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Economics of finger millet (*Eleusine Coracana* (L) Gaertn) as influenced by land situations, various planting geometry and levels of fertilizer under lateritic soil of *konkan* region

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Abstract
The experiment "economics of finger millet (*Eleusine coracana* (L) Gaertn) as influenced by land situations, various planting geometry and levels of fertilizer under lateritic soil of *Konkan* region" was conducted at Agronomy Farm, College of Agriculture, Dapoli, Dist. Ratnagiri (M.S.) during *kharif* season of 2017 and 2018. The field experiment was laid out in a split-split plot design. Main plot treatment consisted of three land situations *viz*., upland situation (LS_1), midland situation (LS_2) and gently sloppy (*Varkas*) land (LS_3), the sub plot treatment consisted of five planting geometry *viz*.,15 cm x 10 cm (PG_1), 20 cm x 10 cm (PG_2), 25 cm x 10 cm (PG_3), 30 cm x 10 cm (PG_4) and 20 cm x 15 cm (PG_5),while, sub-sub plot treatment comprised of five fertilizer levels *viz*., 80: 40: 0 NPK kg ha^{-1} (RDF) without FYM (F_1), 80: 40: 0 NPK kg ha^{-1} (RDF) with FYM 5 t ha^{-1} (F_2), 80: 40: 40 NPK kg ha^{-1} with FYM 5 t ha^{-1} (F_3), 100: 50: 50 NPK kg ha^{-1} with FYM 5 t ha^{-1} (F_4) and 120: 60: 60 NPK kg ha^{-1} with FYM 5 t ha^{-1} (F_5). Thus, there were 25 treatment combinations replicated three times. On the basis of investigation, it can be concluded that the finger millet crop should be grown during *kharif* season on upland situation (well drained) followed by gently sloppy land (*Varkas*) with 25 cm x 10 cm planting geometry along with application of fertilizer dose @ 100: 50: 50 NPK kg ha^{-1} with FYM 5 t ha^{-1} for obtaining maximum yield, quality, net returns and benefit cost ratio under south *Konkan* condition.

Keywords: Economics, Finger millet, Land situations, Levels of fertilizer, Planting geometry, Quality, and Yield

Introduction
Finger millet (*Eleusine coracana* G.) is staple food of tribles and lower income class. Finger millet has some unique qualities, which makes it potentially valuable product. It has low glycemic index. This makes it a boon for the people suffering from diabetes and obesity. It has excellent malting qualities with considerable industrial potential for producing malt extract and beverages. The grains are malted and fed to infants due to its high nutritious value and suggested as the best weaning food which is popularly known as '*Nachani Satva*'. It is usually converted into flour, which is used for preparation of cake / puddings / porridge.

Finger millet is an important food grain crop of semi-arid tropics particularly of India and East Africa and Srilanka. In India, finger millet is cultivated over wide range of agro-climatic conditions almost in all the states. Finger millet contributes nearly 40 per cent of small millets in India. Finger millet contributes an area of 1.27 million ha with average annual production 1.89 million tonnes with productivity 1490 kg ha^{-1} (Anonymous 2011) [3]. In Maharashtra, finger millet occupies an area of about 166.8 thousand hectare ha with an annual grain production of 170.2 thousand tonnes. It is mainly cultivated in Thane, Raigad, Ratnagiri, Sindhudurg, Dhule, Jalgaon, Nashik, Ahmednagar, Pune, Satara and Kolhapur districts.

The largest acreage of *ragi* is in *Konkan* region. In *Konkan* region, finger millet plays an important role in agriculture with an area of 38488 hectares of Maharashtra comprising with an annual production 41136 tonnes. However, the productivity in Thane, Palghar, Raigad, Ratnagiri and Sindhudurg is very low 1167 kg ha^{-1}.

The productivity is low due to delay in nursery sowing and late transplanting, faulty methods of cultivation and little or no use of fertilizers. The secret of boosting its yields mainly lies in timely transplanting and properly fertilizing the crop. It is well known that there is direct positive correlation between fertilizer consumption and food grain production. Major finger millet growing areas in the region are highly eroded sandy clay loams. Poor fertility and low moisture holding capacity are the characteristics of these soils. Fertilizer use efficiency is low in the region due to heavy rainfall and it is revealed from the studies that integration of nutrient sources improves fertilizer use efficiency (Tondon, 1992) [24]. Hence, integrated nutrient management is one of the key components of intensive agriculture.

The finger millet crop has given secondary importance and generally the crop grown on hill slope and varkas land and hence the productivity of finger millet is low due to delay in nursery sowing and late transplanting, faulty methods of cultivation and little or no use of fertilizers. It is nutritionally high value crop and to maintain human health, the demand of nagli has been increased day by day and hence it is necessary to test land suitability for yield maximization of nagli. Finger millet is a premium crop as compared to other millets. Finger millet put forth luxuriant growth during *kharif* season, therefore to find out suitable land situation, planting geometry and optimum fertilizer dose for the maximization of yield. Keeping these points of views, it is proposed to conduct a field experiment on, "economics of finger millet (*Eleusine coracana* (L) Gaertn) as influenced by land situations, various planting geometry and levels of fertilizer under lateritic soil of *Konkan* region" was conducted.

Materials and Methods

The experiment "economics of finger millet (*Eleusine coracana* (L) Gaertn) as influenced by land situations, various planting geometry and levels of fertilizer under lateritic soil of *Konkan* region" was conducted at Agronomy Farm, College of Agriculture, Dapoli, Dist. Ratnagiri (M.S.) during *kharif* season of 2017 and 2018. The site was selected on the basis of suitability of soil for the cultivation of finger millet on various land situations. The topography of the experimental plot was fairly uniform leveled, water saturated and gently sloppy land (*Varkas*). The plot was well drained and provided drainage for removal excess rain water during both years of *kharif* season.

The field experiment was laid out in a split-split plot design. Main plot treatment consisted of three land situations *viz*., upland situation (LS_1), midland situation (LS_2) and gently sloppy (*Varkas*) land (LS_3), the sub plot treatment consisted of five planting geometry *viz*.,15 cm x 10 cm (PG_1), 20 cm x 10 cm (PG_2), 25 cm x 10 cm (PG_3), 30 cm x 10 cm (PG_4) and 20 cm x 15 cm (PG_5),while, sub-sub plot treatment comprised of five fertilizer levels *viz*., 80: 40: 0 NPK kg ha^{-1} (RDF) without FYM (F_1), 80: 40: 0 NPK kg ha^{-1} (RDF) with FYM 5 t ha^{-1} (F_2), 80: 40: 40 NPK kg ha^{-1} with FYM 5 t ha^{-1} (F_3), 100: 50: 50 NPK kg ha^{-1} with FYM 5 t ha^{-1} (F_4) and 120: 60: 60 NPK kg ha^{-1} with FYM 5 t ha^{-1} (F_5). Thus, there were 25 treatment combinations replicated three times. The variety *Dapoli 2* (Somaclonal variation developed through tissue culture technique) of finger millet was used in the investigation. Seeds were treated with thiram @ 3 g kg^{-1} of seed, before sowing in order to protect the crop against seed and soil borne fungal diseases.

The finger millet nursery was manured with FYM @ 100 kg R^{-1} and it was mixed thoroughly into soil at the time of seedbed preparation. Then, nursery beds of 3 m x 1 m size were prepared in a well tilled plot. Fertilizers *viz*., urea @ 1 kg and single super phosphate @ 3 kg were applied for 100 sq. m. nursery area at the time of sowing of finger millet seed. The transplanting of the seedlings was done at different land situations. Application of full dose of FYM and basal dose of N, P_2O_5, K_2O as per the treatments were done at the time of transplanting. The basal dose of N, P_2O_5, K_2O included half dose of nitrogen and full dose of phosphorus and potassium. Remaining half dose of nitrogen (urea) was applied at 30 DAT. Seeds were treated with thiram @ 3 g kg^{-1} of seeds, before sowing in order to protect the crop against seed and soil borne fungal diseases. Poison bait of phorate @ 10 kg ha^{-1} was placed in crab holes in the field and on bund area of experimental plots to control crab attack. Spraying of trycyclozole 75 WP and propiconazole @ 0.05 per cent for control of foot rot and one spraying of carbendanzim @ 0.1 per cent for controlling of leaf spot disease.

All biometric and other observations recorded during the course of investigation. The data related to each character of the finger millet crop was analyzed statistically by using standard method of 'Analysis of variance' as applicable to split-split plot design by Gomez and Gomez (1983). The significance of the treatment difference was tested by 'F' test (variance ratio). Further, the critical difference (C.D) at 5 per cent level of probability was worked out for comparison and statistical interpretation of significance among the treatment means

Results and Discussion

Effect of land situations

The beneficial effect of finger millet crop grown in upland situation (LS_1) followed by gently sloppy land (LS_3) in enhancing the growth through increased crop height, number of functional leaves, number of tillers, and dry matter production ultimately reflected in higher yield contributing characters *viz*., length of earhead, number of fingers $earhead^{-1}$, number of earhead $hill^{-1}$, weight of earhead $hill^{-1}$, grain and straw weight $hill^{-1}$ and thousand grain weight. The grain yield of finger millet was a function of all these yield attributes of an individual plant and ultimately grain yield obtained from the plant. The results are similar with the result reported by Bhatkar (1980) [7], Nayak, (1995) [20] and Chavan *et al*. (2018b) [11].

Significantly highest grain yield of 22.71, 29.77 and 26.24 q ha^{-1} was recorded by upland situation (LS_1) followed by gently sloppy land (LS_3) grain yield of 19.72, 23.70 and 21.71 q ha^{-1} during the years 2017, 2018 and in pooled analysis, respectively. Increase in grain yield over midland situation (LS_2) due to the treatments upland situation (LS_1) and followed by gently sloppy land (LS_3) in pooled analysis (Table 1) was to the tune of 74.05 and 68.63 per cent, respectively. Similar trend was also observed in straw yield (Table 1) during both the years of experimentation and in pooled analysis. The increase in yield might be due to result of optimum growth and development parameters associated with favourable weather condition responsible for more growth and development of crop. The increased yield attributes might be due to increased growth and development parameters which ultimately resulted in increased grain. These results reported by Bhatkar (1980) [7] and Chavan *et al*. (2018a) [10].

In respect of quality parameters, protein content in grain and straw and their total uptake recorded statistically superior in upland situation (LS_1) over rest of land situation during both years of study (Table 4). These results are similar with the finding reported by Ghadage (1982) [15], Navalagi *et al*. (2011) [21] and Chavan *et al*. (2019) [12].

Growing of finger millet during *kharif* season under upland situation (LS_1) gave the highest gross returns (₹ 86,287 ha^{-1},

₹ 1,26,644 ha^{-1} and ₹ 1,06,465 ha^{-1}), net returns (₹ 12,348 ha^{-1}, ₹ 43,398 ha^{-1} and ₹ 27,873 ha^{-1}) and benefit to cost ratio (1.18, 1.54 and 1.36) followed by gently sloppy land (LS_3) during year 2017, 2018 and in case of pooled mean, respectively. Among all these land situations growing of finger millet crop on upland situation (LS_1), followed by gently sloppy land (LS_3) was found economically most profitable as its mean B: C ratio was recorded higher over midland situation (LS_2). The increased gross returns, net returns and benefit to cost ratio due to various land situations and increased grain and straw yield under upland situation (LS_1), followed by gently sloppy land (LS_3) over midland situation (LS_2). Similar findings were also reported by Ahiwale *et al.* (2011) [2].

Effect of various planting geometry

It was revealed from the data presented in Table 1 that, the 25 cm x 10 cm (PG_3) planting geometry recorded significantly highest grain yield of 17.03, 23.57 and 20.30 q ha^{-1} during the years 2017, 2018 and in pooled analysis, respectively and which was statistically identical with 20 cm x 15 cm during, 2017. The straw yield (Table 1) was also observed significantly highest with 25 cm x 10 cm (PG_3) planting geometry treatment of 34.77, 47.35 and 40.27 q ha^{-1} during the years 2017, 2018 and in pooled analysis, respectively and which was statistically identical with 20 cm x 15 cm during, 2017. Dapoli 2 (*Somaclonal*) variety of finger millet plant allowed to transform more energy into the better production of yield attributes and proved advantageous in increasing the yield potential. The results are in confirmation with the results reported by Roy *et al.* (2001) [23] Joshi *et al*. (1989) [18].

Variation on protein content and protein yield (Table 4) in finger millet grain and straw was significantly influenced due to different planting geometry during both the years. However, 25 cm x 10 cm (PG_3) planting geometry treatment recorded higher protein content (8.64 and 10.00%) in grain as well as in straw (5.30 and 3.86%) and total protein harvest (34,676.34 and 44,644.04 kg ha^{-1}) during the first and second year, respectively.

Among the various planting geometry accrued with 25 cm x 10 cm (PG_3) planting geometry treatment recorded maximum gross returns (₹ 63,481 ha^{-1}, ₹ 99,535 ha^{-1} and ₹ 81,508 ha^{-1}), net returns (₹ -6,530 ha^{-1}, ₹ 23,683 ha^{-1} and ₹ 8,577 ha^{-1}) and benefit: cost ratio (0.90, 1.04 and 1.15) during the year 2017, 2018 and in the mean. These increased economic values were due to the significant improvement in the grain and straw yield in various planting geometry. These results are in conformity with that of Roy *et al.* (2001) [23].

Effect of different levels of fertilizer

Perusal of the data presented in Table 1 revealed that, different fertilizer levels significantly influenced the values of mean grain yield of finger millet during individual years and in pooled analysis. Application of 120: 60: 60 NPK kg ha^{-1} with FYM (F_5) recorded significantly higher grain yield (q ha^{-1}) over rest of the treatments in *kharif* 2017 & 2018 and in pooled analysis and statistically identical with 100: 50: 50 NPK kg ha^{-1} with FYM (F_4) during individual years. The increased yield over the treatment 80: 40: 00 NPK kg ha^{-1} (RDF) without FYM (F_1) in pooled analysis due to various fertilizers levels viz. F_2, F_3, F_4 and F_5 was to the tune of 15.30, 31.03, 52.95 and 56.32 per cent, respectively. The mean straw yield (q ha^{-1}) differed significantly due to various fertilizer levels during individual years and in pooled analysis. The fertilizer level 120: 60: 60 NPK kg ha^{-1} with FYM (F_5) produced significantly higher straw yield (37.18, 46.34 and 41.76 q ha^{-1}, respectively) during 2017, 2018 and in pooled analysis over rest of treatments and at par with 100: 50: 50 NPK kg ha^{-1} with FYM (F_4) fertilizer level during 2017 and remaining fertilizer levels in that descending order of significance. The increment in yield of finger millet was mainly be due to higher photosynthetic and metabolic efficiency for assimilation of energy and their partitioning into the yield attributing characters *viz.*, length of earhead, number of fingers earhead^{-1}, number of earhead hill^{-1}, weight of earhead hill^{-1} and grain and straw weight hill^{-1} and yield produced significantly more during the second and first year, respectively (Table 1). The increment in dry matter accumulation hill^{-1} might be due to the production of higher number of source (green leaves) with expanding leaf-area that harvest more solar radiation helpful to catalyses the synthesis of good amount photosynthates and ultimately produced higher yield. Similar findings were reported by Ahiwale *et al*. (2011) [2], Ahiwale *et al*. (2013) [1], Gawade *et al*. (2013) [14], Nevase *et al*. (2013) [22] and Chavan *et al*. (2017a) [8].

The higher protein content in grain (10.37% and 10.67%), straw (5.89% and 4.73%) and total protein harvest (41,567.44 and 48,981.45 kg ha^{-1}) were recorded by application of 120: 60: 60 NPK kg ha^{-1} with FYM (F_5) during the first and second year, respectively (Table 4). This might be due to higher affectivity for nitrate reduction activities in source and catalysis enzyme that are associates with synthesis of amino acid, a precursor for building block of protein in grains. These results were supported by Chellumathu *et al*. (1988) [13] and Goud (2012) [17].

The application of 120: 60: 60 NPK kg ha^{-1} with FYM (F_5) fetched significantly higher gross returns (₹ 70,262 ha^{-1}, ₹ 1,03, 517 ha^{-1} and ₹ 86,890 ha^{-1}) and net returns (₹ -7,348 ha^{-1}, ₹ 17,502 ha^{-1} and ₹5,077 ha^{-1}) and benefit to cost ratio (0.88, 1.18 and 1.03) significantly higher over rest of the treatments during the respective years and which remains on par with the application of 100: 50: 50 NPK kg ha^{-1} with FYM (F_4). This might be due to higher grain and straw yield with the application of 100: 50: 50 NPK kg ha^{-1} with FYM (F_4) during the two consecutive years. These results were supported by Ahiwale *et al*. (2011) [2] and Chavan *et al*. (2017b).

Interaction effects between the land situation, various planting geometry and different levels of fertilizer

a) Land situation X planting geometry (LS X PG)

The upland situation (LS_1) with 25 cm x 10 cm (PG_3) planting geometry recorded significantly higher grain weight over rest of treatment combinations and at par with LS_1 PG_2, LS_1 PG_5, LS_3 PG_3, LS_3 PG_4 and LS_3 PG_5 during 2017 and LS_1 PG_5 and LS_3 PG_3 during the year 2018.

The upland situation (LS_1) with 25 cm x 10 cm (PG_3) planting geometry recorded significantly higher straw weight over rest of treatment combinations during both the years of experimentation except LS_1 PG_4, LS_1 PG_5 and LS_3 PG_3, LS_3 PG_4 combinations during *kharif* 2017 and LS_1 PG_5 during *kharif* 2018. These results were supported by Modak (1979).

The interaction effect between land situation and planting geometry revealed that, the upland situations (LS_1) with 25 cm x 10 cm (PG_3) planting geometry recorded significantly highest grain yield (q ha^{-1}) over rest of treatment combinations and remains at par with each other of treatment combinations LS_1 PG_5 and LS_1 PG_1, LS_1 PG_2, LS_1 PG_4 and LS_1 PG_5 during individual years i.e. 2017, 2018 and LS_1 PG_5 in pooled analysis. These results were supported by Modak (1979).

The interaction effect between land situation and planting geometry on straw yield (q ha^{-1}) differed significantly during both the years and in pooled analysis. The upland situations (LS_1) with 25 cm x 10 cm (PG_3) planting geometry recorded significantly highest straw yield (q ha^{-1}) over rest of treatment combinations during both the years and in pooled analysis. These results were supported by Modak (1979).

The interaction effect between land situation and planting geometry on biological yield of finger millet differed significantly during both the years. The Upland situation (LS_1) with 25 cm x 10 cm (PG_3) planting geometry recorded significantly higher biological yield (q ha^{-1}) over rest of the treatment combinations during both the years.

b) Land situation X different levels of fertilizer (LS X F)

The interaction effect between land situation and fertilizer levels on straw weight differed significantly during both the years. The upland situation (LS_1) with application of 120: 60: 60 NPK kg ha^{-1} with FYM (F_5) recorded significantly higher straw weight over rest of treatment combinations and at par with each other LS_1 PG_4 and LS_3 PG_4 during both the years. These results were supported by Joshi *et al*. (1989) [18] and Anonymous (2007).

The interaction effect between land situation and fertilizer levels on grain yield (q ha^{-1}) differed significantly during both the years. The upland situation (LS_1) with application of 120: 60: 60 NPK kg ha^{-1} with FYM (F_5) recorded significantly highest grain yield (q ha^{-1}) over remaining treatment combinations during both the years and in pooled analysis and remains at par with LS_1F_4 treatment combination during *kharif* 2017, *kharif* 2018 and in pooled analysis.

The interaction effect between land situation and fertilizer levels on straw yield (q ha^{-1}) differed significantly during both the years and in pooled analysis. The upland situation (LS_1) with application of 120: 60: 60 NPK kg ha^{-1} with FYM (F_5) recorded significantly highest straw yield (q ha^{-1}) over remaining treatment combinations during both the years and in pooled analysis and remains at par with LS_1F_4 treatment combination during *kharif* 2018 and in pooled analysis. These results were supported by Joshi *et al*. (1989) [18] and Anonymous (2007).

The interaction effect between land situation and fertilizer levels on biological yield of finger millet differed significantly during both the years. The upland situation (LS_1) with application of 120: 60: 60 NPK kg ha^{-1} with FYM (F_5) recorded significantly higher biological yield over remaining treatment combinations and at par with LS_1F_4 during *kharif* 2017 and *kharif* 2018.

c) Planting geometry X different levels of fertilizer (PG X F)

The interaction effect between planting geometry and fertilizer levels statistically differed during both the years. The planting geometry 25 cm x 10 cm (PG_3) and fertilizer level 120: 60: 60 NPK kg ha^{-1} with FYM (F_5) recorded significantly higher weight of grains over rest of treatment combinations and which was at par with the combinations of PG_3 F_4, PG_5 F_4 and PG_5 F_5 during *kharif* 2017 and PG_5F_4 during *kharif* 2018.

Interaction effect between planting geometry and fertilizer levels on straw weight differed significantly during *kharif* 2017. The 25 cm x 10 cm (PG_3) planting geometry with the supply of 120: 60: 60 NPK kg ha^{-1} with FYM (F_5) recorded significantly higher straw weight over rest of treatment combinations except PG_3 F_4, PG_4 F_4, PG_4 F_5 and PG_5 F_4, PG_5 F_5 treatment combinations.

Interaction effect between planting geometry and fertilizer levels on grain yield (q ha^{-1}) differed significantly during 2018 and in pooled analysis. The 25 cm x 10 cm (PG_3) planting geometry along with application of 120: 60: 60 NPK kg ha^{-1} with FYM (F_5) recorded significantly higher grain yield (q ha^{-1}) of finger millet over rest of treatment combinations during individual years and in pooled analysis and remains at par with PG_3 F_4 during 2018 and PG_3F_4 and PG_5F_5 in pooled analysis. These results were supported by Anonymous, (2007).

Interaction effect between planting geometry and fertilizer levels on straw yield (q ha^{-1}) differed significantly during both the years and in pooled analysis. The 25 cm x 10 cm (PG_3 planting geometry) along with application of 120: 60: 60 NPK kg ha^{-1} with FYM (F_5) recorded significantly higher straw yield (q ha^{-1}) of finger millet over rest of the treatment combinations during individual years and in pooled analysis and remains at par with PG_3 F_4, PG_5 F_4, PG_4 F_5 and PG_5F_5, during 2017 and PG_3F_4 during *kharif* 2018 and in pooled analysis.

Interaction effect between planting geometry and fertilizer levels on biological yield (q ha^{-1}) differed significantly during both the years. The 25 cm x 10 cm (PG_3) planting geometry along with application of 120: 60: 60 NPK kg ha^{-1} with FYM (F_5) recorded significantly higher biological yield of finger millet over rest of the treatment combinations and at par with PG_3 F_4, PG_5 F_4 and PG_5 F_5 during 2017 and PG_3 F_4 during 2018. These results were supported by Anonymous, (1977), and Roy, *et al*.(2001) [23].

d) Land situation X various planting geometry X different levels of fertilizer (LS X PG X F)

The interaction effect between land situations, planting geometry and fertilizer levels were found to be significant during both the years. The upland situation (LS_1) with 25 cm x 10 cm (PG_3) planting geometry and supplied of 120: 60: 60 NPK kg ha^{-1} with FYM (F_5) recorded significantly higher weight of grain over rest of treatment combinations and which was on par with LS_1 PG_3 F_4, LS_3 PG_3 F_4 treatment combinations during 2017 and LS_3 PG_3 F_4 treatment combination during 2018.

Interaction effect between land situations, planting geometry and fertilizer levels on straw weight statistically differed during both the years. The upland situation (LS_1) with planting geometry 25 cm x 10 cm (PG_3) and supplied of 100: 50: 50 NPK kg ha^{-1} with FYM (F_4) recorded significantly higher straw weight over rest of treatment combinations and which was on par with LS_1 PG_3 F_5 during 2017 and LS_1 PG_3 F_5, LS_1 PG_5 F_4 and LS_1 PG_5 F_5 treatment combinations during 2018.

Interaction effect between land situations, planting geometry and fertilizer levels on grain yield (q ha^{-1}) statistically differed during both the years. The upland situation (LS_1) with planting geometry 25 cm x 10 cm (PG_3) and supplied of 120: 60: 60 NPK kg ha^{-1} with FYM (F_5) recorded significantly higher grain yield (q ha^{-1}) over rest of treatment combinations and which remains at par with LS_1 PG_5 F_4 during 2017, & LS_1 PG_1 F_5, LS_1 PG_2 F_4, LS_1 PG_2 F_5,LS_1 PG_3 F_4,LS_1 PG_4 F_4, LS_1 PG_4 F_5 and LS_1 PG_5 F_5 during 2018 and LS_1 PG_3 F_4 and LS_1 PG_5 F_5 in pooled analysis.

Interaction effect between land situations, planting geometry and fertilizer levels on straw yield (q ha^{-1}) statistically differed during both the years and in pooled analysis. The upland situation (LS_1) with 25 cm x 10 cm (PG_3) planting geometry and along with 120: 60: 60 NPK kg ha^{-1} with FYM (F_5) recorded significantly superior in producing straw yield (q ha^{-1}) over rest of treatment combinations and which was at par with LS_1 PG_3 F_4 during 2018 and in pooled analysis. These results were supported by Joshi. *et al*. (1989) [18], Anonymous, (2007) [4].

Interaction effect between land situations, planting geometry and fertilizer levels on biological yield of finger millet statistically differed during both the years. The upland situation (LS_1) with 25 cm x 10 cm (PG_3) planting geometry and supplied with 120: 60: 60 NPK kg ha^{-1} with FYM (F_5) recorded significantly higher biological yield of finger millet over rest of the treatment combinations during both the years and remains at par with LS_1 PG_3 F_4 treatment combination during 2018.

Economics of the treatment combinations

The data pertaining to the cost of cultivation, gross monetary returns, net monitory returns and B: C ratio as influenced by different treatment combinations are presented in Table 6, 7 & 8.

The upland situation (LS_1) were recorded highest gross monetary returns by the treatment combination of LS_1 PG_3 F_4 which was ₹ 1,11,189, ₹ 1,49,246 and ₹ 1,30,217 followed by the treatment combination of LS_1 PG_3 F_5 ₹1,15,508, ₹ 1,51,134 and ₹ 1,33,321 during 2017, 2018 and in the mean value respectively. Similarly, in gently sloppy land situation (LS_3) highest gross monetary returns were recorded by the LS_3 PG_3 F_4 treatment combination which was ₹ 83,908, ₹ 1,20,291 and ₹ 1,02,099 followed by the treatment combination of LS_3 PG_4 F_5 ₹ 85,464,₹ 1,16,947 and ₹ 1,01,226 during 2017, 2018 and in the mean value, respectively. However, the least gross monetary returns were observed under treatment combination of LS_2 PG_1 F_1 which was ₹ 7,656 and ₹ 16,583 and ₹ 12,119 during 2017, 2018 and in the mean value, respectively.

Glimpses of the data presented in Table 6, 7 & 8 stated that, the highest cost of cultivation was recorded under the treatment combination of LS_1 PG_1 F_5 which was ₹ 88,008 ha^{-1}, ₹ 1,01,709 ha^{-1}and ₹ 94,8590 ha^{-1} followed by treatment combination of LS_3 PG_1 F_5 which was ₹ 88,170 ha^{-1}, ₹ 93,400 ha^{-1} and ₹90,785 ha^{-1} during 2017, 2018 and in the mean, respectively. The lowest cost of cultivation in midland situation (LS_2) and gently sloppy land situation (LS_3) were recorded by the treatment combination of LS_2PG_1 F_1 which was ₹ 50,111 ha^{-1}, ₹ 55,247 ha^{-1} and ₹ 52,679 ha^{-1} followed by LS_3 PG_1 F_1 which was ₹ 56,509 ha^{-1},₹ 63,024 ha^{-1} and ₹ 59,766 ha^{-1} during 2017, 2018 and in the mean, respectively.

The highest net monetary returns were recorded by the treatment combination of LS_1 PG_3 F_5 which was ₹ 30,686 ha^{-1}, ₹ 60,300 ha^{-1} and ₹ 45,493 ha^{-1} followed by the treatment combination of LS_1 PG_3 F_4 which was ₹ 28,128 ha^{-1}, ₹ 60,012 ha^{-1} and ₹ 44,070 ha^{-1} during 2017, 2018 and in the mean, respectively. However, the least net monetary returns were noticed under treatment combination of LS_3 PG_4 F_2 which was ₹ 4,658 ha^{-1}, ₹ 2,509 ha^{-1} and ₹ 3,583 ha^{-1} followed by the treatment combination of LS_3 PG_2 F_4 which was ₹ 3,228 ha^{-1}, ₹ 10,342 ha^{-1} and ₹ 6,785 ha^{-1} during 2017, 2018 and in the mean, respectively. The highest negative net monetary returns *i.e*. net loss were recorded by the treatment combination of LS_2 PG_1 F_2 which was found ₹ -64,491 ha^{-1}, ₹ -55,535 ha^{-1} and ₹ -60,013 ha^{-1} followed by the treatment combination of LS_2 PG_1 F_3 which was ₹ -61,575 ha^{-1}, ₹ -50,412 ha^{-1} and ₹ -55,994 ha^{-1} during 2017, 2018 and in the mean values, respectively.

The adoption of any technology by the farmers depends upon its cost effectiveness. The same principle could be applied while deciding the land situations, various planting geometry and levels of fertilizer options for finger millet. Therefore, while arriving at any conclusion and deriving any interference, a detail economic analysis is must. The interaction effect between the land situations x planting geometry, land situations x levels of fertilizer, various planting geometry x levels of fertilizer and land situations x planting geometry x levels of fertilizer on yield of finger millet was found significant during individual years and in the pooled analysis. The economics of treatment combinations was also worked out in the present study.

On the basis of economic analysis, it was observed that, the significantly highest net returns and B: C ratio was obtained when the finger millet crop was grown on upland situation, followed by gently sloppy land (*Varkas*). These results were supported by Chavan *et al.* (2017b) [9].

Table 1: Grain and straw yield of finger millet as influenced by different treatments during *kharif* 2017 & 2018

Treatments	Grain yield (q ha^{-1})			Straw yield (q ha^{-1})		
	2017	2018	Pooled mean	2017	2018	Pooled mean
A) Main plot: Land situations (LS)						
LS_1:Upland	22.71	29.77	26.24	50.78	63.62	57.20
LS_2:Mid land	4.30	9.32	6.81	11.07	19.48	15.27
LS_3:Gently sloppy land	19.72	23.70	21.71	32.46	37.84	35.15
S.Em. ±	0.56	0.45	0.33	0.40	0.41	0.29
C.D. at 5%	2.19	1.77	1.29	1.55	1.61	0.93
B) Sub plot : Planting geometry (PG)						
PG_1:15 cm x 10 cm	13.02	18.64	16.70	27.75	37.63	33.07
PG_2: 20 cm x 10 cm	14.62	19.40	17.01	29.14	38.26	33.38
PG_3: 25 cm x 10 cm	17.03	23.57	20.30	34.77	47.35	40.27
PG_4: 30 cm x 10 cm	14.81	21.32	18.06	32.33	38.38	36.13
PG_5:20 cm x 15 cm	16.67	21.72	19.19	33.19	39.93	36.52
S.Em. ±	0.54	0.33	0.35	0.59	0.34	0.34
C.D. at 5%	1.58	0.96	1.01	1.73	0.99	0.97
C) Sub-sub plot : Fertilizers levels (F)						
F_1: 80: 40: 00 NPK kg ha^{-1} (RDF) without FYM	11.55	16.30	13.92	24.45	33.29	28.87
F_2: 80: 40: 00 NPK kg ha^{-1} (RDF) with FYM	13.75	18.35	16.05	27.36	36.55	31.96
F_3: 80 : 40 : 40 NPK kg ha^{-1} with FYM	15.54	20.95	18.24	31.50	39.70	35.60

F_4:100: 50: 50 NPK kg ha^{-1} with FYM	18.25	24.33	21.29	36.69	45.68	41.19
F_5:120: 60: 60 NPK kg ha^{-1} with FYM	18.82	24.71	21.76	37.18	46.34	41.76
S.Em. ±	0.21	0.20	0.14	0.20	0.16	0.13
C.D. at 5%	0.59	0.55	0.40	0.55	0.46	0.36
Interaction effect						
LS x PG	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
LS x F	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
PG x F	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
LS x PG x F	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
General mean	15.58	20.93	18.25	31.44	40.31	35.87

Table 2: Protein content, protein yield in grain & straw and total protein yield in finger millet as influenced by different treatments during *kharif* 2017 and 2018

Treatments	Protein content in grain (%)		Protein content in straw (%)		Protein yield in grain (kg ha^{-1})		Protein yield in straw (kg ha^{-1})		Total protein yield (kg ha^{-1})	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
A) Main plot: Land situations (LS)										
LS_1: Upland	7.79	7.96	5.33	3.99	18486.85	24607.31	27990.70	25748.74	46477.55	50356.06
LS_2: Mid land	7.62	7.48	3.93	3.31	3675.69	7872.52	4573.13	6739.74	8248.82	14612.26
LS_3: Gently sloppy land (Varkas)	7.61	7.60	4.30	3.80	15118.01	18821.58	14641.26	14777.52	29759.27	33599.11
S.Em. ±	0.06	0.09	0.03	0.02	598.57	484.20	140.32	295.08	667.48	702.78
C.D. at 5%	N.S.	0.37	0.12	0.07	2350.28	1901.22	550.97	1158.64	2620.85	2759.44
PG_1: 15 cm x 10 cm	6.68	6.13	3.80	3.57	10790.58	13170.65	10950.14	13664.34	21740.72	26834.99
PG_2: 20 cm x 10 cm	7.32	6.50	4.15	3.63	11691.11	12689.45	14140.77	14594.21	25831.89	27283.66
PG_3: 25 cm x 10 cm	8.64	10.00	5.30	3.86	14559.84	25337.99	20116.51	19306.05	34676.34	44644.04
PG_4: 30 cm x 10 cm	7.55	7.47	4.32	3.72	10271.94	17704.59	14093.04	15080.89	24364.98	32785.48
PG_5: 20 cm x 15 cm	8.18	8.29	5.03	3.73	14820.77	16599.68	19374.70	16131.18	34195.47	32730.86
S.Em. ±	0.08	0.10	0.03	0.02	459.40	310.67	344.83	171.93	610.64	378.44
C.D. at 5%	0.24	0.30	0.08	0.06	1340.90	906.77	1006.49	501.83	1782.33	1104.60
F_1: 80: 40 : 00 NPK kg ha^{-1} (RDF) without FYM	5.09	4.72	2.98	2.55	6121.00	7876.31	8074.75	8984.92	14195.74	16861.22
F_2: 80: 40: 00 NPK kg ha^{-1} (RDF) with FYM	6.66	6.00	3.85	3.25	9672.20	11294.94	11317.09	12394.75	20989.29	23689.69
F_3: 80: 40: 40 NPK kg ha^{-1} with FYM	7.49	7.49	4.51	3.72	11824.84	15674.66	15280.00	15311.51	27104.84	30986.17
F_4: 100: 50: 50 NPK kg ha^{-1} with FYM	8.76	9.51	5.37	4.25	16281.16	23801.86	20670.93	19958.35	36952.09	43760.20
F_5: 120: 60: 60 NPK kg ha^{-1} with FYM	10.37	10.67	5.89	4.73	18235.05	26854.59	23332.39	22127.15	41567.44	48981.75
S.Em. ±	0.05	0.07	0.03	0.02	194.85	263.98	136.82	94.98	237.97	299.36
C.D. at 5%	0.14	0.19	0.08	0.05	545.59	739.16	383.11	265.94	666.32	838.21
Interaction effect										
LS x PG	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
LS x F	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
PG x F	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
LS x PG x F	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
General mean	7.68	7.68	4.52	3.70	12426.85	17100.47	15735.03	17755.33	28161.88	32855.81

Table 3: Interaction effect of land situations & planting geometry, land situations & fertilizer levels, planting geometry & fertilizer levels and land situations, planting geometry and fertilizer levels on grain yield during *kharif* 2017 and 2018

Treatments	Grain yield (q ha-1)										Pooled mean				
	2017					2018									
LS X PG	PG1	PG2	PG3	PG4	PG5	PG1	PG2	PG3	PG4	PG5	PG1	PG2	PG3	PG4	PG5
LS1	21.04	20.26	27.15	20.25	24.86	29.06	29.47	30.39	29.76	30.16	25.60	24.66	28.46	25.32	27.16
LS2	3.43	4.12	5.46	3.48	5.03	6.64	6.71	15.49	7.57	10.20	5.04	5.84	10.48	5.87	6.84
LS3	19.83	19.49	18.48	20.69	20.11	19.11	21.56	28.96	23.37	25.47	19.47	20.52	24.54	21.98	22.03
	S.E.±	1.01	C.D. at 5%		2.77	S.E.±	0.68	C.D. at 5%		2.01	S.E.±	0.63	C.D. at 5%		1.70
LS x F	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5
LS1	17.44	20.51	23.35	25.82	26.45	24.10	26.76	29.91	33.74	34.33	20.77	23.63	26.63	29.78	30.39
LS2	2.62	2.93	3.74	5.73	6.50	5.40	7.15	9.82	12.05	12.20	4.01	5.04	6.78	8.97	9.28
LS3	14.58	17.81	19.51	23.19	23.50	19.42	21.14	23.12	27.04	27.75	17.00	19.48	21.32	25.12	25.63
	S.E.±	0.64	C.D. at 5%		1.85	S.E.±	0.54	C.D. at 5%		1.57	S.E.±	0.42	C.D. at 5%		1.30
PG x F	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5
PG1	-	-	-	-	-	14.91	16.59	18.74	21.11	21.83	12.59	14.50	16.86	19.35	20.23
PG2	-	-	-	-	-	15.51	17.49	19.55	21.84	22.59	13.02	15.24	17.16	19.41	20.21

PG3	-	-	-	-	-	17.45	20.73	24.11	27.70	27.88	15.19	17.87	20.57	23.90	23.98
PG4	-	-	-	-	-	16.13	18.14	21.17	25.55	25.62	13.43	15.75	17.99	21.74	21.41
PG5	-	-	-	-	-	17.51	18.80	21.19	25.45	25.64	15.40	16.89	18.63	22.05	22.99
	S.E.±	-	C.D. at 5%		-	S.E.±	0.51	C.D. at 5%		1.47	S.E.±	0.45	C.D. at 5%		1.29
LS X PG X F	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5
LS1 PG1	14.52	17.91	21.81	25.25	25.74	25.01	27.64	30.44	32.93	34.80	19.76	22.78	26.13	29.09	30.27
LS1 PG2	14.96	18.65	21.86	22.65	23.18	22.95	25.77	29.17	34.05	33.37	18.95	22.21	25.51	28.35	28.28
LS1 PG3	22.96	24.55	28.40	29.36	30.51	24.11	26.49	28.32	34.73	35.17	23.53	25.52	28.36	32.04	32.84
LS1 PG4	14.60	18.43	20.99	24.18	23.06	23.36	27.17	32.14	34.49	34.77	18.98	22.80	26.56	29.34	28.92
LS1 PG5	20.15	22.99	23.69	27.68	29.77	25.08	26.73	29.48	32.51	33.54	22.61	24.86	26.58	30.10	31.66
LS2 PG1	1.92	2.16	3.17	4.68	5.21	3.56	5.35	7.13	8.61	8.56	2.74	3.76	5.15	6.65	6.88
LS2 PG2	2.57	3.69	3.61	4.96	5.77	6.34	6.90	7.52	7.93	9.15	4.45	5.30	5.56	6.45	7.46
LS2 PG3	3.25	2.59	4.32	8.09	9.05	8.26	11.46	17.84	20.12	19.77	5.75	7.03	11.08	14.10	14.41
LS2 PG4	1.94	2.21	2.66	5.28	5.30	6.23	7.51	9.52	14.41	13.35	4.09	4.86	6.09	9.85	9.33
LS2 PG5	3.44	3.98	4.96	5.62	7.16	2.59	4.51	7.08	9.94	9.44	3.02	4.25	6.02	7.78	8.30
LS3 PG1	14.35	17.12	19.92	22.84	24.92	16.18	16.78	18.67	21.79	22.14	15.26	16.95	19.29	22.31	23.53
LS3 PG2	14.04	16.65	18.88	22.83	20.70	17.25	19.80	21.95	23.54	25.26	15.65	18.22	20.42	23.43	24.90
LS3 PG3	12.60	17.88	18.38	23.32	24.54	19.99	24.26	27.00	33.88	28.70	16.29	21.07	22.27	28.27	29.01
LS3 PG4	15.63	19.42	20.81	24.30	23.27	18.80	19.74	21.84	27.75	28.73	17.22	19.58	21.33	25.54	24.70
LS3 PG5	16.27	17.99	19.57	22.66	24.07	24.86	25.14	26.17	28.25	33.94	20.56	21.57	23.29	26.02	26.00
	S.E.±	0.81	C.D. at 5%		2.27	S.E.±	0.77	C.D. at 5%		2.15	S.E.±	0.55	C.D. at 5%		1.55

Table 4: Interaction effect of land situations & planting geometry, land situations & fertilizer levels, planting geometry & fertilizer levels and land situations, planting geometry and fertilizer levels on straw yield during *kharif* 2017 and 2018

Treatments	**Straw yield (q ha-1)**										**Pooled mean**				
	2017					**2018**									
LS X PG	**PG1**	**PG2**	**PG3**	**PG4**	**PG5**	**PG1**	**PG2**	**PG3**	**PG4**	**PG5**	**PG1**	**PG2**	**PG3**	**PG4**	**PG5**
LS1	47.50	49.62	56.02	50.14	50.63	52.53	62.24	74.46	63.75	65.12	51.07	56.31	65.24	56.44	56.95
LS2	8.41	9.79	13.13	11.69	12.30	17.07	22.36	26.22	15.36	16.39	12.74	14.04	19.26	14.24	16.08
LS3	27.33	28.00	42.00	31.26	33.72	30.70	36.04	41.37	39.90	41.16	29.02	33.95	41.58	34.88	36.31
	S.E.±	1.02	C.D. at 5%		2.99	S.E.±	0.67	C.D. at 5%		1.91	S.E.±	0.60	C.D. at 5%		1.73
LS x F	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5
LS1	38.85	44.53	51.73	58.56	60.24	54.23	58.83	63.15	70.45	71.44	46.54	51.68	57.44	64.51	65.84
LS2	8.14	9.15	10.90	13.42	13.72	15.36	16.39	17.07	22.36	26.22	11.48	12.98	15.04	18.25	18.60
LS3	26.35	28.41	31.87	38.10	37.58	30.70	36.04	39.90	41.16	41.37	28.58	31.20	34.32	40.80	40.84
	S.E.±	0.50	C.D. at 5%		1.44	S.E.±	0.48	C.D. at 5%		1.39	S.E.±	0.35	C.D. at 5%		1.04
PG x F	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5
PG1	20.95	24.09	27.30	32.80	33.59	32.57	35.01	37.34	41.31	41.93	26.76	29.55	32.32	37.06	37.76
PG2	23.39	25.93	29.27	33.51	33.58	28.94	32.99	36.66	46.11	46.62	26.16	29.46	32.96	39.81	40.10
PG3	28.59	30.47	34.31	40.09	40.41	39.63	42.86	47.42	53.16	53.69	32.09	35.69	40.78	46.00	46.80
PG4	24.75	27.81	32.47	38.22	38.40	30.99	35.99	38.22	42.86	43.86	27.87	31.90	35.35	40.54	41.13
PG5	24.56	28.52	34.14	38.84	39.92	34.32	35.89	38.88	44.95	45.62	31.46	33.18	36.59	42.52	43.01
	S.E.±	0.71	C.D. at 5%		2.05	S.E.±	0.47	C.D. at 5%		1.35	S.E.±	0.43	C.D. at 5%		1.23
LS X PG X F	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5
LS1 PG1	34.76	42.08	47.16	55.74	57.74	57.13	61.24	65.05	70.84	71.34	45.95	51.66	56.10	63.29	64.54
LS1 PG2	38.38	43.43	51.31	57.27	57.70	41.01	47.02	52.29	60.89	61.45	39.69	45.22	51.80	59.08	59.57
LS1 PG3	41.22	44.18	49.74	64.31	66.59	66.61	69.20	75.16	80.17	81.16	53.76	59.17	67.17	72.24	73.88
LS1 PG4	38.97	43.82	51.28	57.71	58.91	51.22	60.56	62.34	71.45	73.19	45.10	52.19	56.81	64.58	66.05
LS1 PG5	40.92	49.13	59.17	57.75	60.26	55.16	56.15	60.90	68.92	70.08	48.19	50.17	55.32	63.34	65.17
LS2 PG1	5.70	6.47	7.90	10.97	11.02	13.42	14.67	16.58	20.03	20.67	9.56	10.57	12.24	15.50	15.84
LS2 PG2	7.38	8.37	9.32	11.91	11.99	15.24	18.94	22.00	27.65	27.95	11.31	13.66	15.66	19.78	19.97
LS2 PG3	8.90	9.58	11.14	14.41	14.43	21.07	23.08	25.86	30.50	30.60	15.14	16.78	19.19	22.29	22.91
LS2 PG4	9.49	10.86	13.62	15.71	15.95	12.22	13.60	15.52	17.40	18.03	10.85	12.23	14.57	16.56	16.99
LS2 PG5	9.22	10.48	12.51	14.07	15.23	12.21	13.76	15.93	19.85	20.19	10.56	11.67	13.53	17.14	17.30
LS3 PG1	22.40	23.72	26.85	31.69	32.02	27.16	29.11	30.39	33.07	33.78	24.78	26.42	28.62	32.38	32.90
LS3 PG2	24.41	25.99	27.18	31.35	31.06	30.56	32.99	35.67	49.31	49.80	27.49	29.49	31.43	40.58	40.76
LS3 PG3	35.66	37.64	42.04	46.56	48.10	31.21	36.29	41.22	48.81	50.47	27.37	31.11	35.98	46.57	47.09
LS3 PG4	25.78	28.75	32.52	41.24	40.32	29.53	33.82	36.81	39.72	40.35	27.66	31.28	34.67	40.48	40.34
LS3 PG5	23.53	25.94	30.74	38.14	37.93	35.60	37.75	39.82	46.07	46.58	35.63	37.70	40.93	43.47	43.62
	S.E.±	0.76	C.D. at 5%		2.13	S.E.±	0.63	C.D. at 5%		1.77	S.E.±	0.75	C.D. at 5%		2.23

Table 5: Gross returns, cost of cultivation, net Returns (₹ ha^{-1}) and B: C ratio as influenced by different treatments during *kharif* 2017 and 2018

Treatments	Gross returns (₹ ha^{-1})			Cost of cultivation (₹ ha^{-1})			Net returns (₹ ha^{-1})			B: C ratio		
	2017	2018	Mean	2017	2018	Mean	2017	2018	Mean	2017	2018	Mean
A) Main plot :- Land situations (LS)												
LS_1:Upland	86287	126644	106465	73939	83247	78606	12348	43398	27873	1.18	1.54	1.36
LS_2:Mid land	16711	39554	28133	62907	69242	66099	-46196	-29688	-37942	0.26	0.57	0.42
LS_3:Gently sloppy land (Varkas)	72003	97607	84805	71559	78406	74995	444	19201	9823	1.02	1.27	1.15
S.Em. ±	-	-	-	-	-	-	1562	1457	978	-	-	-
C.D. at 5%	-	-	-	-	-	-	6133	5722	3841	-	-	-
B) Sub plot :- Planting geometry (PG)												
PG_1:15 cm x 10 cm	54787	78744	66765	76212	84371	80295	-21426	-5627	-13526	0.70	0.90	0.80
PG_2: 20 cm x 10 cm	54657	81720	68189	71464	80369	75920	-16807	1351	-7728	0.74	0.99	0.87
PG_3: 25 cm x 10 cm	63481	99535	81508	70011	70903	72935	-6530	23683	8577	0.90	1.40	1.15
PG_4: 30 cm x 10 cm	47866	88911	61613	63631	68329	58588	-5410	14583	3028	1.06	1.16	1.11
PG_5:20 cm x 15 cm	62691	90766	76729	68447	69905	69247	-5756	20861	7553	0.90	1.27	1.08
S.Em. ±	-	-	-	-	-	-	1700	1172	1119	-	-	-
C.D. at 5%	-	-	-	-	-	-	4961	3421	3265	-	-	-
C) Sub-sub plot :- Fertilizers levels (F)												
F_1: 80:40:00 NPK kg ha^{-1} (RDF) without FYM	35334	68972	45378	50345	54545	42051	-4656	14426	3327	1.05	1.23	1.14
F_2: 80:40:00 NPK kg ha^{-1} (RDF) with FYM 5 t ha^{-1}	51387	77403	64395	71714	78551	75133	-20328	-1149	-10738	0.70	0.96	0.83
F_3: 80: 40: 40 NPK kg ha^{-1} with FYM 5 t ha^{-1}	58210	87861	73036	73716	81184	77450	-15505	6677	-4414	0.77	1.06	0.92
F_4:100:50:50 NPK kg ha^{-1} with FYM 5 t ha^{-1}	68289	101924	85107	76382	78581	80469	-8092	23343	7626	0.87	1.19	1.03
F_5:120:60:60 NPK kg ha^{-1} with FYM 5 t ha^{-1}	70262	103517	86890	77610	86015	81882	-7348	17502	5077	0.88	1.18	1.03
S.Em. ±	-	-	-	-	-	-	664	673	455	-	-	-
C.D. at 5%	-	-	-	-	-	-	1860	1883	1275	-	-	-
General mean	58334	87935	73134	69501	76970	73236	-11135	10970	-82	0.82	1.12	0.97

Table 6: Economics of finger millet as influenced by different treatment combinations (Upland LS_1)

Treatment combinations	Gross returns (₹ ha^{-1})			Cost of cultivation (₹ ha^{-1})			Net returns (₹ ha^{-1})			B : C ratio		
	2017	2018	Pooled mean	2017	2018	Pooled mean	2017	2018	Pooled mean	2017	2018	Pooled mean
$LS_1 PG_1 F_1$	55722	107310	81516	57236	68935	63086	-1515	38375	18430	0.97	1.56	1.26
$LS_1 PG_1 F_2$	68558	118139	93349	81951	93420	87686	-13393	24719	5663	0.84	1.26	1.05
$LS_1 PG_1 F_3$	82464	129488	105976	84830	96339	90585	-2366	33149	15391	0.97	1.34	1.16
$LS_1 PG_1 F_4$	95732	140197	117964	86571	99239	92905	9161	40958	25059	1.11	1.41	1.26
$LS_1 PG_1 F_5$	97817	147292	122554	88008	101709	94859	9808	45583	27696	1.11	1.45	1.28
$LS_1 PG_2 F_1$	58067	95608	76838	54209	62766	58487	3858	32842	18350	1.07	1.52	1.30
$LS_1 PG_2 F_2$	71277	107628	89453	78548	87776	83162	-7271	19853	6291	0.91	1.23	1.07
$LS_1 PG_2 F_3$	83649	121588	102619	80148	92016	86082	3501	29572	16536	1.04	1.32	1.18
$LS_1 PG_2 F_4$	87690	141876	114783	83556	94809	89182	4135	47067	25601	1.05	1.50	1.27
$LS_1 PG_2 F_5$	89541	139514	114528	85775	96318	91046	3767	43196	23482	1.04	1.45	1.25
$LS_1 PG_3 F_1$	84607	106330	95469	54134	57516	55825	30473	48815	39644	1.56	1.85	1.71
$LS_1 PG_3 F_2$	91816	115826	103821	77936	81699	79817	13881	34127	24004	1.18	1.42	1.30
$LS_1 PG_3 F_3$	106802	124124	115463	81347	84048	82697	25455	40076	32766	1.31	1.48	1.39
$LS_1 PG_3 F_4$	111189	149246	130217	83061	89234	86147	28128	60012	44070	1.34	1.67	1.51
$LS_1 PG_3 F_5$	115508	151134	133321	84822	90833	87828	30686	60300	45493	1.36	1.66	1.51
$LS_1 PG_4 F_1$	57060	99690	78375	41967	57478	49723	15092	42211	28652	1.36	1.73	1.55
$LS_1 PG_4 F_2$	70664	116230	93447	66613	81492	74052	4052	34738	19395	1.06	1.42	1.24
$LS_1 PG_4 F_3$	80832	135129	107980	69961	84236	77098	10872	50893	30882	1.16	1.60	1.38
$LS_1 PG_4 F_4$	92780	146165	119472	73046	87509	80277	19734	58657	39195	1.27	1.67	1.47
$LS_1 PG_4 F_5$	89438	147659	118549	74369	89490	81930	15069	58169	36619	1.20	1.65	1.43
$LS_1 PG_5 F_1$	75576	107091	91334	49366	53418	51392	26210	53673	39942	1.53	2.00	1.77
$LS_1 PG_5 F_2$	85539	113485	99512	74337	77946	76141	11203	35539	23371	1.15	1.46	1.30
$LS_1 PG_5 F_3$	89187	124891	107039	76846	81175	79010	12341	43716	28028	1.16	1.54	1.35
$LS_1 PG_5 F_4$	104128	138162	121145	79927	85438	82682	24201	52724	38463	1.30	1.62	1.46
$LS_1 PG_5 F_5$	106520	139301	122911	79910	86326	83118	26610	52972	39791	1.33	1.61	1.47

Table 7: Economics of finger millet as influenced by different treatment combinations (Midland LS_2)

Treatment combinations	Gross returns (₹ ha^{-1})			Cost of cultivation (₹ ha^{-1})			Net returns (₹ ha^{-1})			B : C ratio		
	2017	2018	Pooled mean	2017	2018	Pooled mean	2017	2018	Pooled mean	2017	2018	Pooled mean
$LS_2 PG_1 F_1$	7656	16583	12119	50111	55247	52679	-42455	-38664	-40560	0.15	0.30	0.23
$LS_2 PG_1 F_2$	8630	23581	16105	73121	79116	76118	-64491	-55535	-60013	0.12	0.30	0.21
$LS_2 PG_1 F_3$	12247	30670	21459	73822	81082	77452	-61575	-50412	-55994	0.17	0.38	0.27
$LS_2 PG_1 F_4$	17920	37045	27483	75671	83235	79453	-57751	-46189	-51970	0.24	0.45	0.34
$LS_2 PG_1 F_5$	19639	37004	28322	77151	84498	80825	-57512	-47494	-52503	0.25	0.44	0.35
$LS_2 PG_2 F_1$	10167	27380	18773	44645	51047	47846	-34479	-23666	-29073	0.23	0.54	0.38
$LS_2 PG_2 F_2$	14062	30408	22235	67593	74503	71048	-53531	-44095	-48813	0.21	0.41	0.31
$LS_2 PG_2 F_3$	14016	33475	23746	68920	76575	72748	-54904	-43101	-49002	0.20	0.44	0.32
$LS_2 PG_2 F_4$	19038	36424	27731	70348	80773	75560	-51310	-44349	-47829	0.27	0.45	0.36
$LS_2 PG_2 F_5$	21695	41023	31359	72223	81411	76817	-50528	-40388	-45458	0.30	0.50	0.40
$LS_2 PG_3 F_1$	12825	35991	24408	42856	46478	44667	-30031	-10488	-20259	0.30	0.77	0.54
$LS_2 PG_3 F_2$	11021	48402	29711	64952	71147	68050	-53931	-22745	-38338	0.17	0.68	0.42
$LS_2 PG_3 F_3$	17141	72841	44991	66859	75958	71409	-49718	-3117	-26417	0.26	0.96	0.61
$LS_2 PG_3 F_4$	29736	82459	56098	69941	78560	74250	-40205	3899	-18153	0.43	1.05	0.74
$LS_2 PG_3 F_5$	33142	81199	57170	71550	79175	75363	-38409	2024	-18192	0.46	1.02	0.74
$LS_2 PG_4 F_1$	8649	26244	17447	35692	42597	39144	-27043	-16352	-21698	0.24	0.62	0.43
$LS_2 PG_4 F_2$	9864	31337	20601	57334	66445	61889	-47470	-35107	-41289	0.17	0.47	0.32
$LS_2 PG_4 F_3$	12020	39291	25656	58600	68852	63726	-46580	-29561	-38070	0.21	0.57	0.39
$LS_2 PG_4 F_4$	21034	57968	39501	60509	71721	66115	-39475	-13754	-26614	0.35	0.81	0.58
$LS_2 PG_4 F_5$	21175	54167	37671	61838	72245	67041	-40663	-18077	-29370	0.34	0.75	0.55
$LS_2 PG_5 F_1$	13374	12704	13039	42002	41985	41994	-28628	-29282	-28955	0.32	0.30	0.31
$LS_2 PG_5 F_2$	15282	20232	17757	64576	64987	64782	-49294	-44755	-47025	0.24	0.31	0.27
$LS_2 PG_5 F_3$	18847	30312	24580	65767	66187	65977	-46920	-35875	-41398	0.29	0.46	0.37
$LS_2 PG_5 F_4$	21817	41948	31883	68310	67586	67948	-46493	-25637	-36065	0.32	0.62	0.47
$LS_2 PG_5 F_5$	26790	40166	33478	68293	69651	68972	-41503	-29484	-35494	0.39	0.58	0.48

Table 8: Economics of finger millet as influenced by different treatment combinations (Gently sloppy land (*VARKAS*) LS_3)

Treatment combinations	Gross returns (₹ ha^{-1})			Cost of cultivation (₹ ha^{-1})			Net returns (₹ ha^{-1})			B : C ratio		
	2017	2018	Pooled mean	2017	2018	Pooled mean	2017	2018	Pooled mean	2017	2018	Pooled mean
$LS_3 PG_1 F_1$	52098	66966	59532	56509	63024	59766	-4411	3942	-234	0.92	1.06	0.99
$LS_3 PG_1 F_2$	61403	69699	65551	80598	86099	83349	-19196	-16400	-17798	0.76	0.81	0.79
$LS_3 PG_1 F_3$	71263	77035	74149	82901	88347	85624	-11637	-11312	-11475	0.86	0.87	0.87
$LS_3 PG_1 F_4$	81912	89340	85626	86531	91873	89202	-4619	-2534	-3576	0.95	0.97	0.96
$LS_3 PG_1 F_5$	88739	90804	89771	88170	93400	90785	569	-2596	-1013	1.01	0.97	0.99
$LS_3 PG_2 F_1$	51600	71818	61709	51564	59128	55346	36	12690	6363	1.00	1.21	1.11
$LS_3 PG_2 F_2$	60438	81898	71168	75219	82401	78810	-14781	-503	-7642	0.80	0.99	0.90
$LS_3 PG_2 F_3$	67967	90573	79270	77142	84754	80948	-9175	5819	-1678	0.88	1.07	0.97
$LS_3 PG_2 F_4$	83382	100019	91700	80154	89677	84915	3228	10342	6785	1.04	1.12	1.08
$LS_3 PG_2 F_5$	87274	106572	96923	81923	91587	86755	5351	14985	10168	1.07	1.16	1.11
$LS_3 PG_3 F_1$	46696	82161	64428	47814	53487	50650	-1118	28674	13778	0.98	1.54	1.26
$LS_3 PG_3 F_2$	64427	99302	81865	73370	78944	76157	-8943	20358	5708	0.88	1.25	1.07
$LS_3 PG_3 F_3$	67244	107641	87443	74752	81300	78026	-7509	26341	9416	0.89	1.32	1.11
$LS_3 PG_3 F_4$	83908	120291	102099	78046	83207	80626	5862	37084	21473	1.07	1.44	1.25
$LS_3 PG_3 F_5$	81566	119080	100323	79329	85490	82409	2237	33590	17913	1.02	1.39	1.21
$LS_3 PG_4 F_1$	57081	77331	67206	41296	56435	48866	15785	20896	18340	1.38	1.37	1.38
$LS_3 PG_4 F_2$	70116	81900	76008	65458	79391	72425	4658	2509	3583	1.07	1.03	1.05
$LS_3 PG_4 F_3$	75555	90453	83004	67934	81635	74785	7621	8818	8220	1.11	1.11	1.11
$LS_3 PG_4 F_4$	84043	113158	100495	70664	87040	78852	13379	26118	19748	1.18	1.30	1.24
$LS_3 PG_4 F_5$	85464	116947	101206	72817	88366	80592	12647	28581	20614	1.17	1.32	1.25
$LS_3 PG_5 F_1$	61620	101368	81494	49404	48638	49021	12215	52729	32472	1.25	2.09	1.67
$LS_3 PG_5 F_2$	67703	102970	85337	74109	72902	73506	-6406	30068	11831	0.91	1.41	1.16
$LS_3 PG_5 F_3$	73920	110400	92160	75902	75253	75577	-1982	35147	16583	0.97	1.47	1.22
$LS_3 PG_5 F_4$	74427	116570	95499	78988	76849	77919	-4561	39721	17580	0.94	1.52	1.23
$LS_3 PG_5 F_5$	75639	118891	97265	78971	79727	79349	-3332	39161	17916	0.96	1.49	1.23

Conclusion

On the basis of investigation, it can be concluded that the finger millet crop should be grown during *kharif* season on upland situation (well drained) followed by gently sloppy land (*Varkas*) with 25 cm x 10 cm planting geometry along with application of fertilizer dose @ 100: 50: 50 NPK kg ha^{-1} with FYM 5 t ha^{-1} for obtaining maximum yield, quality, net returns and benefit cost ratio under south *Konkan* condition.

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