



Performance of finger millet varieties to different levels of fertilizer on yield and soil properties in sub-montane zone of Maharashtra

R.D. NIGADE* AND S.M. MORE

Department of Agronomy, Zonal Agricultural Research Station, NARP, KOLHAPUR (M.S.) INDIA
(Email : ramnigade@gmail.com)

Abstract : Field experiments were conducted at the Zonal Agricultural Research Station, NARP., Shenda Park, Kolhapur (Maharashtra) during *Kharif* season of three years of 2009 to 2011 to study the response of finger millet varieties to different levels of fertilizer on crop yield and soil properties. The results revealed that, on shallow and lighter type of soils in IX rainfall situation under sub-montane zone of Maharashtra, for obtaining highest grain and straw yield, the long duration varieties should be fertilized with the recommended dose of fertilizer (60:30:00 kg NPK ha⁻¹). The medium duration varieties showed good response to application of 75 per cent of recommended dose.

Key Words : Fertilizer, Finger millet, Rainfed, Low fertility

View Point Article : Nigade, R.D. and More, S.M. (2013). Performance of finger millet varieties to different levels of fertilizer on yield and soil properties in sub-montane zone of Maharashtra. *Internat. J. agric. Sci.*, **9**(1): 256-259.

Article History : Received : 25.08.2012; Revised : 25.10.2012; Accepted : 08.12.2012

INTRODUCTION

Nutrient absorption pattern of the plant and its efficient utilization of the applied nutrients are necessary for obtaining the economical returns. Finger millet (*Eleusine coracana* L.) locally called as Nagli/ Nachni/ Ragi is the most important crop grown in Maharashtra State, which gives good response to applied fertilizers. The yield of finger millet is very low in the state as the crop is mostly grown along the hill sides on sloppy land on light textured soils. It is also coupled with negligence in adoption of improved package of practices viz., variety, use of balance fertilizer, proper sowing time, spacing etc. In recent years much emphasis has been given for use of fertilizers to produce adequate amount of high quality food. Such nutrient supply system helps for maintenance and possibly improvement of soil fertility for sustaining crop productivity on long term basis (Babalad, 1999).

The low yield in cereals in the Entisols under rainfed conditions mainly attributed to poor nutrient status of soil, limited use of nitrogenous fertilizer either through chemical or

organic sources coupled with insufficient moisture during crop growth period. Keeping in view these facts, the experiments were conducted to study the performance of finger millet genotypes to different levels of fertilizer.

MATERIALS AND METHODS

Field experiments were conducted during *Kharif* season of 2009, 2010 and 2011 under rainfed condition at the Zonal Agricultural Research Station, Shenda Park, Kolhapur (Maharashtra). The experimental site was silty clay with pH 7.20, E.C. 0.10 dSm⁻¹, organic carbon 0.35 per cent, available N 228.0, P₂O₅ 19.7 and K₂O 109.6 kg ha⁻¹. The row spacing of 30 cm were kept for finger millet crop and was sown by dibbling method. The thinning was done at 15 days after sowing and only two healthy plants was kept per hill by maintaining the distance of 10 cm within the plants. The experiment was laid out in Split Plot Design with three replications. Four levels of fertilizer (0, 50, 75 and 100% of RDF) were assigned to main plots and six finger millet genotypes were assigned as sub

* Author for correspondence

plot (KOPN 235, PR 202, Dapoli 1, GPU 28, VL 149, VR 708). Recommended dose of fertilizers for finger millet is 60: 30: 00 kg NPK ha⁻¹ for sub montane zone of Maharashtra. The 50 per cent of nitrogen was applied through urea as per treatment and 30 kg P₂O₅/ha was applied through single super phosphate as basal dose; remaining 50 per cent of nitrogen was applied as top dressing at one month after sowing. The seed was treated with biofertilizers (*Azospirillum brasilense* + *Aspergillus awamuri*) as seed treatment to all the treatments. The gross plot size was 4.50 x 3.0 m² with the net plot of 4.20 x 2.40 m². The crop was sown on 30th, 23rd, and 30th June in 2009, 2010 and 2011, respectively. Necessary plant protection measures were adopted to protect the crop from pest and diseases. The interculturing operations *viz.*, two weeding followed by one hoeing was adopted. Rainfall received during the crop growth period was 943.1, 1029.0, and 983.9 mm during 2009, 2010 and 2011 in 56, 59 and 78 rainy days respectively. Grain and straw yield as well as growth and yield attributing characters were recorded at appropriate growth stages.

RESULTS AND DISCUSSION

The experimental findings obtained from the present study have been discussed in following heads:

Growth parameters :

Effect of fertilizer levels :

The data presented in Table 1 indicated that, the significantly highest plant height (87.4 cm), number of tillers (3.2), length of finger (6.4 cm), number of finger per ear (6.6) and thousand grain weight (3.015 g) was recorded with

application of recommended dose of fertilizers. However, it was at par with the application of 75 per cent recommended dose of fertilizers. These results corroborates with the findings of Chavan *et al.* (1995), Maitra *et al.* (2001) and Basavrajappa *et al.* (2002) who reported the higher values of yield contributing characters with higher application of N and P doses through chemical fertilizer.

Effect of varieties :

The significantly highest plant height (86.4 cm) and thousands grain weight (3.013 g) was recorded with the variety KOPN 235. However, significantly highest number of tillers (3.2), length of finger (6.6 cm) and number of fingers (6.6) was observed with the variety GPU 28.

Interaction effects :

The interaction effects between different fertilizer levels and different genotypes were found to be non significant.

Grain and straw yield :

The pooled grain and straw yield data are presented in Table 2.

Effect of fertilizers levels :

The highest grain and straw yield (19.42 and 26.22 q ha⁻¹, respectively) was recorded with the 100 per cent application of recommended dose of fertilizer and was significantly superior over 75 per cent, 50 per cent of recommended dose of fertilizers and absolute control. Roy *et al.* (2001), Bhoite and Nimbalkar (1995) and Bhosale *et al.* (1994) reported that, the

Table 1: Pooled data on growth and yield attributing characters of finger millet varieties as influenced by different fertilizer levels (2009-2011)

| Treatments | Plant height (cm) | No. of tillers | Length of finger (cm) | No. of fingers ¹ ear | 1000 grain weight (g) |
|-----------------------------------|-------------------|----------------|-----------------------|---------------------------------|-----------------------|
| Fertilizer levels | | | | | |
| F ₀ - Absolute control | 61.9 | 2.2 | 5.2 | 4.6 | 2.769 |
| F ₁ - 50% RDF | 77.1 | 2.6 | 5.7 | 5.7 | 2.846 |
| F ₂ - 75% RDF | 86.2 | 3.0 | 6.2 | 6.3 | 2.948 |
| F ₃ - 100% RDF | 87.4 | 3.2 | 6.4 | 6.6 | 3.015 |
| S.E.± | 1.0 | 0.12 | 0.18 | 0.07 | 0.035 |
| C.D. 0.05 | 3.6 | 0.41 | 0.64 | 0.23 | 0.120 |
| Varieties | | | | | |
| V ₁ - KOPN 235 | 86.4 | 2.9 | 6.6 | 6.4 | 3.013 |
| V ₂ - PR 202 | 78.5 | 2.6 | 5.4 | 5.9 | 2.910 |
| V ₃ - Dapoli 1 | 75.4 | 2.9 | 5.4 | 5.8 | 2.916 |
| V ₄ - GPU 28 | 85.5 | 3.2 | 6.6 | 6.6 | 3.040 |
| V ₅ - VL 149 | 75.8 | 2.4 | 6.1 | 5.3 | 2.800 |
| V ₆ - VR 708 | 67.3 | 2.5 | 5.6 | 4.9 | 2.686 |
| S.E.± | 0.8 | 0.06 | 0.15 | 0.09 | 0.030 |
| C.D. 0.05 | 2.4 | 0.16 | 0.44 | 0.25 | 0.085 |
| Interaction (A x B) | | | | | |
| S.E.± | 1.7 | 0.11 | 0.31 | 0.17 | 0.060 |
| C.D. 0.05 | 4.8 | 0.32 | 0.88 | 0.49 | 0.170 |
| C.V. % | 5.65 | 8.27 | 13.39 | 5.13 | 5.10 |

grain and straw yield of finger millet increased significantly with the subsequent increase in nitrogen levels.

Effect of varieties :

The variety KOPN 235 recorded the significantly highest grain (18.31q ha⁻¹) over PR 202, Dapoli 1, VL 149 and VR 708 and it was at par with GPU 28. However, the highest straw yield (25.29 q ha⁻¹) was recorded with the GPU 28 which was significantly superior over rest of the varieties except KOPN 235. Nigade *et al.* (2011) reported that, the long and medium duration variety responses to higher level of fertilizer application.

Interaction effects :

The interaction effects due to fertilizer levels and varieties were found to be significant (Table 3). The long duration variety KOPN 235 recorded the significantly highest grain and straw yield (24.55 and 32.83 q ha⁻¹, respectively) with the application of recommended dose of fertilizer. The grain and straw yield recorded with the application of 75 per cent of recommended dose of fertilizer (21.36 and 29.54 q ha⁻¹, respectively) was significantly highest over the medium duration variety GPU 28. Bhoite and Nimbalkar (1995) reported that, the variety PR 202 recorded highest grain and straw yield

Table 2: Pooled data on grain and straw yield (q/ha) of finger millet varieties as influenced by different fertilizer levels

| Treatments | Grain yield (q ha ⁻¹) | | | Pooled Mean | Straw yield (q ha ⁻¹) | | | Pooled Mean |
|-----------------------------------|-----------------------------------|-------|-------|-------------|-----------------------------------|-------|-------|-------------|
| | 2009 | 2010 | 2011 | | 2009 | 2010 | 2011 | |
| Fertilizer levels | | | | | | | | |
| F ₀ - Absolute control | 10.06 | 9.55 | 9.30 | 9.64 | 14.45 | 12.94 | 13.04 | 13.48 |
| F ₁ - 50% RDF | 14.31 | 14.47 | 14.02 | 14.27 | 20.59 | 19.60 | 17.43 | 19.20 |
| F ₂ - 75% RDF | 16.22 | 17.18 | 17.72 | 17.04 | 23.50 | 22.64 | 23.29 | 23.14 |
| F ₃ - 100% RDF | 19.06 | 19.55 | 19.66 | 19.42 | 26.34 | 26.48 | 25.83 | 26.22 |
| S.E.± | 0.44 | 0.72 | 0.73 | 0.29 | 0.59 | 1.00 | 0.91 | 0.46 |
| C.D. 0.05 | 1.53 | 2.49 | 2.51 | 1.02 | 2.03 | 3.46 | 3.17 | 1.58 |
| Varieties | | | | | | | | |
| V ₁ - KOPN 235 | 17.32 | 19.62 | 18.00 | 18.31 | 23.79 | 26.57 | 25.35 | 25.23 |
| V ₂ - PR 202 | 16.28 | 15.56 | 14.60 | 15.48 | 22.80 | 20.17 | 18.96 | 20.65 |
| V ₃ - Dapoli 1 | 14.74 | 15.35 | 14.63 | 14.91 | 21.33 | 20.33 | 17.95 | 19.87 |
| V ₄ - GPU 28 | 18.52 | 17.41 | 18.38 | 18.10 | 26.81 | 24.01 | 25.06 | 25.29 |
| V ₅ - VL 149 | 12.80 | 13.19 | 13.48 | 13.16 | 18.29 | 17.81 | 16.57 | 17.56 |
| V ₆ - VR 708 | 9.81 | 9.98 | 11.96 | 10.58 | 14.29 | 13.57 | 15.51 | 14.46 |
| S.E.± | 1.19 | 0.77 | 0.76 | 0.34 | 1.71 | 1.09 | 1.09 | 0.49 |
| C.D. 0.05 | 3.39 | 2.20 | 2.17 | 0.96 | 4.88 | 3.11 | 3.13 | 1.41 |
| Interaction (AxB) | | | | | | | | |
| S.E.± | 2.21 | 1.54 | 1.52 | 0.67 | 3.17 | 2.18 | 2.19 | 0.99 |
| C.D. 0.05 | NS | NS | 4.35 | 1.92 | NS | NS | 6.26 | 2.83 |
| C.V. % | 12.58 | 17.52 | 17.40 | 8.29 | 11.76 | 18.49 | 19.51 | 9.42 |

Table 3 : Pooled data on grain and straw yield (q ha⁻¹) of finger millet as influenced by interaction effects between different varieties x fertilizer levels (2009 - 2011)

| Treatments | Grain yield (q ha ⁻¹) | | | | | | Mean | Straw yield (q ha ⁻¹) | | | | | | Mean | |
|---------------------------|-----------------------------------|--------|----------|--------|--------|--------|-----------|-----------------------------------|--------|----------|--------|--------|--------|--------|-----------|
| | KOPN 235 | PR 202 | Dapoli 1 | GPU 28 | VL 149 | VR 708 | | KOPN 235 | PR 202 | Dapoli 1 | GPU 28 | VL 149 | VR 708 | | |
| F ₀ - Control | 12.12 | 9.17 | 8.90 | 11.61 | 8.97 | 7.05 | 9.64 | 16.53 | 12.58 | 12.24 | 16.56 | 12.23 | 10.73 | 13.48 | |
| F ₁ -50% RDF | 16.72 | 15.32 | 14.48 | 17.02 | 12.44 | 9.61 | 14.27 | 24.18 | 20.97 | 18.42 | 23.34 | 15.69 | 12.62 | 19.20 | |
| F ₂ - 75% RDF | 19.86 | 16.60 | 17.07 | 21.36 | 15.03 | 12.34 | 17.04 | 27.39 | 21.61 | 23.22 | 29.54 | 20.52 | 16.58 | 23.14 | |
| F ₃ - 100% RDF | 24.55 | 20.84 | 19.18 | 22.42 | 16.20 | 13.33 | 19.42 | 32.83 | 27.44 | 25.59 | 31.72 | 21.81 | 17.90 | 26.22 | |
| Mean | 18.31 | 15.48 | 14.91 | 18.10 | 13.16 | 10.58 | 15.09 | 25.23 | 20.65 | 19.87 | 25.29 | 17.56 | 14.46 | 20.51 | |
| Source | S.E. ± | | | | | | C.D. 0.05 | Source | | | | | | S.E. ± | C.D. 0.05 |
| Fertilizer | 0.29 | | | | | | 1.02 | Fertilizer | | | | | | 0.46 | 1.58 |
| Varieties | 0.34 | | | | | | 0.96 | Varieties | | | | | | 0.49 | 1.41 |
| V x F | 0.67 | | | | | | 1.92 | V x F | | | | | | 0.99 | 2.83 |
| F x V | 0.68 | | | | | | 1.95 | F x V | | | | | | 1.01 | 2.89 |

Table 4: Mean data of soil properties and nutrient contents and uptake after harvest of finger millet crop as influenced by different fertilizer levels (2009 - 2011)

| Treatments | pH | E.C. (dSm ⁻¹) | O.C. % | Available nutrients (kg ha ⁻¹) | | | Plant nutrient uptake (kg ha ⁻¹) | | |
|-----------------------------------|------|---------------------------|--------|--|------|-------|--|------|-------|
| | | | | N | P | K | N | P | K |
| Fertilizer levels | | | | | | | | | |
| F ₀ - Absolute control | 6.7 | 0.08 | 0.35 | 142.7 | 17.8 | 108.1 | 20.3 | 8.2 | 53.0 |
| F ₁ - 50% RDF | 6.8 | 0.08 | 0.37 | 153.9 | 18.6 | 108.8 | 20.8 | 12.3 | 79.9 |
| F ₂ - 75% RDF | 6.6 | 0.08 | 0.38 | 193.8 | 18.9 | 107.8 | 38.9 | 15.6 | 101.0 |
| F ₃ - 100% RDF | 6.7 | 0.09 | 0.39 | 223.0 | 19.7 | 109.6 | 43.3 | 17.3 | 112.1 |
| S.E. ± | 0.06 | 0.004 | 0.005 | 1.44 | 0.20 | 1.09 | 0.78 | 0.20 | 1.04 |
| C.D. 0.05 | NS | NS | NS | 5.01 | 0.68 | NS | 2.71 | 0.70 | 3.59 |
| Varieties | | | | | | | | | |
| V ₁ - KOPN 235 | 6.7 | 0.08 | 0.36 | 171.0 | 18.6 | 109.9 | 39.3 | 15.8 | 102.6 |
| V ₂ - PR 202 | 6.8 | 0.07 | 0.38 | 176.2 | 18.9 | 107.5 | 32.1 | 12.9 | 83.2 |
| V ₃ - Dapoli 1 | 6.8 | 0.08 | 0.38 | 181.6 | 18.8 | 107.6 | 32.2 | 12.8 | 83.4 |
| V ₄ - GPU 28 | 6.6 | 0.08 | 0.36 | 175.3 | 18.7 | 107.7 | 40.4 | 16.2 | 104.7 |
| V ₅ - VL 149 | 6.6 | 0.08 | 0.37 | 182.7 | 18.7 | 108.8 | 29.6 | 11.9 | 76.8 |
| V ₆ - VR 708 | 6.8 | 0.07 | 0.38 | 183.4 | 18.8 | 109.8 | 26.3 | 10.5 | 68.2 |
| S.E. ± | 0.09 | 0.004 | 0.006 | 1.12 | 0.34 | 0.82 | 0.99 | 0.32 | 1.61 |
| C.D. 0.05 | NS | NS | NS | 3.21 | NS | NS | 2.85 | 0.92 | 4.59 |
| Interaction (AxB) | | | | | | | | | |
| S.E. ± | 0.18 | 0.008 | 0.01 | 2.51 | 0.66 | 1.85 | 1.99 | 0.62 | 3.11 |
| C.D. 0.05 | NS | NS | NS | NS | NS | NS | 5.70 | 1.78 | NS |
| C.V. % | 4.75 | 16.66 | 5.45 | 3.44 | 6.36 | 4.28 | 9.96 | 8.38 | 6.44 |

with the application of higher doses of nitrogen.

Soil studies :

The data in Table 4 on physico chemical properties of soil after harvest of finger millet showed that, the soil parameters namely pH, EC and organic carbon did not differ amongst the treatments due to different fertilizer level and varieties.

The significantly highest available nitrogen and phosphorus was observed with the 100 per cent application of recommended dose of fertilizer. The available potassium content did not differ amongst the treatments. The data on plant uptake showed that, the significantly highest uptake of NPK observed with the 100 per cent application of recommended dose of fertilizer. Amongst the varieties the significantly highest NPK uptake was recorded by the variety GPU 28 over rest of the varieties except variety KOPN 235 which was at par. The results are in conformity with the findings of Roy *et al.* (2001) and Basavrajappa *et al.* (2002).

From these studies it was concluded that for obtaining highest grain and straw yield the long duration varieties should be fertilized with the recommended dose of fertilizer (60:30:00 kg NPK ha⁻¹). The medium duration varieties showed good response to application of 75 per cent of recommended dose of fertilizer.

REFERENCES

Babalad, H.B. (1999). Integrated nutrient management in soybean based cropping systems. Ph.D. Thesis, University of Agricultural sciences, Dharwad, KARNATAKA (INDIA).

Basavarajapp, R., Prabhakar, A.S. and Halikatti, S.I. (2002). Effect of tillage, organics, nitrogen and their interactions on yield attributes and yield of foxtail millet (*Sataria italica*) under shallow alfisol during rainy season. *Indian J. Agron.*, **47** (3): 390-397.

Bhoite, S.V. and Nimbalkar. V.S. (1995). Response of finger millet cultivation to nitrogen and phosphorus under rainfed condition. *J. Maharashtra Agric. Univ.*, **20** (2): 189-190.

Bhosale, A.S., Patil, B.R. and Kumbhojkar, B.D. (1994). Response of rainfed finger millet to graded levels of fertilizers. *J. Maharashtra Agric. Univ.*, **19**(2) 228-230

Chavan, A.P., Chavan, S.A. and Khanvilkar, S.A. (1995). Response of finger millet nitrogen, methods of fertilizer application and age of seedlings at transplanting. *J. Maharashtra Agric. Univ.*, **20** (3) 466-467.

Maitra, S., Ghosh, D.C. Soundu, G. and Jana, P.K. (2001). Performance of intercropping legumes in finger millet (*Eleusine coracana*) at varying fertility levels. *Indian J. Agron.*, **46** (1): 38-44.

Nigade, R.D., Jadhav, B.S. and Bhosale, A.S. (2011). Response of finger millet long duration variety to different levels of nitrogen under rainfed conditions. *Internat. J. Agric. Sci.*, **7**(1): 152-155.

Roy, D.K., Chakraborty, T., Sound, G. and Maitra, S. (2001). Effect of fertility levels and plant population on yield and uptake of nitrogen, phosphorus and potassium in finger millet of West Bengal. *Indian J. Agron.*, **46** (4): 707-711.

*_*_*_*_*_*_*_*_*_*