**System of ragi intensification for getting higher grain yield, Nutrient uptake and Economics on ragi crop as influenced by Age of seedlings and Crop geometry**

**Abstract**

Finger millet is called as drought man crop, owing to its capability to withstand water stress, nutrition stress and warming stress. The productivity of finger millet under dry land conditions is low owing to low yielding varieties and poor management practices. Method of planting or establishment and planting geometry plays important role in harnessing the resources to fullest potential. A study was carried out at Agricultural and Horticultural Research Station, Honnavile to evaluate the performance of rainfed finger millet (Var. ML-365) in system of ragi intensification, SRI) of planting at different crop geometry (One to two seedlings per hill, guni method) during the *kharif* season in 2024-25. The experiment was assigned twelve treatments, laid out in split plot design with three replications. The treatments included: Main plots: 3 Age of seedlings; M1: 14 days old seedlings, M2: 21 days old seedlings, M3: 28 days old seedlings in ‘Guni’ method; Subplots: 4 planting geometries; S1: 20 × 20 cm, S2: 25 × 25 cm, S3: 30 × 30 cm, S4: 35× 35 cm and S5: 30 x 10 cm. The results showed that number of ear heads, finger length and ear head weight were significantly higher in 28 DAT (Days after transplanting) compared to 14 & 21 DAT. The grain yield (3017 kg ha-1), straw yield (4801.20 kg ha-1) were significantly enhanced by 28 DAT compared to different age of transplanting combinations but in case of crop geometry, 35x35 cm recorded highest grain yield (2718.67 kg ha-1) and straw yield (4222.67 kg ha-1). The nutrient uptake (N, P and K) and B-C ratio were also higher in ‘guni’ method at 28 DAT and 35 x 35 cm spacing geometry but N availability after the harvest of the crop was lower in 35 x 35 cm spacing compared to other planting geometry. Hence, it can be concluded that transplanting of 28 days old seedlings in ‘guni’ method with 35 × 35 cm spacing performed better than mere transplanting of 14 & 21 days old seedlings in finger millet to achieve higher yield and straw yield.

**Keywords:** Economics, Finger millet, ‘Guni’ method, Plant Uptake, Yield attributes, Yield.

# INTRODUCTION

Finger millet (*Eleusine coracana*) is an [annual herbaceous plant](https://en.wikipedia.org/wiki/Annual_plant) widely grown as a [cereal](https://en.wikipedia.org/wiki/Cereal) crop in the [arid](https://en.wikipedia.org/wiki/Arid) and [semiarid](https://en.wikipedia.org/wiki/Semi-arid_climate) areas in [Africa](https://en.wikipedia.org/wiki/Africa) and [Asia](https://en.wikipedia.org/wiki/Asia). It is a [tetraploid](https://en.wikipedia.org/wiki/Tetraploid) and [self-pollinating](https://en.wikipedia.org/wiki/Self-pollination) species probably evolved from its wild relative *Eleusine africana*. Finger millet is native to the [Ethiopian](https://en.wikipedia.org/wiki/Ethiopian_Highlands) and [Ugandan](https://en.wikipedia.org/wiki/Uganda) highlands. Interesting crop characteristics of finger millet are the ability to withstand cultivation at altitudes over 2,000 metres (6,600 ft) above sea level, its high drought tolerance, and the long storage time of the grains. Finger millet is a staple grain in many parts of India, especially [Karnataka](https://en.wikipedia.org/wiki/Karnataka), where it is known as ragi. It is malted and its grain is [ground](https://en.wikipedia.org/wiki/Mill_%28grinding%29) into [flour](https://en.wikipedia.org/wiki/Flour).

Planting method varies among farmers according to their choice; leisure period, labour availability and wage rates etc. The most practiced method in finger millet is broadcasting and random transplanting. There is uneven distribution of plants which causes the competition among plants for moisture and nutrients. Yield enhancement in finger millet is possible when cultivated with SCI, because there is less competition among plants and weed, plants can utilize below and above ground resources efficiently (Bhatta et al., 2017). Guni or guli is the vernacular name in Kannada language representing the idea of SCI in finger millet also called as scooping method. In ‘guli’ ragi cultivation, young millet seedlings 28 days old are transplanted into holes spaced 35 x 35 cm in a square grid pattern, two seedlings per hole. Guli ragi includes putting a handful of compost or manure into each hole along with the seedlings to boost soil fertility (Adhikari *et al.,* 2018). Further, when the plants are established in a square grid, inter-cultivation between rows is possible in perpendicular directions, not just between rows. It is similar to SRI method of paddy cultivation called as “System of Ragi Intensification”. In the awake of the attempts to popularize this concept and surge in the interest of farmers, a need has risen to generate the scientific data to validate this concept.

Production volume of ragi across India, financial year 2024, Karnataka was the leading producer of ragi (finger millet) in India, with about 865 thousand metric tons. It was followed by the states of Tamil Nadu and Uttarakhand. Poor germination, often, is the result of inadequate moisture after sowing in low rainfall areas. Under these conditions, the adoption of a simple technique like seed hardening will not only improve germination and subsequent plant stand but also impart early seedling vigour and tolerance to drought. Hence, there is need of intensification of ragi in order to obtain high yield.

**MATERIALS AND METHODS**

A field experiment was conducted Agricultural and Horticultural Research Station, Honnavile to evaluate the performance of rainfed finger millet (Var. ML-365) in system of ragi intensification, SRI) of planting at different crop geometry (One to two seedlings per hill, guni method) during the *kharif* season in 2024-25 in split plot design with three replications. The soil of the experimental site was sandy clay loam in texture, neutral in reaction (pH 7.11), low in organic carbon (0.48 %) and available nitrogen (60 kg ha-1), medium in available phosphorous (30 kg ha-1) and available potassium (30 kg ha-1). Treatments included Main plots; Main plots: 3 Age of seedlings; M1: 14 days old seedlings, M2: 21 days old seedlings, M3: 28 days old seedlings in ‘Guni’ method; Subplots: 4 planting geometries; S1: 20 × 20 cm, S2: 25 × 25 cm, S3: 30 × 30 cm, S4: 35× 35 cm and S5: 30 x 10 cm in finger millet (Var. ML-365).

The experimental field was ploughed under dry condition with tractor drawn disc plough followed by ploughing with cultivator and the clods were broken with rotovator. Finally, the field was uniformly levelled and laid out into experimental plots separated by buffer channels as per the treatments. Direct sowing was taken up as per the treatments on 20th August, 2024. The seeds were line sown evenly on the beds. Powdered FYM was evenly sprinkled to cover the seeds and watering was done at evening hours. After 15 days top dressing was done at 250 g of urea for every seed bed. Seedlings were ready for transplanting at 28 DAS. In M2 treatment i.e., transplanting of the seedlings were taken up in different geometries as per the treatments @ 2-3 seedlings per hill on 20th August, 2024. For ‘guni’ method, the individual plots were uniformly leveled and small gunis or scoops were formed manually using spade at an intersect point of 30 cm × 10 cm, 30 cm × 30 cm, 45 cm × 45 cm and 60 cm × 60 cm spacing. A well rotten FYM @ 1 kg/scoop as spot placement was made to ‘guni’ planting method. On the same day i.e., 12th August, 2019, transplanting of 25 days old seedlings was done in the centre of the ‘guni’ @ 2-3 seedlings per hill. The row to row and plant to plant spacing were kept S1: 20 × 20 cm, S2: 25 × 25 cm, S3: 30 × 30 cm, S4: 35× 35 cm and S5: 30 x 10 cm as per the treatments. Recommended dose of N, P2O5 and K2O (40:30:25 kg ha-1) were applied in the form of urea, single super phosphate and muriate of potash. Half dose of N and full dose of P2O5 and K2O were applied as basal dose. Remaining quantity of nitrogen was applied to soil in two equal splits at tillering and panicle emergence.

Sampling: In order to record the yield parameters in each net plot, five representative plants were randomly selected and tagged. All the successive observations were recorded on the selected plants during the crop growth period. One row on either side of the plot and two plants on either end of each row were harvested as border rows. Besides this, one crop row was ear marked for periodical destructive sampling to estimate leaf area and dry matter production. The remaining plants in the plot were considered as net plot including five tagged plants which were harvested separately and after recording yield was added to net plot yield. The ear heads of finger millet in the net plot were harvested separately for each treatment at harvest stage and dried separately. Then ear heads of each plot were threshed manually, winnowed and cleaned separately. The straw in each net plot was harvested separately and sun dried. The grain and straw weight were recorded and converted to hectare. Experimental data obtained were subjected to statistical analysis adopting Fisher’s method of ‘analysis of variance’ as out lined by Gomez and Gomez (1984).

# RESULTS AND DISCUSSION

**Yield attributes:**

The yield attributes like number of ear heads per square meter, weight of ear head, and length of finger were significantly influenced by establishment method and crop geometry. No. of ear heads per m2: Among the transplanting of different aged seedlings, A3 (28 days old) recorded the highest mean no. of ear heads per m2 (84.12). Among, different crop geometry adopted in transplanting, S5 (30 cm × 10 cm) recorded the higher mean no. of ear heads per m2 (115.23). Among the different combination, S5A3 (Transplanting of 28 days old seedlings with 30 cm × 10 cm crop geometry) recorded the significantly higher number of ear heads (131.00) followed by S3A3 (Transplanting of 28 days old seedlings with 30 cm × 30 cm crop geometry) (71.48). Minimum number of ear heads recorded in S1A1 (Transplanting of 14 days old seedlings with 20 cm × 20 cm crop geometry) (50.00). (Table 1). Weight of ear heads: Among the transplanting of different aged seedlings, A3 (28 days old) recorded the highest mean weight of ear heads (6.97 g). Among, different crop geometry adopted in transplanting, S4 (35 cm × 35 cm) recorded the higher mean weight of ear heads (9.72 g).Higher weight of ear heads recorded in S4A3 (Transplanting of 28 days old seedlings with 35 cm × 35 cm crop geometry) (9.72 g) followed by S3A3 (Transplanting of 28 days old seedlings with 30 cm × 30 cm crop geometry) (7.64 g). Lower weight of ear heads recorded in S1A1 (Transplanting of 14 days old seedlings with 20 cm × 20 cm crop geometry (2.79 g) (Table 1).Number of fingers per ear: Among the transplanting of different aged seedlings, A3 (28 days old) recorded the highest number of fingers per ear (4.79). Among, different crop geometry adopted in transplanting, S4 (35 cm × 35 cm) recorded the higher mean number of fingers per ear (5.58).More number of fingers per ear heads recorded in S4A3 (Transplanting of 28 days old seedlings with 35 cm × 35 cm crop geometry) (5.58) followed by S5A3 (Transplanting of 28 days old seedlings with 30 cm × 10 cm crop geometry) (5.00 g). Lower weight of ear heads recorded in S1A1 (Transplanting of 14 days old seedlings with 20 cm × 20 cm crop geometry (4.10) (Table 1).Length of finger (cm): Among the transplanting of different aged seedlings, A3 (28 days old) recorded the highest mean length of finger (4.73 cm). Among, different crop geometry adopted in transplanting, S4 (35 cm × 35 cm) recorded the higher mean length of finger of 5.34 cm. Maximum of length of fingers recorded in S4A3 (Transplanting of 28 days old seedlings with 35 cm × 35 cm crop geometry) (5.34 cm) followed by S3A3 (Transplanting of 28 days old seedlings with 30 cm × 30 cm crop geometry) (4.79 cm). Minimum length of fingers in ear heads recorded in S1A2 (Transplanting of 41 days old seedlings with 20 cm × 20 cm crop geometry (3.89 cm) (Table 2).

Test weight: There is no much difference in the test weight of grains of different treatment combination (Table 2).Garin yield (kg ha-1): Among the transplanting of different aged seedlings, A3 (28 days old) recorded the highest mean yield of 3017.40 kg/ha. Among, different crop geometry adopted in transplanting, S4 (35 cm × 35 cm) recorded the higher mean yield of 2718 kg/ha.Higher grain yield was recorded in S4A3 (Transplanting of 28 days old seedlings with 35 cm × 35 cm crop geometry) (3541 kg ha-1) followed by S3A3 (Transplanting of 28 days old seedlings with 30 cm × 30 cm crop geometry) (3003.00 kg ha-1). Lower grain yield was recorded in S2A1 (Transplanting of 21 days old seedlings with 25 cm × 25 cm crop geometry (1589 kg ha-1) (Table 3). Straw yield (kg ha-1): Among the transplanting of different aged seedlings, A3 (28 days old) recorded the highest mean straw yield of 4801.20 kg/ha. Among, different crop geometry adopted in transplanting, S3 (30 cm × 30 cm) recorded the higher mean straw yield of 4363.67 kg/ha. Higher straw yield was recorded in S2A3 (Transplanting of 28 days old seedlings with 25 cm × 25 cm crop geometry) (4971 kg ha-1) followed by S1A3 (Transplanting of 28 days old seedlings with 20 cm × 20 cm crop geometry) (4971.00 kg ha-1). Lower straw yield was recorded in S1A1 (Transplanting of 14 days old seedlings with 20 cm × 20 cm crop geometry (3230 kg ha-1) (Table 3).Harvest index: Among the transplanting of different aged seedlings, A3 (28 days old) recorded the highest mean HI of 0.39. Among, different crop geometry adopted in transplanting, S4 (35 cm × 35 cm) recorded the higher mean HI of 0.39.Highest harvesting index was recorded in S4A3 (Transplanting of 28 days old seedlings with 35 cm × 35 cm crop geometry) (0.42) followed by S5A3 (Transplanting of 28 days old seedlings with 30 cm × 10 cm crop geometry) (0.40). Under optimum spaced environment (45 cm × 45 cm), the number of productive tillers per unit area and weight of ear heads were higher on per unit basis eventually which results in production of higher grain yield at the end. These results are also in consonance with the findings of Uphoff (2002) in SRI method of rice cultivation. Harvest index was also higher in guni method and 45 × 45 cm spacing. Roy et al. (2002); Zhu et al. (2002) also reported that planting of finger millet under wider spacing than closer spacing improved canopy photosynthesis, increased the percentage of productive tillers and ear head formation. Adhikari (2016) reported from Odisha that improved varieties of finger millet produced 4.8 tonnes/ha under SCI/SFI management, while local varieties gave 4.2 tonnes/ha with these methods. The highest yield recorded was 6 tonnes/ha. On fertile soils, finger millet yields with SCI methods have been found to average 4.5–4.7 tonnes/ha, a four-fold increase over farmers’ usual yields. In Nepal also, SCI grain yield was 82% higher than with direct- seeding, and 25 % more than transplanting (Bhatta et al., 2017). Natarajan et al. (2019) from Tamil Nadu reported that 30 cm × 30 cm and 25 × 25 cm (wider spacing) was found to give better yields of finger millet in SCI compared to closer spacing i.e., 20 cm × 20 cm.

**To work out the nutrient uptake of effect of different age of seedlings and plant geometry**

Higher nitrogen (109.20 kg ha-1), phosphorus (25.10 kg ha-1) and potassium (78.10 kg ha-1) uptake was evident from S4A3 (transplanting of 28 days old seedlings with 35 cm × 35 cm crop geometry). On the other hand, the significantly lowest nitrogen uptake of 60.00 kg ha-1, phosphorous uptake of 11 kg ha-1 and potassium uptake of 40.10 kg ha-1 was recorded with the treatment combination of S1A1 (direct line sowing with 20 cm × 20 cm).There is no much difference in the pH, EC (d Sm-1), Organic carbon (%) of different treatment combination. The interaction effect between establishment method and crop geometry was not significant with respect to weight of ear head (g), number of fingers per ear head and test weight of finger millet. Ahiwale et al. (2011) also found that the finger millet crop established by transplanting at 20 cm × 15 cm spacing (Thomba method) produced higher ear weight and grain weight per ear. Further, the present results are in consonance with those of Navale (2013).

**To work out the economics of effect of different age of seedlings and plant geometry**

Significantly higher gross returns (₹ 1,15,436.60 ha-1), net returns (₹ 71,701.60 ha-1) and B-C ratio (2.64) was recorded with S4A3 (transplanting of 28 days old seedlings with 35 cm × 35 cm crop geometry) followed by S3A3 (transplanting of 25 days old seedlings 30 cm × 30 cm crop geometry) treatment combination (Table 4). On the other hand, the significantly lowest monetary returns were recorded with the S1A1 combination (direct line sowing with 20 cm × 20 cm).

**Table 1: Yield attributes of finger millet as influenced by methods of establishment and crop geometry.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Treatment** | **Number of ear heads m-2** | **Weight of ear head (g)** | **Number of fingers ear** **head-1** |
| **Establishment method (A)** |
| **Crop geometry (S)** | **A1:14 DAT** | **A2:21 DAT** | **A3:28 DAT** | **Mean** | **A1:14 DAT** | **A2:21 DAT** | **A3:28 DAT** | **Mean** | **A1:14 DAT** | **A2:21 DAT** | **A3:28 DAT** | **Mean** |
| **S1 (**20 × 20 cm) | 50.00 | 60.18 | 70.11 | **60.10** | 2.79 | 3.18 | 2.89 | **2.95** | 4.10 | 4.60 | 3.61 | **4.10** |
| **S2 (**25 × 25 cm) | 51.00 | 62.90 | 78.12 | **64.01** | 6.81 | 5.58 | 6.10 | **6.16** | 4.10 | 4.22 | 4.32 | **4.21** |
| **S3 (**30 × 30 cm) | 56.18 | 79.00 | 79.27 | **71.48** | 7.18 | 7.62 | 8.00 | **7.60** | 4.20 | 4.60 | 4.71 | **4.50** |
| **S4 (**35 × 35 cm) | 30.10 | 42.17 | 62.11 | **44.79** | 9.30 | 10.15 | 9.72 | **9.72** | 5.23 | 5.40 | 6.12 | **5.58** |
| **S5 (**30 × 10 cm) | 98.20 | 116.50 | 131.00 | **115.23** | 7.10 | 7.70 | 8.12 | **7.64** | 4.80 | 5.00 | 5.21 | **5.00** |
| **Mean** | **57.10** | **72.15** | **84.12** |  | **6.64** | **6.85** | **6.97** |  | **4.49** | **4.76** | **4.79** |  |
| **For comparison the mean of** | **SEm±** | **CD(P=0.05)** | **SEm±** | **CD(P=0.05)** | **SEm±** | **CD(P=0.05)** |
| Establishment method (A) | 0.19 | 0.74 | 0.00 | 0.02 | 0.00 | 0.02 |
| Crop geometry (S) | 1.08 | 3.14 | 0.12 | 0.35 | 0.08 | 0.22 |
| Sub plot (S) at same level of main plot (A) | 1.86 | 5.44 | 0.21 | 0.60 | 0.13 | 0.38 |
| Main plot (A) at same level of sub plot (S) | 0.42 | 1.23 | 0.14 | 0.40 | 0.11 | 0.31 |

**Table 2: Grain yield (kg ha-1), Straw yield (kg ha-1) and Harvest Index of finger millet as influenced by methods of establishment and crop geometry**

|  |  |  |  |
| --- | --- | --- | --- |
| **Treatment** | **Grain yield (kg ha-1)** | **Straw yield (kg ha-1)** | **Harvest Index** |
| **Establishment method (A)** |
| **Crop geometry (S)** | **A1** | **A2** | **A3** | **Mean** | **A1** | **A2** | **A3** | **Mean** | **A1** | **A2** | **A3** | **Mean** |
| **S1** | 1957.00 | 2201.00 | 2548.00 | **2235.33** | 3230.00 | 4255.00 | 4951.00 | **4145.33** | 0.38 | 0.34 | 0.34 | 0.35 |
| **S2** | 1589.00 | 2400.00 | 2995.00 | **2328.00** | 3241.00 | 4260.00 | 4971.00 | **4157.33** | 0.33 | 0.36 | 0.38 | 0.36 |
| **S3** | 2018.00 | 2572.00 | 3003.00 | **2531.00** | 4041.00 | 4373.00 | 4677.00 | **4363.67** | 0.33 | 0.37 | 0.39 | 0.36 |
| **S4** | 1998.00 | 2617.00 | 3541.00 | **2718.67** | 3330.00 | 4400.00 | 4938.00 | **4222.67** | 0.38 | 0.37 | 0.42 | 0.39 |
| **S5** | 1600.00 | 2442.00 | 3000.00 | **2347.33** | 3931.00 | 4125.00 | 4469.00 | **4175.00** | 0.29 | 0.37 | 0.40 | 0.35 |
| **Mean** | **1832.40** | **2446.40** | **3017.40** |  | **3554.60** | **4282.60** | **4801.20** |  | 0.34 | 0.36 | 0.39 |  |
| **For comparison the mean of** | **SEm±** | **CD(P=0.05)** | **SEm±** | **CD(P=0.05)** | **SEm±** | **CD(P=0.05)** |
| Establishment method (A) | 6.56 | 25.75 | 6.67 | 26.19 | 0.00 | 0.00 |
| Crop geometry (S) | 39.57 | 115.51 | 67.16 | 196.01 | 0.01 | 0.02 |
| Sub plot (S) at same level of main plot (A) | 68.54 | 200.07 | 116.32 | 339.50 | 0.01 | 0.03 |
| Main plot (A) at same level of sub plot (S) | 2.62 | 7.64 | 3.20 | 9.35 | 0.03 | 0.09 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Treatment** | **Nitrogen uptake (kg ha-1)** | **Phosphorus uptake (kg ha-1)** | **Potassium uptake (kg ha-1)** |
| **Establishment method (A)** |
| **Crop geometry (S)** | **A1** | **A2** | **A3** | **Mean** | **A1** | **A2** | **A3** | **Mean** | **A1** | **A2** | **A3** | **Mean** |
| **S1** | 60.00 | 84.10 | 94.00 | **79.37** | 11.00 | 11.10 | 10.90 | **11.00** | 40.10 | 55.20 | 58.30 | **51.20** |
| **S2** | 61.40 | 85.00 | 105.00 | **83.80** | 12.00 | 17.10 | 23.50 | **17.53** | 44.20 | 60.10 | 73.30 | **59.20** |
| **S3** | 75.20 | 88.20 | 100.10 | **87.83** | 13.10 | 16.20 | 19.80 | **16.37** | 54.00 | 61.90 | 69.80 | **61.90** |
| **S4** | 66.70 | 89.90 | 109.20 | **88.60** | 12.10 | 18.30 | 25.10 | **18.50** | 47.30 | 63.60 | 78.10 | **63.00** |
| **S5** | 69.50 | 77.60 | 95.30 | **80.80** | 12.80 | 14.10 | 17.20 | **14.70** | 50.10 | 56.20 | 60.10 | **55.47** |
| **Mean** | **66.56** | **84.96** | **100.72** |  | **12.20** | **15.36** | **19.30** |  | **47.14** | **59.40** | **67.92** |  |
| **For comparison the mean of** | **SEm±** | **CD (P=0.05)** | **SEm±** | **CD (P=0.05)** | **SEm±** | **CD (P=0.05)** |
| Establishment method (A) | 0.22 | 0.85 | 0.08 | 0.30 | 0.15 | 0.58 |
| Crop geometry (S) | 1.35 | 3.95 | 0.26 | 0.75 | 0.94 | 2.73 |
| Sub plot (S) at same level of main plot (A) | 2.34 | 6.84 | 0.45 | 1.30 | 1.62 | 4.74 |
| Main plot (A) at same level of sub plot (S) | 0.48 | 1.40 | 0.25 | 0.72 | 0.40 | 1.16 |

**Table 3: Nutrient uptake (kg ha-1) of finger millet as influenced by method of establishment and crop geometry at harvest**

|  |  |  |  |
| --- | --- | --- | --- |
| **Treatment** | **Gross returns (**₹**ha-1)** | **Net returns (**₹ **ha-1)** | **B:C ratio** |
| **Establishment method (A)** |
| **Crop geometry (S)** | **A1** | **A2** | **A3** | **Mean** | **A1** | **A2** | **A3** | **Mean** | **A1** | **A2** | **A3** | **Mean** |
| S1 | 63798.20 | 71752.6 | 83064.0 | **72871.87** | 28913.20 | 35016.60 | 39329.80 | **34419.87** | 1.83 | 1.95 | 1.90 | **1.89** |
| S2 | 51801.40 | 78240.0 | 97637.0 | **75892.80** | 16916.40 | 41504.00 | 53902.00 | **37440.80** | 1.48 | 2.13 | 2.23 | **1.95** |
| S3 | 65786.80 | 83847.2 | 97897.8 | **82510.60** | 30901.80 | 47111.20 | 54162.80 | **44058.60** | 1.89 | 2.28 | 2.24 | **2.14** |
| S4 | 65134.80 | 85314.2 | 115436.6 | **88628.53** | 30249.80 | 48578.20 | 71701.60 | **50176.53** | 1.87 | 2.32 | 2.64 | **2.28** |
| S5 | 52160.00 | 79609.2 | 97800.0 | **76523.07** | 17275.00 | 42873.20 | 54065.00 | **38071.07** | 1.50 | 2.17 | 2.24 | **1.97** |
| **Mean** | **59736.24** | **79752.6** | **98367.4** |  | 24851.24 | 43016.64 | 54632.24 |  | 1.71 | 2.17 | 2.25 |  |
| **For comparison the mean of** | SEm± | CD (P=0.05) | SEm± | CD (P=0.05) | SEm± | CD (P=0.05) |
| Establishment method (A) | 306.70 | 1204.26 | 257.06 | 1009.34 | 0.01 | 0.02 |
| Crop geometry (S) | 1275.97 | 3724.29 | 676.70 | 1975.16 | 0.03 | 0.09 |
| Sub plot (S) at same levelof main plot (A) | 2210.04 | 6450.66 | 1172.09 | 3421.07 | 0.06 | 0.16 |
| Main plot (A) at same level of sub plot (S) | 16.00 | 46.70 | 14.07 | 41.07 | 0.07 | 0.22 |

**Table 4: Economics of finger millet as influenced by methods of establishment and crop geometry**

# CONCLUSION

From the present study, it can be concluded that transplanting of rainfed finger millet in system of ragi intensification (‘*guni’* method) at 35 cm × 35 cm spacing along with 28 days age old seedlings to led to enhanced yield, nutrient uptake and improved economics.

# REFERENCES

Adhikari, P., Araya, H., Aruna, G., Balamatti, A., Banerjee, S., Baskaran, P., and Verma, A. (2018). System of crop intensification for more productive, resource- conserving, climate-resilient, and sustainable agriculture: Experience with diverse crops in varying agroecologies. International journal of agricultural sustainability, 16(1): 1-28.

Ahiwale, P. H., Chavan, L. S. and Jagtap, D. N. (2011). Effect of establishment methods and nutrient management on yield attributes and yield of finger millet (Eleusine coracana G.). Advanced Research Journal of Crop Improvement, 2(2): 247-250.

Bhatta, L. R., Subedi, R., Joshi, P., and Gurung, S. B. (2017). Effect of Crop Establishment Methods and Varieties on Tillering Habit, Growth Rate and Yield of Finger- Millet. Agricultural Research and Technology: Open Access Journal, 47(3): 367-371.

Gomez, K. A. and Gomez, A. A. (1984). Statistical Procedures for Agricultural Research. John Willey and Sons Publishers, New York. Pp: 97-107.

Natarajan, S., Ganapathy, M., Arivazhagan, K. and Srinivasu,V. (2019). Efect of spacing and nutrient sources on system of finger millet (Eleusine coracana) intensification. Indian Journal of Agronomy, 64(1): 98-102.

Navale, H. (2013). Influence of spacing and method of planting on seed yield and quality of foxtail millet (Setaria italica) varieties. M.Sc. thesis, University of Agricultural Sciences, Dharwad, Karnataka.

Roy, N. R., Chakraborty, T., Sounda, G. and Maitra, S. (2002). Growth and yield attributes of finger millet as influenced by plant population and different levels of nitrogen and phosphorus. Indian Agriculturist, 46(1&2): 65-71.

Uphoff, N. (2002). Opportunities for raising yields by changing management practices: the system of rice intensification in Madagascar. Agro-ecological innovations: increasing food production with participatory development. 145-61.