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*Research Article*

# Yield Parameters and Economics of Foxtail Millet (*Setaria italica* L.) Cultivation as Influenced by the Agronomic Fortification with Zinc and Iron

**Sathisha G. S.[1*], Desai B. K.[2], Latha H. S.[3] and Yogesh L. N.[4]**

[1,2,3]Department of Agronomy, College of Agriculture,
University of Agricultural Sciences, Raichur-584104, Karnataka, India

[4]Department of Genetics and Plant Breeding, Agricultural Research Station, Hagari, Ballari, Karnataka, India

*Corresponding Author E-mail: sathishsgowda1901@gmail.com

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## ABSTRACT

*A field experiment was conducted to study effect of agronomic fortification of zinc and iron on yield parameters and cost of cultivation of foxtail millet at Agricultural Research Station, Hagari, Karnataka in medium black soil during rabi-2017. The experiment was laid out in split plot design having three genotypes in the main plot and seven methods of micronutrients application in sub plot, it was replicated thrice. The results of the study revealed that sub plot the treatment which received RDF + Soil application of $ZnSO_4$ at 15 kg $ha^{-1}$ and $FeSO_4$ at 10 kg $ha^{-1}$ + Foliar application of 0.5% $ZnSO_4$ and $FeSO_4$ each at 30 DAS recorded significantly higher number of ear heads $plant^{-1}$ (4.21), length of ear head (25.25 cm), weight of ear head (11.16 g), grain weight (10.21 g $plant^{-1}$) and 1000 grain weight (5.80 g). In interaction, the genotype Sia-2644 with treatment RDF + Soil application of $ZnSO_4$ at 15 kg $ha^{-1}$ and $FeSO_4$ at 10 kg $ha^{-1}$ + Foliar application of 0.5% $ZnSO_4$ and $FeSO_4$ each at 30 DAS recorded significantly higher number of ear heads $plant^{-1}$ (4.32), length of ear head (25.73 cm), weight of ear head (11.49 g) and grain weight (10.35 g $plant^{-1}$). Regarding the cost of cultivation significantly highest B:C ratio (2.73) was obtained in RDF + Seed treatment with 0.5 % $ZnSO_4$ & $FeSO_4$ each + Foliar application of 0.5% $ZnSO_4$ and $FeSO_4$ each at 30 DAS.*

***Keywords:*** *Foxtail millet, Fortification, Zinc and iron, Yield parameters, Economics.*

## INTRODUCTION

Millets are better adapted to dry, infertile soils than most other crops and are therefore often cultivated under extremely harsh conditions - for example, high temperatures, low and erratic precipitation, short growing seasons and acidic and infertile soils with poor water-holding capacity. Most millets have strong, deep rooting systems and short life cycles, and can grow rapidly when moisture is available.

Foxtail millet (*Setaria italica* L.) is an annual grass grown for human food. It is the second-most widely planted species of millet and the most important in East Asia.

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This is extensively grown in the arid and semi-arid regions of Asia and Africa, as well as in some other economically developed countries of the world. In Southeast Asia, foxtail millet is commonly cultivated in its dry, upland regions. Nutritional composition of foxtail millet per 100 g edible portion is proteins (12.3 g), carbohydrates (60.9 g), fat (4.3 g), crude fibre (8.0 g), calcium (31 mg), minerals (3.3g) and thiamine (0.59 mg) (Gopalan et al., 2007). In developing countries, millet cropping systems tend to be extensive, with limited application of improved technologies, except in some of the more commercialized farming regions in India. These crops are usually grown without irrigation or chemical fertilizer, on light, well-drained soils that are poor in organic matter content. When supplementary or full irrigation is available, farmers prefer to cultivate more remunerative crops.

Malnutrition is an alarming problem in the world. People in developing countries are the major victims of this problem. Even though much progress has been made the problem seems to be unresolved. It is believed that the most sustainable solutions for malnutrition lie in agriculture.

Therefore there is a better scope for growing these millets in the developing countries with the adoption of certain improved cultivation practices. Where these millets will provides the nutritional security to the increasing population and also boosts the income of the farmers due to increasing demand for the millets in the urban population. Therefore in the present study we investigated the effect of zinc and iron application methods on the yield parameters and economics of foxtail millet cultivation.

## MATERIALS AND METHODS

The experiment was conducted at Agricultural Research Station, Hagari which is situated between 15° 14' N latitude and 77° 07' E longitude with an altitude of 414 meters above the mean sea level and is located in Zone-3 of Karnataka. The experiment was laid out in split plot design and comprised of two factors for study *viz.*, Main plot treatments: Genotypes (G) comprised *viz.*, $G_1$: HN-7 (Low in Fe and Zn), $G_2$: HN-46 (Medium in Fe and high in Zn), $G_3$: Sia-2644 (High in Fe and medium in Zn). Subplot treatments: Micronutrients application (M) comprised *viz.*, $M_1$: RDF (control), $M_2$: RDF + Seed treatment with 0.5% $ZnSO_4$ & $FeSO_4$ each, $M_3$: RDF + Soil application of $ZnSO_4$ @ 15 kg $ha^{-1}$ and $FeSO_4$ @ 10 kg $ha^{-1}$, $M_4$: RDF + Foliar application of 0.5% $ZnSO_4$ and $FeSO_4$ each at 30 DAS, $M_5$: RDF + Seed treatment with 0.5% $ZnSO_4$ & $FeSO_4$ each + Soil application of $ZnSO_4$ @ 15 kg $ha^{-1}$ and $FeSO_4$ @ 10 kg $ha^{-1}$, $M_6$: RDF + Seed treatment with 0.5% $ZnSO_4$ & $FeSO_4$ each + Foliar application of 0.5% $ZnSO_4$ and $FeSO_4$ each at 30 DAS, $M_7$: RDF + Soil application of $ZnSO_4$ @ 15 kg $ha^{-1}$ and $FeSO_4$ @ 10 kg $ha^{-1}$ + Foliar application of 0.5% $ZnSO_4$ and $FeSO_4$ each at 30 DAS. The gross plot size was 3.0 m × 3.0 m and net plot size was 1.8 m × 2.6 m. The spacing given was 30 cm × 10 cm. The soil of the experimental site belongs to medium deep black soil and clay texture, neutral in soil reaction (7.50) and low in electrical conductivity (0.25 dS $m^{-1}$). The organic carbon content was 0.72 per cent and low in available N (262.00 kg $ha^{-1}$), medium in available phosphorus (39.25 kg $P_2O_5$ $ha^{-1}$) and medium in available potassium (307.00 kg $K_2O$ $ha^{-1}$), DTPA extractable zinc (0.67 ppm) and DTPA extractable iron (3.92 ppm). The observations related to the yield parameters are recorded the time of harvest.

## RESULTS AND DISCUSSION

**Yield parameters of foxtail millet as influenced by the agronomic fortification**

The treatment, RDF + Soil application of $ZnSO_4$ at 15 kg $ha^{-1}$ and $FeSO_4$ at 10 kg $ha^{-1}$ + Foliar application of 0.5% $ZnSO_4$ and $FeSO_4$ each at 30 DAS recorded significantly higher number of ear heads $plant^{-1}$ (4.21), length of ear head (25.25 cm), weight of ear head (11.16 g), grain weight (10.21 g plant$^{-1}$) and 1000 grain weight (5.80 g) among the micronutrients application and it was at par with the treatment RDF + Seed treatment with 0.5% $ZnSO_4$ & $FeSO_4$ each + Foliar application of 0.5% $ZnSO_4$ and $FeSO_4$ each at 30 DAS (Table 1 and 2). In these two treatments the micronutrients are applied through the foliar application along with the seed treatment and soil application. Hence the application of micronutrients in combination at different intervals through seed treatment, soil application and foliar application gives a better absorption of micronutrients than sole application. Similar results recorded by Mosanna and Ebrahim (2015) and Arunkumar et al. (2017).

In interaction effect significantly higher number of ear heads plant$^{-1}$ (4.32), length of ear head (25.73 cm), weight of ear head (11.49 g) and grain weight (10.35 g plant$^{-1}$) was found in Sia-2644 with RDF + Soil application of $ZnSO_4$ @ 15 kg ha$^{-1}$ & $FeSO_4$ @ 10 kg ha$^{-1}$ + Foliar application of 0.5% $ZnSO_4$ and $FeSO_4$ each at 30 DAS but it was on par with HN-46 with RDF + Seed treatment with 0.5% $ZnSO_4$ & $FeSO_4$ each + Foliar application of 0.5% $ZnSO_4$ and $FeSO_4$ each at 30 DAS, HN-7 with RDF + Seed treatment with 0.5% $ZnSO_4$ & $FeSO_4$ each + Foliar application of 0.5% $ZnSO_4$ and $FeSO_4$ each at 30 DAS, HN-7 with RDF + Soil application of $ZnSO_4$ @ 15 kg ha$^{-1}$ & $FeSO_4$ @ 10 kg ha$^{-1}$ + Foliar application of 0.5% $ZnSO_4$ and $FeSO_4$ each 30 DAS and HN-46 with RDF + Soil application of $ZnSO_4$ @ 15 kg ha$^{-1}$ & $FeSO_4$ @ 10 kg ha$^{-1}$ + Foliar application of 0.5% $ZnSO_4$ and $FeSO_4$ each 30 DAS (Table 1 and 2). The increase in the yield attributes could be due to continuous supply of micronutrients (Zn and Fe) to the crop at different intervals through the soil application, seed treatment, foliar application and their combinations. Zn and Fe are part of the photosynthesis, assimilation and translocation of photosynthates from source (leaves) to sink (ear head) (Singh et al., 1995). The results are in conformity with the findings of Adsul et al. (2011), Dhaliwal et al. (2012), Debroy et al. (2013), Olusengun et al. (2014) and Mosanna and Ebrahim (2015).

**Economics of foxtail millet production as influenced agronomic fortification**

Among the micronutrient applications significantly higher B:C ratio (2.73) recorded in the treatment RDF + Seed treatment with 0.5% $ZnSO_4$ & $FeSO_4$ each + Foliar application of 0.5% $ZnSO_4$ and $FeSO_4$ each at 30 DAS and lower B:C ratio (2.30) have been noticed in Control. The interaction of HN-46 with RDF + Seed treatment with 0.5% $ZnSO_4$ & $FeSO_4$ each + Foliar application of 0.5% $ZnSO_4$ and $FeSO_4$ each at 30 DAS recorded highest B:C ratio (2.81) and it was on par with HN-7 with RDF + Seed treatment with 0.5% $ZnSO_4$ & $FeSO_4$ each + Foliar application of 0.5% $ZnSO_4$ and $FeSO_4$ each at 30 DAS (2.79) (Table 3). Combined application of zinc and iron through seed treatment and foliar application gives better growth and yield parameters due to the application of micronutrients at different growth stages through different methods over sole application. Even though higher grain and stover yield (Table 4.) recorded in the RDF + Soil application of $ZnSO_4$ at 15 kg ha$^{-1}$ and $FeSO_4$ at 10 kg ha$^{-1}$ + Foliar application of 0.5% $ZnSO_4$ and $FeSO_4$ each 30 DAS. But higher B:C ratio recorded in RDF + Seed treatment with 0.5 % $ZnSO_4$ & $FeSO_4$ each + Foliar application of 0.5 % $ZnSO_4$ and $FeSO_4$ each at 30 DAS due to comparatively least cost of cultivation and at par grain and stover yield with RDF + Soil application of $ZnSO_4$ at 15 kg ha$^{-1}$ and $FeSO_4$ at 10 kg ha$^{-1}$ + Foliar application of 0.5% $ZnSO_4$ and $FeSO_4$ each 30 DAS. Similar findings were noticed by Yadav et al. (2011), Durgude et al. (2013) and Meena et al. (2013).

**Table 1: Number of ear heads plant$^{-1}$, length of ear head (cm) and weight of ear head (g) of foxtail millet as influenced by genotypes and agronomic fortification**

| | Number of ear heads plant$^{-1}$ | | | | Length of ear head (cm) | | | | Weight of ear head (g) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **$G_1$** | **$G_2$** | **$G_3$** | **Mean** | **$G_1$** | **$G_2$** | **$G_3$** | **Mean** | **$G_1$** | **$G_2$** | **$G_3$** | **Mean** |
| **$M_1$** | 2.47 | 2.37 | 2.45 | **2.43** | 17.03 | 17.48 | 17.81 | **17.44** | 7.02 | 7.10 | 7.13 | **7.08** |
| **$M_2$** | 2.70 | 2.68 | 2.83 | **2.74** | 18.22 | 18.42 | 18.12 | **18.25** | 7.40 | 7.42 | 7.24 | **7.35** |
| **$M_3$** | 3.13 | 3.03 | 3.40 | **3.19** | 18.92 | 19.03 | 20.83 | **19.59** | 7.58 | 7.71 | 8.88 | **8.05** |
| **$M_4$** | 3.15 | 3.12 | 3.87 | **3.38** | 20.25 | 19.95 | 21.90 | **20.70** | 8.16 | 8.66 | 9.05 | **8.62** |
| **$M_5$** | 3.81 | 3.92 | 3.20 | **3.64** | 23.83 | 24.06 | 21.88 | **23.26** | 9.78 | 9.92 | 9.04 | **9.58** |
| **$M_6$** | 4.22 | 4.26 | 3.71 | **4.06** | 25.32 | 25.46 | 23.57 | **24.78** | 11.29 | 11.43 | 10.48 | **11.06** |
| **$M_7$** | 4.18 | 4.15 | 4.32 | **4.21** | 25.06 | 24.94 | 25.73 | **25.25** | 11.09 | 10.89 | 11.49 | **11.16** |
| **Mean** | **3.38** | **3.36** | **3.40** | **3.38** | **21.23** | **21.34** | **21.41** | **21.32** | **8.90** | **9.02** | **9.04** | **8.99** |
| | **S.Em±** | | **C D (P=0.05)** | | **S.Em±** | | **C D (P=0.05)** | | **S.Em±** | | **C D (P=0.05)** | |
| Main plot | 0.06 | | 0.25 | | 0.22 | | NS | | 0.06 | | NS | |
| Sub plot | 0.07 | | 0.21 | | 0.19 | | 0.55 | | 0.16 | | 0.44 | |
| Interaction | 0.13 | | 0.35 | | 0.33 | | 0.93 | | 0.27 | | 0.75 | |

**Main plot : Genotypes (G)**

**$G_1$:** HN-7 (low in Fe and Zn)

**$G_2$:** HN-46 (medium in Fe and high in Zn)

**$G_3$:** Sia-2644 (high in Fe and medium in Zn)

**Sub plot : Micro nutrients application (M)**

**$M_1$**: RDF (control)

**$M_2$**: RDF + Seed treatment with 0.5 % $ZnSO_4$ & $FeSO_4$ each

**$M_3$**: RDF + Soil application of $ZnSO_4$ @ 15 kg ha$^{-1}$ and $FeSO_4$ @ 10 kg ha$^{-1}$

**$M_4$**: RDF + Foliar application of 0.5 % $ZnSO_4$ and $FeSO_4$ each at 30 DAS

**$M_5$**: RDF + Seed treatment + Soil application ($M_2 + M_3$)

**$M_6$**: RDF + Seed treatment + Foliar application ($M_2 + M_4$)

**$M_7$**: RDF + Soil application + Foliar application ($M_3 + M_4$)

**RDF :** 30:15:15 kg N, $P_2O_5$ and $K_2O$ ha$^{-1}$ + FYM @ 2.5 t ha$^{-1}$

**Table 2: Grain weight (g plant$^{-1}$) and 1000 grain weight of foxtail millet as influenced by genotypes and agronomic fortification**

| | Grain weight (g plant$^{-1}$) | | | | 1000 grain weight (g) | | | |
|---|---|---|---|---|---|---|---|---|
| | **$G_1$** | **$G_2$** | **$G_3$** | **Mean** | **$G_1$** | **$G_2$** | **$G_3$** | **Mean** |
| **$M_1$** | 5.06 | 5.12 | 5.46 | **5.21** | 4.45 | 4.58 | 4.65 | **4.56** |
| **$M_2$** | 6.67 | 6.52 | 6.41 | **6.53** | 4.69 | 4.77 | 4.85 | **4.77** |
| **$M_3$** | 7.64 | 7.86 | 8.36 | **7.95** | 5.05 | 4.84 | 4.90 | **4.93** |
| **$M_4$** | 8.22 | 8.18 | 8.60 | **8.33** | 5.55 | 5.25 | 5.36 | **5.39** |
| **$M_5$** | 9.06 | 9.09 | 8.35 | **8.83** | 5.62 | 5.65 | 5.55 | **5.60** |
| **$M_6$** | 10.21 | 10.24 | 9.65 | **10.03** | 5.76 | 5.80 | 5.70 | **5.75** |
| **$M_7$** | 10.18 | 10.09 | 10.35 | **10.21** | 5.75 | 5.79 | 5.87 | **5.80** |
| **Mean** | **8.15** | **8.16** | **8.17** | **8.16** | **5.27** | **5.24** | **5.27** | **5.26** |
| | **S.Em±** | | **C D (P=0.05)** | | **S.Em±** | | **C D (P=0.05)** | |
| Main plot | 0.05 | | NS | | 0.03 | | NS | |
| Sub plot | 0.06 | | 0.19 | | 0.06 | | 0.18 | |
| Interaction | 0.11 | | 0.31 | | 0.11 | | NS | |

**Main plot : Genotypes (G)**

**$G_1$:** HN-7 (low in Fe and Zn)

**$G_2$:** HN-46 (medium in Fe and high in Zn)

**$G_3$:** Sia-2644 (high in Fe and medium in Zn)

**Sub plot : Micro nutrients application (M)**

**$M_1$**: RDF (control)

**$M_2$**: RDF + Seed treatment with 0.5 % $ZnSO_4$ & $FeSO_4$ each

**$M_3$**: RDF + Soil application of $ZnSO_4$ @ 15 kg ha$^{-1}$ and $FeSO_4$ @ 10 kg ha$^{-1}$

**$M_4$**: RDF + Foliar application of 0.5 % $ZnSO_4$ and $FeSO_4$ each at 30 DAS

**$M_5$**: RDF + Seed treatment + Soil application ($M_2 + M_3$)

**$M_6$**: RDF + Seed treatment + Foliar application ($M_2 + M_4$)

**$M_7$**: RDF + Soil application + Foliar application ($M_3 + M_4$)

**RDF :** 30:15:15 kg N, $P_2O_5$ and $K_2O$ ha$^{-1}$ + FYM @ 2.5 t ha$^{-1}$

**Table 3: Economics of foxtail millet production as influenced by different genotypes and agronomic fortification**

| | Cost of cultivation (Rs $ha^{-1}$) | | | | Gross Returns (Rs $ha^{-1}$) | | | | Net Returns (Rs $ha^{-1}$) | | | | B:C | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $G_1$ | $G_2$ | $G_3$ | Mean | $G_1$ | $G_2$ | $G_3$ | Mean | $G_1$ | $G_2$ | $G_3$ | Mean | $G_1$ | $G_2$ | $G_3$ | Mean |
| $M_1$ | 14827 | 14827 | 14827 | **14827** | 33477 | 33512 | 35197 | **34062** | 18650 | 18685 | 20370 | **19235** | 2.26 | 2.26 | 2.37 | **2.30** |
| $M_2$ | 14837 | 14837 | 14837 | **14837** | 35321 | 35838 | 36085 | **35748** | 20484 | 21001 | 21248 | **20911** | 2.38 | 2.42 | 2.43 | **2.41** |
| $M_3$ | 16327 | 16327 | 16327 | **16327** | 35817 | 36476 | 39396 | **37230** | 19490 | 20149 | 23069 | **20903** | 2.19 | 2.23 | 2.41 | **2.28** |
| $M_4$ | 14847 | 14847 | 14847 | **14847** | 36903 | 36725 | 39464 | **37697** | 22056 | 21878 | 24617 | **22850** | 2.49 | 2.47 | 2.66 | **2.54** |
| $M_5$ | 16327 | 16327 | 16327 | **16327** | 39148 | 39403 | 38006 | **38852** | 22821 | 23076 | 21679 | **22525** | 2.40 | 2.41 | 2.33 | **2.38** |
| $M_6$ | 14857 | 14857 | 14857 | **14857** | 41390 | 41746 | 38636 | **40591** | 26533 | 26889 | 23779 | **25734** | 2.79 | 2.81 | 2.60 | **2.73** |
| $M_7$ | 16347 | 16347 | 16347 | **16347** | 40980 | 40747 | 41897 | **41208** | 24633 | 24400 | 25550 | **24861** | 2.51 | 2.49 | 2.56 | **2.52** |
| **Mean** | **15781** | **15871** | **15871** | **-** | **37576** | **37778** | **38383** | **37912** | **22095** | **22296** | **22901** | **22431** | **2.43** | **2.44** | **2.48** | **2.45** |
| | **S.Em±** | | **C D (P=0.05)** | | **S.Em±** | | **C D (P=0.05)** | | **S.Em±** | | **C D (P=0.05)** | | **S.Em±** | | **C D (P=0.05)** | |
| Main plot | - | | - | | 228 | | NS | | 228 | | NS | | 0.01 | | NS | |
| Sub plot | - | | - | | 445 | | 1275 | | 445 | | 1275 | | 0.03 | | 0.08 | |
| Interaction | - | | - | | 770 | | 2153 | | 770 | | 2153 | | 0.05 | | 0.14 | |

**Main plot : Genotypes (G)**

**$G_1$:** HN-7 (low in Fe and Zn)

**$G_2$:** HN-46 (medium in Fe and high in Zn)

**$G_3$:** Sia-2644 (high in Fe and medium in Zn)

**Sub plot : Micro nutrients application (M)**

**$M_1$**: RDF (control)

**$M_2$**: RDF **+** Seed treatment with 0.5 % $ZnSO_4$ & $FeSO_4$ each

**$M_3$**: RDF **+** Soil application of $ZnSO_4$ @ 15 kg $ha^{-1}$ and $FeSO_4$ @ 10 kg $ha^{-1}$

**$M_4$**: RDF **+** Foliar application of 0.5 % $ZnSO_4$ and $FeSO_4$ each at 30 DAS

**$M_5$**: RDF + Seed treatment + Soil application ($M_2 + M_3$)

**$M_6$**: RDF + Seed treatment + Foliar application ($M_2 + M_4$)

**$M_7$**: RDF + Soil application + Foliar application ($M_3 + M_4$)

**RDF :** 30:15:15 kg N, $P_2O_5$ and $K_2O$ $ha^{-1}$ + FYM @ 2.5 t $ha^{-1}$

**Table 4: Grain yield (kg $ha^{-1}$), stover yield (kg $ha^{-1}$) and harvest index (%) of foxtail millet as influenced by genotypes and agronomic fortification**

| | Grain yield (kg $ha^{-1}$) | | | | Stover yield (kg $ha^{-1}$) | | | | Harvest index (%) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $G_1$ | $G_2$ | $G_3$ | Mean | $G_1$ | $G_2$ | $G_3$ | Mean | $G_1$ | $G_2$ | $G_3$ | Mean |
| $M_1$ | 1732 | 1724 | 1846 | **1767** | 8464 | 8549 | 8699 | **8571** | 16.97 | 16.79 | 17.49 | **17.08** |
| $M_2$ | 1835 | 1872 | 1896 | **1868** | 8867 | 8916 | 8886 | **8890** | 17.13 | 17.35 | 17.57 | **17.35** |
| $M_3$ | 1874 | 1935 | 2148 | **1986** | 8883 | 8837 | 9083 | **8934** | 17.41 | 17.96 | 19.12 | **18.16** |
| $M_4$ | 1953 | 1944 | 2150 | **2015** | 8980 | 8934 | 9109 | **9008** | 17.86 | 17.87 | 19.09 | **18.27** |
| $M_5$ | 2117 | 2134 | 2035 | **2095** | 9165 | 9196 | 9057 | **9139** | 18.76 | 18.83 | 18.34 | **18.64** |
| $M_6$ | 2285 | 2309 | 2076 | **2223** | 9313 | 9358 | 9149 | **9274** | 19.69 | 19.78 | 18.49 | **19.32** |
| $M_7$ | 2256 | 2239 | 2321 | **2272** | 9274 | 9255 | 9363 | **9298** | 19.56 | 19.47 | 19.85 | **19.63** |
| **Mean** | **2007** | **2022** | **2067** | **2032** | **8993** | **9006** | **9049** | **9016** | **18.20** | **18.29** | **18.56** | **18.35** |
| | **S.Em±** | | **C D (P=0.05)** | | **S.Em±** | | **C D (P=0.05)** | | **S.Em±** | | **C D (P=0.05)** | |
| Main plot | 18 | | NS | | 28 | | NS | | 0.12 | | NS | |
| Sub plot | 38 | | 108 | | 26 | | 76 | | 0.29 | | 0.84 | |
| Interaction | 65 | | 182 | | 46 | | 128 | | 0.50 | | NS | |

**Main plot : Genotypes (G)**

**$G_1$:** HN-7 (low in Fe and Zn)

**$G_2$:** HN-46 (medium in Fe and high in Zn)

**$G_3$:** Sia-2644 (high in Fe and medium in Zn)

**Sub plot : Micro nutrients application (M)**

**$M_1$**: RDF (control)

**$M_2$**: RDF **+** Seed treatment with 0.5 % $ZnSO_4$ & $FeSO_4$ each

**$M_3$**: RDF **+** Soil application of $ZnSO_4$ @ 15 kg $ha^{-1}$ and $FeSO_4$ @ 10 kg $ha^{-1}$

**$M_4$**: RDF **+** Foliar application of 0.5 % $ZnSO_4$ and $FeSO_4$ each at 30 DAS

**$M_5$**: RDF + Seed treatment + Soil application ($M_2 + M_3$)

**$M_6$**: RDF + Seed treatment + Foliar application ($M_2 + M_4$)

**$M_7$**: RDF + Soil application + Foliar application ($M_3 + M_4$)

**RDF :** 30:15:15 kg N, $P_2O_5$ and $K_2O$ $ha^{-1}$ + FYM @ 2.5 t $ha^{-1}$

## CONCLUSION

Millets are considered as the underutilised crops, they are restricted to the poor fertile and marginal soils, where most of the nutrients are deficient. Among the micronutrients Zinc and Iron are most deficient in Indian soil. Hence, application of these micronutrients along with the RDF will increases the yield and in turn assures better monetary returns. The treatment, RDF + Soil application of $ZnSO_4$ at 15 kg $ha^{-1}$ and $FeSO_4$ at 10 kg $ha^{-1}$ + Foliar application of 0.5% $ZnSO_4$ and $FeSO_4$ each at 30 DAS gives better yield attributes, whereas higher B:C ratio recorded in the treatment RDF + Seed treatment with 0.5% $ZnSO_4$ & $FeSO_4$ each + Foliar application of 0.5% $ZnSO_4$ and $FeSO_4$ each at 30 DAS.

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