez and Gomez, 1984).

Results and Discussion

Crop Growth Rate (CGR)

Crop growth rate was significantly influenced by NPK levels at all growth intervals, whereas varietal and NPK × variety effects were non-significant (Table 1). The highest CGR during 30-60 DAS was recorded with 125% RDF (F_4: 67.16 g m^{-2} day^{-1}), which was statistically comparable with 100% RDF (F_3: 65.02 g m^{-2} day^{-1}), while 75% RDF (F_2: 59.25 g m^{-2} day^{-1}) and absolute control (F_1: 35.29 g m^{-2} day^{-1}) recorded lower values. During 60-90 DAS, 125% RDF (F_4: 11.34 g m^{-2} day^{-1}) recorded the highest CGR and was comparable with 100% RDF (F_3: 10.89 g m^{-2} day^{-1}) and 75% RDF (F_2: 10.21 g m^{-2} day^{-1}). At 90 DAS-harvest, 100% RDF (F_3: 1.36 g m^{-2} day^{-1}) and 75% RDF (F_2: 1.35 g m^{-2} day^{-1}) were comparable. Differences among varieties and their interaction with NPK levels were non-significant at all growth stages. The higher NPK supply enhanced CGR through improved nutrient availability, vegetative growth and dry matter production, while the decline towards harvest reflected reduced vegetative growth and greater assimilate partitioning to reproductive organs. The non-significant varietal and interaction effects indicated a consistent response of varieties to NPK nutrition, in agreement with Bhunyia *et al*. (2025) and Salam *et al*. (2025).

Relative Growth Rate (RGR)

Relative growth rate was significantly influenced by NPK levels and varieties, while their interaction was non-significant (Table 1). During 30-60 DAS, 100% RDF (F_3: 0.0688 g g^{-1} day^{-1}) was comparable with 75% RDF (F_2: 0.0689) and 125% RDF (F_4: 0.0684), whereas absolute control (F_1: 0.0626) recorded a lower value. During 60-90 DAS, absolute control (F_1: 0.0187 g g^{-1} day^{-1}) recorded the highest RGR, while 100% RDF (F_3: 0.0121) and 125% RDF (F_4: 0.0121) were comparable. At 90 DAS-harvest,

Table 1 : Crop Growth Rate and Relative Growth Rate of finger millet varieties at crop growth stages as influenced by different NPK levels.

Treatment	Crop Growth Rate (g m^{-2} day^{-1})			Relative Growth Rate (g g^{-1} day^{-1})		
	30-60 DAS	60-90 DAS	90DAS-harvest	30-60 DAS	60-90 DAS	90DAS-harvest
Main plot: NPK Levels (F)						
F_1	35.29	6.66	1.10	0.0626	0.0187	0.00153
F_2	59.25	10.21	1.35	0.0689	0.0088	0.00150
F_3	65.02	10.89	1.36	0.0688	0.0121	0.00123
F_4	67.16	11.34	1.27	0.0684	0.0121	0.00115
S. Em. ±	0.67	0.03	0.04	0.0011	0.0009	0.00005
CD (p=0.05)	2.31	0.10	0.13	0.0037	0.0032	0.00017
Sub plot: Varieties (V)						
V_1	48.59	9.78	1.20	0.0648	0.0150	0.00145
V_2	59.59	9.84	1.18	0.0682	0.0122	0.00120
V_3	60.42	9.91	1.40	0.0676	0.0122	0.00140
V_4	58.13	9.57	1.29	0.0682	0.0124	0.00135
S. Em. ±	3.33	0.43	0.06	0.0009	0.0007	0.00006
CD (p=0.05)	NS	NS	NS	0.0026	0.0021	0.00017
Interaction: (F×V)						
F_1V_1	24.62	7.98	1.29	0.0570	0.0228	0.00193
F_1V_2	39.85	6.16	1.00	0.0664	0.0168	0.00133
F_1V_3	40.05	6.69	1.09	0.0648	0.0166	0.00146
F_1V_4	36.62	5.80	1.01	0.0623	0.0187	0.00138
F_2V_1	47.10	9.84	1.24	0.0643	0.0120	0.00154
F_2V_2	63.57	10.10	1.26	0.0699	0.0076	0.00138
F_2V_3	64.95	10.04	1.47	0.0702	0.0082	0.00152
F_2V_4	61.38	10.84	1.42	0.0713	0.0074	0.00157
F_3V_1	59.43	10.79	0.93	0.0689	0.0130	0.00105
F_3V_2	66.73	11.31	1.37	0.0685	0.0122	0.00116
F_3V_3	67.60	11.27	1.60	0.0677	0.0120	0.00136
F_3V_4	66.33	10.20	1.53	0.0699	0.0113	0.00134
F_4V_1	63.20	10.50	1.33	0.0688	0.0120	0.00128
F_4V_2	68.20	11.80	1.08	0.0681	0.0123	0.00094
F_4V_3	69.07	11.63	1.46	0.0676	0.0121	0.00127
F_4V_4	68.17	11.42	1.20	0.0691	0.0122	0.00112
S. Em. ±	6.67	0.87	0.13	0.0018	0.0014	0.00012
CD (p=0.05)	NS	NS	NS	NS	NS	NS

Main plot: Levels of NPK

F_1 : Absolute control
F_2 : 75% RDF (75:37.5:37.5 N:P_2O_5:K_2O kg ha^{-1})
F_3 : 100% RDF (100:50:50 N:P_2O_5:K_2O kg ha^{-1})
F_4 : 125% RDF (125:62.5:62.5 N:P_2O_5:K_2O kg h^{-1})

Sub plot: Varieties

V_1 : KMR-702
V_2 : KMR-708
V_3 : KMR-316*(Check variety)
V_4 : KMR-301*(Check variety)

absolute control (F_1: 0.00153) and 75% RDF (F_2: 0.00150) were comparable, while 100% RDF (F_3: 0.00123) and 125% RDF (F_4: 0.00115) were also statistically comparable. Among varieties, KMR-708 (V_2: 0.0682 g g^{-1} day^{-1}) and KMR-301 (V_4: 0.0682) recorded comparable RGR during 30-60 DAS and were also comparable with KMR-316 (V_3: 0.0676). During 60-90 DAS, KMR-702 (V_1: 0.0150) recorded higher RGR, whereas KMR-708 (V_2: 0.0122), KMR-316 (V_3: 0.0122) and KMR-301 (V_4: 0.0124) were comparable. During 90 DAS-harvest, KMR-702 (V_1: 0.00145 g g^{-1} day^{-1}) recorded numerically higher RGR, followed by KMR-316 (V_3: 0.00140), KMR-301 (V_4: 0.00135) and KMR-708 (V_2: 0.00120). The greater RGR during the early

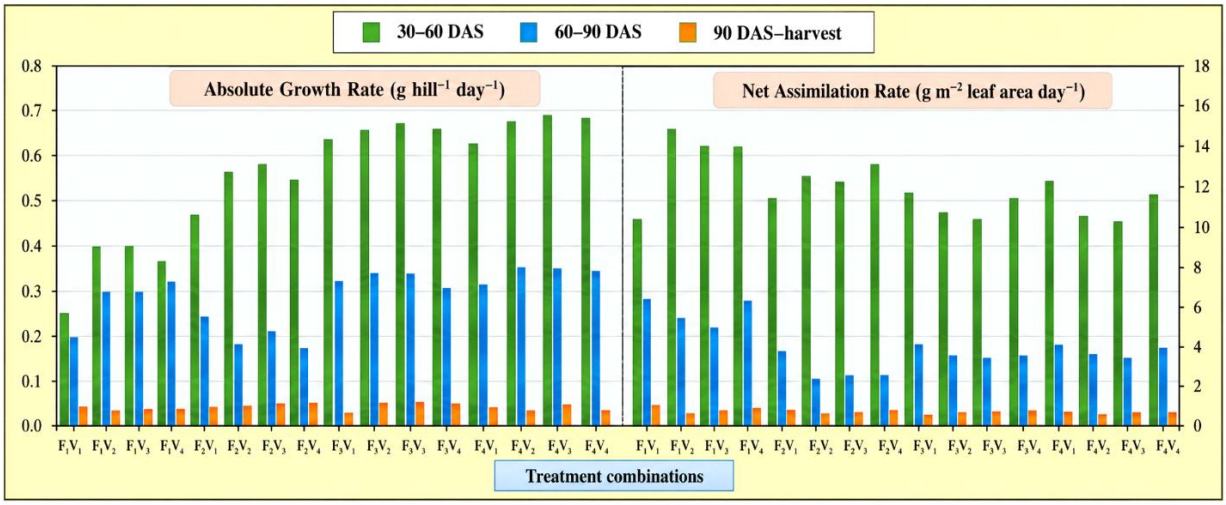


Fig. 1 : Absolute growth rate and net assimilation rate of finger millet varieties as influenced by graded NPK nutrition under the Cauvery command area of Karnataka.

growth phase under adequate NPK supply was attributed to enhanced leaf development and efficient biomass production. The progressive decline in RGR with crop advancement due to increasing plant biomass and reduced relative accumulation of dry matter towards maturity. Varietal differences in RGR may reflect inherent differences in growth pattern and biomass partitioning, while the non-significant NPK × variety interaction indicates a consistent varietal response to nutrient levels. (Salam *et al*., 2025).

Absolute Growth Rate (AGR)

Absolute growth rate was significantly influenced by NPK levels, varieties and their interaction at all growth intervals (Table 2 and Fig. 1). During 30-60 DAS, 125% RDF (F_4 : 0.672 g hill^{-1} day^{-1}) recorded the highest AGR and was comparable with 100% RDF (F_3 : 0.650). During 60-90 DAS, 100% RDF (F_3 : 0.327) recorded the highest value, whereas during 90 DAS-harvest, 100% RDF (F_3 : 0.041), 75% RDF (F_2 : 0.041) and 125% RDF (F_4 : 0.038) were comparable. Among varieties, KMR-316 (V_3) recorded the highest AGR during 30-60 DAS (0.604) and was comparable with KMR-708 (V_2 : 0.596) and KMR-301 (V_4 : 0.581). During 60-90 DAS, KMR-316 (V_3 : 0.299) was comparable with KMR-708 (V_2 : 0.295) and KMR-702 (V_1 : 0.293), while during 90 DAS-harvest, KMR-316 (V_3 : 0.042) was comparable with KMR-301 (V_4 : 0.039). The NPK × variety interaction was significant across all growth intervals. During 30-60 DAS, F_4 V_3 (0.691 g hill^{-1} day^{-1}) recorded the highest AGR and was comparable with F_4 V_2 (0.682), F_4 V_4 (0.682), F_3 V_3 (0.676) and F_3 V_4 (0.663). During 60-90 DAS, F_4V_2 (0.351) recorded the highest AGR and was comparable with F_4 V_3 (0.349), F_4 V_4 (0.343), F_3 V_2 (0.339) and F_3 V_3 (0.338). During 90 DAS-harvest, F_3 V_3 (0.048) recorded the highest AGR and was comparable with F_2 V_3 (0.044), F_4 V_3 (0.044), F_2 V_4 (0.043), F_4 V_1 (0.040) and F_1 V_1 (0.039). The higher AGR under adequate NPK supply indicates enhanced biomass accumulation, The variation among varieties suggests differences in inherent growth potential, while the significant interaction reflects differential varietal responses to nutrient availability across growth stages (Bhunyia *et al*., 2025).

Net Assimilation Rate (NAR)

Net assimilation rate was significantly influenced by NPK levels, varieties and their interaction (Table 2 and Fig. 1). During 30-60 DAS, the absolute control (F_1: 13.75 g m^{-2} leaf area day^{-1}) recorded the highest NAR, while the other nutrient levels differed significantly from it. During 60-90 DAS, absolute control (F_1: 6.09) recorded the highest value, whereas 100% RDF (F_3: 3.35) and 125% RDF (F_4: 3.37) were comparable. During 90 DAS-harvest, F_3 (0.35) and F_4 (0.32) were comparable. Among varieties, KMR-301 (V_4: 13.00) recorded the highest NAR during 30-60 DAS and was comparable with KMR-708 (V_2: 12.61) and KMR-316 (V_3: 12.31). During 60-90 DAS, KMR-702 (V_1: 4.56) recorded the highest NAR, while KMR-708 (V_2: 3.51) and KMR-316 (V_3: 3.40) were comparable. The interaction between NPK levels and varieties was significant throughout the crop growth period. During 30-60 DAS, F_1 V_2 (15.05 g m^{-2} leaf area day^{-1}) recorded the highest NAR and was comparable with F_1 V_3 (14.52) and F_1 V_4 (14.47). During 60-90 DAS, F_1 V_1 (7.24) recorded the highest NAR, while the remaining combinations recorded significantly lower values. During 90 DAS-harvest, F_1 V_1 (0.89) registered the highest NAR, whereas F_4 V_2 (0.25) recorded the lowest. The higher NAR under absolute control during

Table 2 : Absolute Growth Rate and Net Assimilation Rate of finger millet varieties at crop growth stages as influenced by different NPK levels.

Treatment	Absolute Growth Rate (g hill{ 1 day{ 1)			Net Assimilation Rate (g m{ 2 leaf area day{ 1)		
	30-60 DAS	60-90 DAS	90DAS-harvest	30-60 DAS	60-90 DAS	90DAS-harvest
Main plot: NPK Levels (F)						
F_1	0.353	0.306	0.033	13.75	6.09	0.58
F_2	0.593	0.201	0.041	12.78	2.50	0.46
F_3	0.650	0.327	0.041	11.63	3.35	0.35
F_4	0.672	0.339	0.038	11.72	3.37	0.32
S. Em. ±	0.009	0.003	0.001	0.26	0.07	0.01
CD (p=0.05)	0.032	0.011	0.005	0.92	0.26	0.03
Sub plot: Varieties (V)						
V_1	0.486	0.293	0.036	11.96	4.56	0.53
V_2	0.596	0.295	0.035	12.61	3.51	0.35
V_3	0.604	0.299	0.042	12.31	3.40	0.40
V_4	0.581	0.287	0.039	13.00	3.83	0.44
S. Em. ±	0.009	0.002	0.001	0.22	0.07	0.01
CD (p=0.05)	0.025	0.007	0.004	0.63	0.21	0.02
Interaction: (F×V)						
F_1V_1	0.246	0.295	0.039	10.95	7.24	0.89
F_1V_2	0.399	0.303	0.030	15.05	5.53	0.45
F_1V_3	0.400	0.301	0.033	14.52	5.15	0.46
F_1V_4	0.366	0.325	0.030	14.47	6.45	0.51
F_2V_1	0.471	0.239	0.037	12.00	3.53	0.53
F_2V_2	0.636	0.185	0.038	12.91	2.06	0.38
F_2V_3	0.649	0.206	0.044	12.70	2.22	0.44
F_2V_4	0.614	0.174	0.043	13.50	2.21	0.51
F_3V_1	0.594	0.324	0.028	12.18	3.83	0.29
F_3V_2	0.667	0.339	0.041	11.34	3.24	0.33
F_3V_3	0.676	0.338	0.048	11.05	3.12	0.37
F_3V_4	0.663	0.306	0.046	11.96	3.20	0.41
F_4V_1	0.632	0.315	0.040	12.71	3.64	0.40
F_4V_2	0.682	0.351	0.032	11.14	3.23	0.25
F_4V_3	0.691	0.349	0.044	10.95	3.13	0.33
F_4V_4	0.682	0.343	0.036	12.08	3.48	0.31
S. Em. ±	0.017	0.005	0.003	0.43	0.14	0.01
CD (p=0.05)	0.050	0.014	0.008	1.26	0.42	0.04

Main plot: Levels of NPK

F_1 : Absolute control
F_2 : 75% RDF (75:37.5:37.5 N:P_2O_5:K_2O kg ha^{-1})
F_3 : 100% RDF (100:50:50 N:P_2O_5:K_2O kg ha^{-1})
F_4 : 125% RDF (125:62.5:62.5 N:P_2O_5:K_2O kg h^{-1})

Sub plot: Varieties

V_1 : KMR-702
V_2 : KMR-708
V_3 : KMR-316*(Check variety)
V_4 : KMR-301*(Check variety)

the early growth stages was attributed to a relatively smaller and less dense canopy, resulting in better light penetration and efficient assimilation per unit leaf area. The decline in NAR with crop advancement was associated with increased canopy density, mutual shading and greater assimilate partitioning towards reproductive growth. Varietal differences indicate inherent variation in photosynthetic efficiency, while the significant NPK × variety interaction suggests differential physiological responses of varieties to nutrient availability (Pallavi *et al.*, 2016).

Leaf Area Duration (LAD)

Leaf area duration (LAD) was significantly

Table 3 : Leaf Area Duration and Leaf Area Index of finger millet varieties at crop growth stages as influenced by different NPK levels.

Treatment	Leaf Area Duration (Days)			Leaf Area Index (LAI)			
	30-60 DAS	60-90 DAS	90DAS-harvest	30 DAS	60 DAS	90 DAS	Harvest
Main plot: NPK Levels (F)							
F_1	27.96	51.82	60.23	0.47	1.40	2.06	1.96
F_2	49.42	82.83	88.61	0.95	2.35	3.17	2.73
F_3	58.87	99.47	115.73	1.24	2.69	3.94	3.77
F_4	60.56	102.53	119.47	1.26	2.78	4.06	3.91
S. Em. ±	1.10	1.86	2.08	0.02	0.05	0.07	0.07
CD (p=0.05)	3.82	6.43	7.21	0.08	0.18	0.25	0.23
Sub plot: Varieties (V)							
V_1	42.51	70.46	78.03	0.85	1.99	2.71	2.49
V_2	52.11	90.57	104.29	1.02	2.45	3.59	3.37
V_3	53.89	93.95	108.96	1.07	2.53	3.74	3.53
V_4	48.31	81.67	92.75	0.98	2.24	3.20	2.98
S. Em. ±	0.88	1.49	1.73	0.02	0.04	0.06	0.06
CD (p=0.05)	2.56	4.36	5.04	0.05	0.12	0.17	0.16
Interaction: (F×V)							
F_1V_1	24.68	40.86	43.30	0.42	1.23	1.49	1.39
F_1V_2	29.15	55.59	66.60	0.48	1.46	2.25	2.20
F_1V_3	30.24	59.76	71.43	0.51	1.51	2.48	2.29
F_1V_4	27.78	51.06	59.59	0.46	1.39	2.02	1.96
F_2V_1	41.59	68.29	70.60	0.83	1.94	2.61	2.10
F_2V_2	52.90	90.37	98.47	0.98	2.54	3.48	3.09
F_2V_3	54.82	93.57	101.01	1.03	2.63	3.61	3.12
F_2V_4	48.38	79.11	84.35	0.94	2.28	2.99	2.63
F_3V_1	51.37	85.24	97.49	1.06	2.36	3.32	3.18
F_3V_2	61.84	106.23	123.48	1.29	2.83	4.25	3.98
F_3V_3	64.27	109.75	130.28	1.34	2.94	4.37	4.31
F_3V_4	58.02	96.68	111.66	1.24	2.62	3.82	3.62
F_4V_1	52.42	87.44	100.74	1.07	2.42	3.41	3.31
F_4V_2	64.55	110.12	128.61	1.32	2.98	4.36	4.21
F_4V_3	66.23	112.72	133.13	1.39	3.03	4.49	4.39
F_4V_4	59.05	99.83	115.40	1.26	2.67	3.98	3.71
S. Em. ±	1.75	2.99	3.46	0.04	0.08	0.12	0.11
CD (p=0.05)	NS	NS	NS	NS	NS	NS	NS

Main plot: Levels of NPK

F_1 : Absolute control
F_2 : 75% RDF (75:37.5:37.5 N:P_2O_5:K_2O kg ha^{-1})
F_3 : 100% RDF (100:50:50 N:P_2O_5:K_2O kg ha^{-1})
F_4 : 125% RDF (125:62.5:62.5 N:P_2O_5:K_2O kg h^{-1})

Sub plot: Varieties

V_1 : KMR-702
V_2 : KMR-708
V_3 : KMR-316*(Check variety)
V_4 : KMR-301*(Check variety)

influenced by NPK levels and varieties at all growth intervals, while their interaction was non-significant (Table 3). 125% RDF (F_4) recorded the highest LAD during 30-60 DAS (60.56 days), which was comparable with 100% RDF (F_3 : 58.87 days). Similarly, F_4 recorded the highest LAD during 60-90 DAS (102.53 days) and 90 DAS-harvest (119.47 days), remaining comparable with F_3 (99.47 and 115.73 days, respectively). Among varieties, KMR-316 (V_3) recorded the highest LAD during 30-60 DAS (53.89 days), 60-90 DAS (93.95 days) and 90 DAS-harvest (108.96 days) and was comparable with KMR-708 (V_2 : 52.11, 90.57 and 104.29 days, respectively).

The greater NPK levels increased LAD by promoting leaf development and prolonging the persistence of active leaf area, thereby supporting sustained photosynthesis and dry matter accumulation. Varietal differences may reflect variation in canopy development and leaf retention, while the non-significant NPK × variety interaction indicates a consistent response of varieties to nutrient levels (Salam *et al*., 2025).

Leaf Area Index (LAI)

Leaf area index (LAI) was significantly influenced by NPK levels and varieties at all crop stages, whereas the interaction was non-significant (Table 3). 125% RDF (F_4) recorded the highest LAI at 30 DAS (1.26), 60 DAS (2.78), 90 DAS (4.06) and harvest (3.91), and was on par with 100% RDF (F_3) at all stages (1.24, 2.69, 3.94 and 3.77, respectively). Among varieties, KMR-316 (V_3) recorded the highest LAI at 30, 60, 90 DAS and at harvest (1.07, 2.53, 3.74 and 3.53) and was on par with KMR-708 (1.02, 2.45, 3.59 and 3.37, respectively). The higher NPK supply enhanced LAI through improved leaf production and canopy development, whereas the decline towards harvest was associated with progressive leaf senescence. Varietal differences indicate variation in canopy-forming ability, while the non-significant NPK × variety interaction suggests a consistent response of varieties to nutrient levels. Overall, higher LAI and LAD indicate better canopy development and maintenance of photosynthetically active leaf area (Pallavi *et al*., 2016; Salam *et al*., 2025).

Conclusion

The study revealed that graded NPK nutrition significantly influenced the growth indices and canopy development of finger millet under irrigated condition. Higher nutrient supply, particularly 125% RDF, enhanced CGR, LAI and LAD, which were statistically on par with 100% RDF. Among the varieties, KMR-316 recorded higher AGR, LAI and LAD and was statistically on par with KMR-708 for major growth attributes. The NPK levels × varieties interaction was significant for AGR and NAR indicated differential physiological responses of varieties to nutrient availability. Overall, balanced NPK nutrition along with a responsive variety improved biomass accumulation and canopy development of finger millet.

References

Anonymous (2024a). *Selected state-wise area, production and productivity of ragi*. Available at: https://www.indiastatagri.com/table/agriculture/selected-state-wise-area-production-productivity-r/1456831.

Anonymous (2024b). *Nutritional benefits of millets*. Available at: https://www.millets.res.in/millets_info.php.

Babu, S.S., Manjunath B.L., Suresh K.B. and Hemanth K. (2019). Nutrient management in finger millet for enhancing productivity under rainfed condition. *Int. J. Curr. Microbiol. App. Sci*., **8(1)**, 1772-1777.

Bhunyia, S., Mandal T.K., Panda R., Hossain N. and Mandal A (2025). Effect of spatial nutrient dose on the growth and yield of finger millet varieties in coastal part of West Bengal. *Int. J. Bioresource Sci.*, **12(1)**, 35-40.

Biradar D.P., Chinnappa B., Kannan R. and Patil B.V. (2018). Effect of phosphorus levels on growth and yield of finger millet (*Eleusine coracana* L.) genotypes. *J. Pharmacogn. Phytochem.*, **7(5)**, 2189-2192.

Devi, P.B., Vijayabharathi R., Sathyadevi T., Mangeshwari M., Priyadarisini V.B. and Vadivel V. (2014). Health benefits of finger millet (*Eleusine coracana* L.) polyphenols and dietary fiber: A review. *J. Food Sci. Technol.*, **51(6)**, 1021-1040.

Ghosh, P., Pal S.K. and Chakraborty P.K. (2016). Potassium nutrition in finger millet: Role and responses. *Int. J. Bioresour. Sci.*, **3(2)**, 91-95.

Gomez, K.A. and Gomez A.A. (1984). Data that violate some assumptions of the analysis of variance. In: Gomez, K.A. and Gomez A.A. (Eds.). *Statistical Procedures for Agricultural Research*. 2nd ed. John Wiley & Sons, Inc., New York, pp. 294-315.

Manjunath, B.L., Babu S.S., Suresh K.B. and Hemanth K. (2019). Nutrient management in finger millet for enhancing productivity under rainfed condition. *Int. J. Curr. Microbiol. App. Sci*., **8(3)**, 1980-1987.

Pallavi, Ch., Josheph B., Aariff Khan M.A. and Hemalath S. (2016). Physiological parameters, leaf nitrogen content and grain yield of finger millet as affected by different sources of organic manures under INM in comparison with RDF. *Int. J. Curr. Res. Biosci. Plant Biol.*, **3(8)**, 123-130.

Radford P.J. (1967). Growth analysis formulae, their use and abuse. *Crop Sci.*, **7**, 171-175.

Ravindran, M., Rajeswari V. and Senthilkumar K. (2017). Effect of nitrogen levels on growth and yield of finger millet under rainfed condition. *Int. J. Curr. Microbiol. App. Sci*., **6(11)**, 1876-1882.

Salam, P.K., Shrivastava G.K., Thakur A.K., Savu R.M., Tiwari N., Mahobia R.K. and Krishna (2025). Influence of nutrient levels and weed management practices on growth performance of finger millet (*Eleusine coracana* L.) cultivars under Bastar plateau region of Chhattisgarh. *Int. J. Adv. Biochem. Res.*, **9(6)**, 1120-1131.

Sunil, C.M., Sahana S.R., Raveendra H.R. and Bhagyalakshmi T. (2023). Response of finger millet (*Eleusine coracana* L. Gaertn.) varieties to different fertilizer levels under Cauvery command area of Karnataka (Zone-6). *Pharma Innov. J.*, **12(10)**, 1174-1177.

Udupa, S.M., Ramachandra V. and Kumar A. (2017). Evaluation of finger millet genotypes under rainfed and irrigated conditions in Karnataka. *J. Farm Sci.*, **30(4)**, 558-561.

Watson, D.J. (1952). The physiological basis of variation in yield. *Adv. Agron.*, **4**, 101-145.

Yoshida, S. (1981). Fundamentals of Rice Crop Science. *Int. Rice Res. Inst.*, Los Banos, Laguna, Philippines, 269 p.