EFFECT OF DIFFERENT FARMING TYPES ON GROWTH, YIELD AND YIELD ATTRIBUTING PARAMETERS OF FINGER MILLET UNDER FINGER MILLET BASED INTERCROPPING SYSTEMS

Abstract

A field experiment was conducted on performance of finger millet based inter cropping system under different farming types during *kharif* 2019-20 and 2020-21 at College of Agriculture, KSN UAHS Shivamogga. The Experiment was laid out with split-plot design having Three farming types as main plots (conventional, organic, and natural farming) and finger millet based inter cropping system as subplots (Finger millet + red gram, finger millet + field bean, Sole finger millet , sole red gram and sole field bean) in three replications. Among different farming types, conventional farming type recorded significantly higher yield parameters *viz.,* number of productive tillers hill^{-1} (5.14), number of ear heads hill^{-1}(3.83), number of fingers per ear head (6.31), number of grains ear head^{-1} (4002.50), and test weight (3.71 g) there by achieved significantly higher grain yield (2449.83 kg ha^{-1}) and straw yield (3957.42 kg ha^{-1}) as compared to organic (2039.67 kg ha^{-1} and 3297.30 kg ha^{-1}) and natural farming (1470.83 kg ha^{-1}and 2328.35 kg ha^{-1}) respectively. Among the finger millet based inter cropping system, the higher grain and straw yield (2225.67 kg ha^{-1} and 3561.13 kg ha^{-1}) respectively was recorded in sole finger millet as compare to finger millet + redgram (1991.67 kg ha^{-1} and 3243.17 kg ha^{-1}) respectively and finger millet + field bean (1743.00 kg ha^{-1} and 2778.77 kg ha^{-1}) respectively. Whereas, the interaction effect between farming types and finger millet based intercropping systems was found non-significant.

Keywords: Growth, Yield, Finger-millet, Farming systems and Inter cropping systems

Introduction

Finger millet (*Eleusine coracana* L. Gaertin) is one of the important rainfed crop widely cultivated in dry tracts of Southern Karnataka for grain and fodder purpose in varied agro climatic conditions under resource constrained situations. It is also called as kurrakan millet or koracan millet, ragi, nachni in India, African millet and rapoko in South Africa and dagusa in Ethiopia. In India, it is grown in Karnataka, Tamil Nadu, Andra Pradesh, Orissa, Jharkand, Maharastra and Uttarakhand over an area of 11.17 lakh hectares with the production of 20.60 lakh tonnes with an average productivity of 1661 kg ha^{-1} (Wafula *et al*. 2021). Karnataka is the largest producer of finger millet in India grown in an area of 6.28 lakh ha with annual production of 9.3 lakh tonnes and productivity of 1759 kg ha^{-1} (Wafula *et al*. 2021). More importantly, its greater plasticity and adaptability to different ecological condition, feasibility for transplanting, better suitability to different cropping systems and mid-season correction during vagaries of monsoon in the contingent plans made it so popular crop Krishne gowda, (2004).

Many experts in the field of agriculture have voiced concern that any more efforts to persist with increased and often indiscriminate use of chemical inputs will only prove counterproductive in the long run and cause irreparable damage to soil health. Marching towards achieving sustainability in agriculture, is one of the major concerns of humanity as on today. In wake of this reverting to non – chemical agriculture practice has assumed great importance to attain sustainability in production. In this search for ecofriendly and farmer friendly alternate type of farming organic or natural farming is increasingly becoming popular nowadays.

Diversification of cropping system is necessary to get higher yield and returns, to maintain soil health, preserve environment and meet daily food and fodder requirement of human and animal system (Padhi and Panigrahi, 2006). Organic or natural farming relies on adoption of diversified multi cropping systems. The cereal-legume intercropping is mainly practiced in subsistence agriculture. Legumes are included in intercropping system to mainly get protein requirement of the family with some additional returns. Scientific intercropping of pulses with cereals and other non-legume companion crops have certain inbuilt advantage over pure cropping (Velautham and Somasundaram, 2000). Keeping these things in view, an experiment entitled “Performance of different farming types in finger millet based inter cropping system under Southern Transition Zone of Karnataka” was undertaken with the following objective to study the effect of different farming types on growth, yield and yield attributing parameters of finger millet under finger millet based intercropping systems

Materials and Methods

Field experiment on performance of different farming types in finger millet based inter - cropping system under Southern Transition Zone of Karnataka was conducted during *kharif* seasons for two consecutive years during during 2019 and 2020 at field unit, Department of Agronomy, College of Agriculture, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Navile, Shivamogga, Karnataka. The geographical reference point of the experimental site was 14° 1' N latitude and 75° 42' E longitude with an altitude of 650 meters above mean sea level. There were three main plots and five sub plots treatments which comprised of two factors for study *viz.*, farming types (three) and cropping system (five) and details of the field experiment conducted is given below.

Main plot (Farming types)

M_1**:** Conventional farming (CF)
M_2**:** Organic farming (OF)
M_3**:** Natural farming (NF)

Sub plot (Cropping systems)

S_1**:** Finger millet + Red gram (8:2)
S_2**:** Finger millet + Field bean (8:1)
S_3: Sole Finger millet crop
S_4: Sole Red gram crop
S_5: Sole Field bean crop

3.5.1.2 Treatment combinations

T_1: CF - (Finger millet + Red gram)
T_2: CF - (Finger millet + Field bean)
T_3: CF - (Sole finger millet crop)
T_4: CF - (Sole red gram crop)
T_5: CF - (Sole field bean crop)
T_6: OF - (Finger millet + Red gram)
T_7: OF - (Finger millet + Field bean)
T_8: OF - (Sole finger millet crop)
T_9: OF - (Sole red gram crop)
T_{10}: OF - (Sole field bean crop)
T_{11}: NF - (Finger millet + Red gram)
T_{12}: NF - (Finger millet + Field bean)
T_{13}: NF - (Sole finger millet crop)

T_{14}: NF - (Sole red gram crop)

T_{15}: NF - (Sole field bean crop)

Chart 1 : Design and experimental details

Design		Split plot design
Treatments Combination		15
Replications		03
Gross plot size		7.2 m × 4.2 m
Net plot size		6.0 m × 3.6 m
Season		*Kharif* of 2018-2019 and 2019 -2020
Location		ZAHRS, Shivamogga
Plan of layout		Fig :3.2
Crop		Main crop finger millet, intercrops red gram and field bean
Variety of finger millet		ML-365
Variety of red gram		BRG-4
Variety of field bean		Local field bean
Spacing		Finger millet 30 cm × 10 cm Red gram 60 cm × 30 cm Field bean 60 cm × 30 cm
Recommended dose of fertilizers		Finger millet 50:40:25 N, P_2O_5, K_2O kg ha^{-1}. Red gram 25:50:25 N, P_2O_5, K_20 kg ha^{-1} Field bean 25:50:25 N, P_2O_5, K_20 kg ha^{-1}
Date of sowing	Season - I	18-07-2019
	Season - II	02-07-2020
Date of harvest	Season - I	12-12-2019
	Season - II	26 -11-2020

<u>Details of the inputs used in the experiments</u>:

In case of conventional farming, FYM @ 7.5 t ha^{-1} applied before sowing. Recommended dose of Nutrients 50:40:25 kg N: P_2O_5: K_2O ha^{-1} along with micronutrients such as $ZnSO_4$ @ 12.5 kg ha^{-1} and Borax @ 10 kg ha^{-1} were applied as soil application. The Seeds were treated with Carbendazim @ 2g kg $^{-1}$ of seeds before sowing and bio fertilizers were *Pseudomonas* and *Trichoderma Viride* @ 500 g each mixed with 25 kg of FYM and then applied. The practices followed in organic farming were applied recommended dose of nutrients, supplied through FYM on N equivalent basis and FYM @ 7.5 t ha^{-1} applied before sowing. Seeds are treated with Rhizobium @ 20 g kg^{-1} of seed. The Biofertilizers such as Azospirillum and phosphorus solubilizing bacteria (PSB) were applied @ 1 kg ha^{-1} each mixing with FYM. The Nimbicidin @ 2 ml per litre of water as a bio insecticide to control pests and diseases in organic farming system. Where as in case of natural farming, seeds were treated with beejamrutha at the time of sowing. Soil application of ghana jeevamrutha @ 1000 kg ha^{-1} at the time of sowing was applied. The Foliar application of jeevamrutha @ 500 lit ha^{-1} at 30, 60 and 90 days after sowing was carried out. Neemastra @ 3 lit per 100 litres of water and sour butter milk @ 5 litres per 100 litre of water to control pests and diseases. The growth parameters such as plant height, no of leaves per plant, no of tillers per plant and leaf area index were recorded in five tagged plants. Yield and yield components of finger millet were the total number of productive tillers, total number of fingers and number of ear heads, the total number of grains per ear head recorded in five tagged plants. Ears from five randomly selected plants were separated, dried and hand threshed. The threshed seeds were used to record grain weight $plant^{-1}$. 1000 grain samples were drawn from net plot produce of each treatment for recording test weight and expressed in g. The grain yield obtained from each net plot area was sun dried to 10-12 per cent moisture and later yield was converted to kg ha^{-1}. The straw from net plot area was cut close to the ground level and was left for air drying in the field. Later it was weighed and computed as straw yield in (3957 kg ha^{-1}).

Result and Discussion

Growth parameters of finger millet showed significant improvement at harvest of finger millet. Plant height is considered as an important morphological characters of growth influenced by different farming types in finger millet based intercropping system is furnished in Table 1. Combined application of recommended dose of FYM and fertilizers as per recommended package of practice (conventional farming) excelled significantly over other treatments by recording significant improvement in plant height (118.63 cm) as compared to crop management by following organic practices (organic farming) (110.40 cm) and crop management through natural practices (natural farming) (73.18 cm) at harvest, respectively. Similar trend of significantly higher number of leaves (35.27) and number of tillers (5.37) at harvest respectively, were recorded in conventional farming as compared to organic farming w. r. t number of leaves (31.78) and number of tillers (5.18) at harvest, respectively. Significantly lesser number of leaves (26.92) and tillers (3.69) at harvest respectively, were observed in natural farming (Table 1). Increased plant height, number of leaves and number of tillers under conventional farming could be due to balanced application of nutrients through organic and inorganic source of manures which readily supplied available inorganic forms of nutrients, particularly nitrogen, which is a key element of protoplasm and plays a favourable function in cell division and elongation. The significant reduction in growth parameters in organic farming *viz*., plant height, number of leaves and tillers under organic farming might be due to low and slow availability of nutrients required essentially for plant growth. In natural farming use of jeevamrutha and ghana jeevamrutha could not increase the plant height, number of leaves and number of tillers significantly due to less availability of nutrients in soil for plant growth. The results obtained are in accordance with results of Manjunath *et al.* (2009) and Yogananda *et al.* (2015).

In finger millet based cropping system treatments, sole finger millet system found efficient in recording higher plant height, number of leaves and number of tillers per plant (Table 1). Statistically taller plants were observed in sole finger millet (107.53 cm) as compared to finger millet + red gram (100.60 cm).Significantly shorter plants noticed with finger millet + field bean (94.08 cm,) at harvest, respectively. Number of leaves plant^{-1} (32.93) and number tillers plant^{-1} (5.09) at harvest, respectively recorded in sole finger millet were on par with finger millet + red gram (31.77 for number of leaves) (4.78 for number of tillers plant^{-1}) at harvest, respectively. Significantly lower number of leaves plant^{-1} (29.27) and number of tillers plant^{-1} (4.38) were recorded in finger millet + field bean during its growth stage. Significant improvement in plant height, number of leaves and tillers in sole cropping indicates no competition for resources. Further, due to competition for resources under intercropping system registered statistically lesser growth parameters of finger millet. This is in line with findings of Miko and Manga (2008) and Jagadeesha (2009).

Leaf area of the canopy is an important trait related to radiation absorption and thus determine biological yield. Leaf area depends on genetic background, agronomic practices, climatic conditions and also nutrient accumulation and it's partitioning within the leaves. To obtain higher dry matter, photosynthetic efficiency of leaf area is very much essential. Higher leaf area (1030.17 cm^2 plant^{-1}) was recorded with conventional farming and statistically superior over organic farming (787.00 cm^2 plant^{-1}) and natural farming (584.67 cm^2 plant^{-1}) at harvest, respectively. In conventional farming statistically higher leaf area could be owing to the fact that, chemical fertilisers can rapidly deliver the required quantity of nutrients in a balanced proportion coinciding with the crop requirement, there by improved leaf initiation and expansion. Organic farming performed comparatively better than natural farming by recording higher growth attributes which might be due to the added FYM increased the soil organic matter and improved the physical and biological properties of the soil apart from sustained availability of nutrients. In natural farming the application of ghana jeevamrutha and jeevamrutha at regular intervals act as a stimulus in the plant system which in turn increased the production of growth regulators in the cell system and action of growth hormones such as IAA and GA_3 resulted in producing leaf area to certain extent. The results are in accordance with Tomar *et al*. (2018) and Sutar *et al*. (2019). In finger millet based intercropping systems, treatment under sole finger millet was efficient in producing higher leaf area of finger millet (930.33 cm^2 $plant^{-1}$) as compared to finger millet + red gram (800.67 cm^2 $plant^{-1}$). Significantly lesser leaf area was found with finger millet + field bean (670.83 cm^2 $plant^{-1}$) at harvest, respectively (Table 1).

Interaction effect between different treatments under study did not show any significant influence on growth parameters like plant height, number of leaves, and number of tillers, leaf area and leaf area index. However, numerically higher values of growth parameters were observed with nutrient supplied through inorganic fertilizers with sole finger millet followed by conventional farming with finger millet + red gram and organic farming with sole finger millet.

The yield and yield components of finger millet varied significantly by different farming types in finger millet based intercropping system. The data is presented in Table.2 - 3.

Productive tillers per plant (5.14), number of ear head per plant (3.83), number of fingers per ear head (6.47), number of grains per ear head (4003) and test weight (3.71 g) at harvest were significantly higher in conventional farming compared to organic farming (4.97, 3.40, 6.26, 3432 and 3.61 g, respectively) and significantly lower yield attributes were recorded in natural farming (3.57, 2.61, 4.75, 2395 and 3.10 g, respectively).

Significant improvement in the yield attributes under conventional farming was mainly due to combined application of FYM and fertilisers which facilitated the quick supply of essential nutrients in required quantity and added FYM acts as a storehouse of micro and macronutrients there by helped to increase nutrient availability to the crop. Yield attributes under organic farming might be due to steady and continuous supply of nitrogen throughout the crop growth period, along with gradual transformation and mineralization of organics and solubilisation of water insoluble phosphorous compounds by organic acids released during organic manures decomposition. In natural farming, yield attributes obtained might be due to application of jeevamrutha as jeevamrutha contains higher microbial load and growth hormones which might have enhanced the mobilization of nutrients and facilitated the release of adsorbed nutrients in the soil which resulted in increased yield attributes. This is in accordance to the findings of Muhammad *et al*. (2015); Ramamoorthy *et al*. (2004); Kumar and Singh (2006) and Ramesh *et al*. (2018).

Among intercropping systems significantly higher yield components such as productive tillers plant^{-1}, number of ear head plant^{-1}, number of fingers ear head^{-1}, number of grains ear head^{-1} and test weight were recorded in sole finger millet cropping system (Table.2 - 3) which ultimately contributed for higher grain and straw yield. Higher productive tillers plant^{-1} (4.85), number of ear head plant^{-1} (3.50), number of fingers ear head^{-1}(6.18), number of grains ear head^{-1} (3471) and test weight (3.59 g) were recorded in sole finger millet compared to finger millet + red gram (4.58, 3.24, 5.82, 3264 and 3.49 g) and statistically lower yield attributes were recorded in finger millet + field bean (4.24, 3.10, 5.33, 3094 and 3.34 g), respectively. Above results are in conformity with the findings of Shri *et al*. (2014). The higher values with respect to yield parameters are attributed to lack of inter space competition under sole cropping that could otherwise happen in intercropping system. Similar results were also obtained by Prakash (2015), noticed significantly higher grain yield attributes were obtained in sole finger millet. Interactive effects were found non-significant during both the years of experimentation.

Yield parameters

The grain and straw yield of finger millet were significantly influenced by different farming types the data is presented in Table 3. Among different farming types, conventional farming recorded higher grain and straw yield (2450 kg ha^{-1} and 3957 kg ha^{-1}) which was significantly superior compared to organic farming (2040 kg ha^{-1} and 3297 kg ha^{-1}) and natural farming (1471 kg ha^{-1} and 2328 kg ha^{-1}, respectively). Natural and organic farming recorded 40 and 17 per cent reduction in grain yield over the conventional farming. Increased yield under conventional farming might be due to balanced application of nutrients supplied through FYM and inorganic fertilizers led to release of higher amount of nutrients which resulted in significant higher nitrogen, phosphorous and potassium content in the soil (309.83, 129.83 and 283.55 N,P_2O_5,K_2O respectively) at 60 days after incubation. These inorganic fertilizers readily supply the nutrients for plant growth and development and also the supply matched the crops nutrient demand. In organic farming, nutrients supplied through organic manures like FYM on

N equivalent basis. These organic manures led to slow release of macro and micro nutrients throughout the crop growth. Organic matter in the form of FYM applied to soil has solubilizing effect on some of the mineral compound present in soil and brings about conversion of number of chemical elements to available form. Organic matter on decomposition solubilizes insoluble P fraction through release of various organic acids and increase P status of the soil. Under natural farming without adding any chemical fertilizers, yield of 1471 kg ha^{-1} obtained could be due to application of cow based jeevamrutha and ghana jeevamrutha, which has enormous amount of microbial load. These formulations also contains macronutrients like N, P and K, essential micronutrients, many vitamins, essential amino acids, growth promoting factors like IAA, GA, which may provide nutrition to rhizosphere microorganisms and thus help to increase the microorganisms population. Mulching with crop residues is essential practice to be followed under natural farming Significantly higher microbial population recorded in natural farming could be due to mulching practice which helps in providing proper micro environment for microorganism for their better establishment and it is converted to organic matter then it self-act as carbon source and due to frequent addition of fresh microorganism that is virulent culture through jeevamrutha that leads to higher microbial population. Devakumar *et al*. (2008) and Sreenivasa *et al*. (2009) have also reported the presence of higher beneficial microbial population and the beneficial effect of jeevamrutha in enhancing the growth and yield. Similar results reported by Manjaiah and Singh (2001); Lori *et al*. (2017); Yadav and Chipa, (2005) and Boraiah *et al*. (2017) found that as compared to conventional and organic farming, natural farming recorded 40 and 28 per cent decreased yield and might be due to application of natural farming inputs and without adding any chemical fertilizers which in turn did not supply nutrients requirement of crop demand which lead to lower yield.

Where as in finger millet based intercropping system expressively higher grain and straw yield of finger millet was found with the sole finger millet (2226 and 3561 kg ha^{-1}) followed by finger millet + red gram (1992 and 3243 kg ha^{-1}) and lower grain and straw yield was found with finger millet + field bean (1743 and 2779 kg ha^{-1}) correspondingly. Yield decrease in finger millet + field bean and finger millet + red gram was to an extent of 22 and 09 per cent over sole finger millet. Higher yield of sole finger millet had plant population (3,33,333 ha^{-1}) which helped to get more number of ear head per unit area this resulted in higher grain yield and straw yield of sole finger millet. Under replacement series, plant population of finger millet was reduced to the extent of (27%) in finger millet + red gram and finger millet + field bean intercropping system. it might leads to reduction in finger millet yield under intercrop treatments like finger millet + red gram (10.51 %) and finger millet + field bean (21.69 %) was due to crowding effect of field bean as it had smothered finger millet crop. However, reduction in finger millet yield was to a lesser extent of (10.51 %) in finger millet + red gram intercropping system could be attributed for less competition index of red gram as red gram is slow grower in initial stages which might have favored finger millet crop with its differential above and below ground growth habits results corroborate the findings of Venkatesh (2008) and Jadeyegowda (2015).

The results of the present investigation permit to infer that by and large the interaction effect of different farming types and finger millet based intercropping systems remained non-significant. Crop management with conventional farming performed better followed by organic farming. Whereas, yield variations do exist among the interaction treatments. Highest grain yield was recorded in sole finger millet grown under conventional farming (2769 kg ha^{-1}). It was closely followed by package of practice in finger millet + red gram (2460 kg ha^{-1}) and finger millet grown under organic farming (2300 kg ha^{-1}). However, lower yield obtained under natural farming with finger millet + field bean (1305 kg ha^{-1}).

Data pertaining to harvest index influenced by different farming types under finger millet based intercropping systems are presented in Table 3. Harvest index is a function of both economic and biological yield and indicates how efficiently a plant body can transform its photosynthates into economically usable products. The harvest indices of various treatments did not differ significantly. The harvest index ranging from 0.382 to 0.387 and 0.381 to 0.386 in various treatments of farming types and intercropping system respectively and it might be due to several reasons including poor sink development and poor source utilization. The results are in accordance with Rukmangada Reddy *et al.* (2007); Anand *et al.* (2006); Dinesh Kumar (2006); Umesh *et al*. (2006) and Govindappa (2003) in finger millet. Interaction effect of farming types and intercropping systems were found non-significant.

Conclusion

The study investigated the effect of different farming types on growth, yield and yield attributing parameters of finger millet under finger millet based intercropping systems. In finger millet based cropping system treatments, sole finger millet system found efficient in recording higher plant height, number of leaves and number of tillers per plant. The interaction effect between farming types and finger millet based intercropping systems was found non-significant. Diversification of cropping system is crucial to get higher yield and returns, to maintain soil health, preserve environment and meet daily food and fodder requirement of human and animal system.

Table 1: Growth parameters of finger millet as influenced by different farming types in finger millet based intercropping system

Treatments	Plant Height (cm)			Number of leaves per plant			Number of tillers per plant			Leaf area (cm^2 $plant^{-1}$)		
	2019	2019	2019	2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled
FARMING TYPES (M)												
Conventional farming	116.07	121.20	118.63	34.83	35.70	35.27	5.30	5.43	5.37	1025.00	1035.33	1030.17
Organic farming	107.77	113.03	110.40	31.37	32.20	31.78	5.07	5.30	5.18	783.33	790.67	787.00
Natural farming	71.40	74.97	73.18	26.53	27.30	26.92	3.67	3.72	3.69	580.00	589.33	584.67
S. Em±	1.06	1.11	1.09	**0.36**	**0.37**	**0.36**	**0.05**	**0.05**	**0.05**	**9.76**	**9.84**	**9.80**
C.D @ 5 %	4.18	4.36	4.27	**1.41**	**1.44**	**1.43**	**0.20**	**0.21**	**0.21**	**38.33**	**38.63**	**38.48**
FINGER MILLET BASED CROPPING SYSTEMS (S)												
Finger millet + Red gram	97.83	97.83	97.83	31.37	32.17	31.77	4.70	4.85	4.78	795.67	805.67	800.67
Finger millet + Field bean	91.77	91.77	91.77	28.80	29.73	29.27	4.33	4.43	4.38	666.67	675.00	670.83
Sole Finger millet	105.63	105.63	105.63	32.57	33.30	32.93	5.00	5.17	5.09	926.00	934.67	930.33
S. Em±	**1.71**	**1.71**	**1.71**	**0.53**	**0.54**	**0.54**	**0.08**	**0.08**	**0.08**	**14.04**	**14.18**	**14.11**
C.D @ 5 %	**5.26**	**5.26**	**5.26**	**1.63**	**1.67**	**1.65**	**0.25**	**0.26**	**0.25**	**43.25**	**43.69**	**43.47**
INTERACTIONS (M X S)												
CF: Finger millet + Red gram	114.50	114.50	114.50	35.30	36.10	35.70	5.30	5.50	5.40	1037.00	1056.00	1046.50
CF: Finger millet + Field bean	107.00	107.00	107.00	32.30	33.20	32.75	4.90	4.96	4.93	890.00	898.00	894.00
CF: Sole Finger millet	126.70	126.70	126.70	36.90	37.80	37.35	5.70	5.84	5.77	1148.00	1152.00	1150.00
OF: Finger millet + Red gram	107.00	107.00	107.00	31.90	32.60	32.25	5.10	5.30	5.20	790.00	795.00	792.50
OF: Finger millet + Field bean	104.30	104.30	104.30	29.30	30.40	29.85	4.70	4.90	4.80	620.00	629.00	624.50
OF: Sole Finger millet	112.00	112.00	112.00	32.90	33.60	33.25	5.40	5.70	5.55	940.00	948.00	944.00
NF: Finger millet + Red gram	72.00	72.00	72.00	26.90	27.80	27.35	3.70	3.75	3.73	560.00	566.00	563.00
NF: Finger millet + Field bean	64.00	64.00	64.00	24.80	25.60	25.20	3.40	3.42	3.41	490.00	498.00	494.00
NF: Sole Finger millet	78.20	78.20	78.20	27.90	28.50	28.20	3.90	3.98	3.94	690.00	704.00	697.00
S. Em±	**2.96**	**2.96**	**2.96**	**0.92**	**0.94**	**0.93**	**0.14**	**0.14**	**0.14**	**24.31**	**24.56**	**24.43**
C.D (SP at same level of MP)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
C.D (MP at same or different level of SP)	**NS**	**NS**	**NS**	**2019**	**2020**	**Pooled**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

NOTE: DAS: Days after sowing, NS: Non significant, MP: Main plot, SP: Sub plot

Table 2: Yield attributing parameters of finger millet as influenced by different farming types in finger millet based intercropping system

Treatments	Number of ear head per plant			Number of fingers per ear head			Number of grains per ear head			Test weight (g)		
	2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled
FARMING TYPES (M)												
Conventional farming	3.81	3.85	3.83	6.46	6.48	6.47	3970	4035	4002	3.66	3.76	3.71
Organic farming	3.39	3.41	3.40	6.21	6.31	6.26	3410	3453	3431	3.60	3.61	3.61
Natural farming	2.59	2.63	2.61	4.70	4.80	4.75	2366	2423	2395	3.08	3.12	3.10
S. Em±	**0.04**	**0.04**	**0.04**	**0.06**	**0.06**	**0.06**	**36.24**	**37.09**	**36.67**	**0.03**	**0.03**	**0.03**
C.D @ 5 %	**0.14**	**0.15**	**0.14**	**0.20**	**0.19**	**0.20**	**142.29**	**145.64**	**143.97**	**0.09**	**0.09**	**0.09**
FINGER MILLET BASED CROPPING SYSTEMS (S)												
Finger millet + Red gram	3.23	3.25	3.24	5.77	5.87	5.82	3241	3286	3264	3.46	3.51	3.48
Finger millet + Field bean	3.08	3.11	3.10	5.28	5.38	5.33	3066	3121	3094	3.32	3.36	3.34
Sole Finger millet	3.48	3.53	3.50	6.12	6.23	6.18	3438	3503	3470	3.56	3.62	3.60
S. Em±	**0.06**	**0.06**	**0.06**	**0.10**	**0.10**	**0.10**	**57.11**	**58.04**	**57.58**	**0.06**	**0.06**	**0.06**
C.D @ 5 %	**0.17**	**0.18**	**0.17**	**0.30**	**0.31**	**0.30**	**175.99**	**178.83**	**177.41**	**0.10**	**0.12**	**0.11**
INTERACTIONS (M X S)												
CF: Finger millet + Red gram	3.78	3.79	3.79	6.59	6.61	6.60	3970	4010	3990	3.67	3.75	3.71
CF: Finger millet + Field bean	3.63	3.65	3.64	5.87	5.89	5.88	3765	3815	3790	3.47	3.59	3.53
CF: Sole Finger millet	4.01	4.10	4.06	6.91	6.93	6.92	4175	4280	4227	3.83	3.94	3.89
OF: Finger millet + Red gram	3.38	3.40	3.39	6.21	6.31	6.26	3375	3390	3382	3.62	3.67	3.65
OF: Finger millet + Field bean	3.24	3.26	3.25	5.76	5.86	5.81	3165	3230	3197	3.48	3.42	3.45
OF: Sole Finger millet	3.54	3.57	3.56	6.67	6.77	6.72	3690	3740	3715	3.70	3.74	3.72
NF: Finger millet + Red gram	2.52	2.56	2.54	4.70	4.80	4.75	2380	2460	2420	3.08	3.12	3.10
NF: Finger millet + Field bean	2.38	2.41	2.40	4.50	4.60	4.55	2270	2320	2295	3.02	3.06	3.04
NF: Sole Finger millet	2.88	2.91	2.90	4.90	5.01	4.96	2450	2490	2470	3.15	3.18	3.17

S. Em±	**0.10**	**0.10**	**0.10**	**0.17**	**0.17**	**0.17**	**98.93**	**100.52**	**99.72**	**0.10**	**0.10**	**0.10**
C.D (SP at same level of MP)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
C.D (MP at same or different level of SP)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

NOTE: DAS: Days after sowing, NS: Non significant, MP: Main plot, SP: Sub plot

Table 3: Grain, straw, biological yield and harvest index of finger millet as influenced by different farming types in finger millet based intercropping system

Treatments	**Grain yield (kg ha^{-1})**			**Straw yield (kg ha^{-1})**			**Biological yield (kg ha^{-1})**			**Harvest index (HI)**		
	2019	**2020**	**Pooled**	**2019**	**2020**	**Pooled**	**2019**	**2020**	**Pooled**	**2019**	**2020**	**Pooled**
FARMING TYPES (M)												
Conventional farming	2357	2543	2450	3657	4257	3957	6014	6800	6407	0.392	0.373	0.382
Organic farming	1907	2173	2040	3018	3577	3297	4925	5750	5337	0.387	0.378	0.382
Natural farming	1442	1500	1471	2304	2352	2328	3746	3852	3799	0.385	0.39	0.387
S. Em±	**22.61**	**50.37**	**27.69**	**35.42**	**39.08**	**37.21**	**43.05**	**48.35**	**46.75**	**0.005**	**0.005**	**0.005**
C.D @ 5 %	**88.8**	**197.78**	**108.74**	**139.06**	**153.45**	**146.09**	**156.35**	**162.32**	**158.26**	**NS**	**NS**	**NS**
FINGER MILLET BASED CROPPING SYSTEMS (S)												
Finger millet + Red gram	1910	2073	1992	3056	3430	3243	4966	5503	5235	0.385	0.378	0.381
Finger millet + Field bean	1667	1819	1743	2595	2963	2779	4262	4782	4522	0.39	0.382	0.386
Sole Finger millet	2128	2323	2226	3329	3793	3561	5457	6116	5787	0.39	0.381	0.385
S. Em±	**33.19**	**65.04**	**36.62**	**51.99**	**59.79**	**55.88**	**41.25**	**61.52**	**40.35**	**0.007**	**0.006**	**0.006**
C.D @ 5 %	**102.28**	**200.4**	**112.85**	**160.21**	**184.23**	**172.17**	**120.45**	**180.21**	**135.61**	**NS**	**NS**	**NS**
INTERACTIONS (M X S)												

CF: Finger millet + Red gram	2360^{b}	2560^{b}	2460^{b}	3776^{b}	4358^{b}	4067^{b}	6136	6918	6527	0.385	0.37	0.377
CF: Finger millet + Field bean	2080^{c}	2160^{cd}	2120^{cd}	3120^{cd}	3694^{c}	3407^{d}	5200	5854	5527	0.4	0.369	0.384
CF: Sole Finger millet	2630^{a}	2909^{a}	2769^{a}	4076^{a}	4720^{a}	4398^{a}	6706	7629	7167	0.392	0.381	0.386
OF: Finger millet + Red gram	1890^{d}	2140^{cd}	2015^{d}	3024^{d}	3531^{c}	3277^{d}	4914	5671	5292	0.385	0.377	0.381
OF: Finger millet + Field bean	1670^{e}	1938^{de}	1804^{e}	2638^{e}	3100^{d}	2869^{e}	4308	5038	4673	0.388	0.385	0.386
OF: Sole Finger millet	2160^{c}	2440^{bc}	2300^{bc}	3391^{c}	4099^{b}	3745^{c}	5551	6539	6045	0.389	0.373	0.381
NF: Finger millet + Red gram	1480^{f}	1520^{f}	1500^{fg}	2368^{e}	2402^{ef}	2385^{fg}	3848	3922	3885	0.385	0.388	0.386
NF: Finger millet + Field bean	1250^{g}	1360^{f}	1305^{g}	2025^{f}	2095^{f}	2060^{g}	3275	3455	3365	0.382	0.394	0.387
NF: Sole Finger millet	1595^{ef}	1620^{ef}	1607^{f}	2520^{e}	2560^{e}	2540^{f}	4115	4180	4147	0.388	0.388	0.387
S. Em±	**57.49**	**112.64**	**63.43**	**90.05**	**103.56**	**96.78**	**61.24**	**107.36**	**72.42**	**0.011**	**0.011**	**0.011**
C.D (SP at same level of MP)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
C.D (MP at same or different level of SP)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

NOTE: DAS: Days after sowing, NS: Non significant, MP: Main plot, SP: Sub plot

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