Effect of Organic Manures Combinations on Yield Attributes of Finger Millet *Var. VL Mandua 379*

Abstract

A field experiment was conducted at Himalayan University farm, Itanagar, Arunachal Pradesh, during the kharif season of 2023 with 8 treatments replicated thrice with 24 plots each 3×3 meter in randomized block design, to determine the effect of organic manures on yield of finger millet (*Eleusine coracana L.*). The experiment included the following treatments T_1- Control ,T_2- Castor oilcake at 2.5kg/ha+ Poultry manure at 2.5kg/ha,T_3- Bone meal at 2.5kg/ha + Poultry manure at 2.5kg/ha,T_4- Mustard oilcake at 2.5kg/ha + Goat manure at 2.5kg/ha,T_5- Bone meal at 2.5kg/ha + Neem oilcake at 2.5kg/ha + Fym at 2.5kg/ha,T_6- Neem oilcake at 2.5kg/ha + Goat manure at 2.5kg/ha, T_7- Mustard oilcake at 2.5kg/ha + Poultry manure 2.5kg/ha, and T_8- Bone meal at 2.5kg/ha + Goat manure at 2.5kg/ha. All the fertilizers were top dressed on the surface layer of the soil after 1 week of transplantation. The highest finger length (cm) recorded was 6.5 cm at harvest, the highest test weight (g) recorded was 3.1 g at harvest, the highest grain yield recorded was (t ha^{-1}) 4.02 t ha^{-1} at harvest, highest straw yield (t ha^{-1}) recorded was 7.9 t ha^{-1} and harvest index (%) 36.78 % at harvest were observed with treatment T_5- Bone meal at 2.5kg/ha + Neem oilcake 2.5kg/ha + Fym at 2.5kg/ha
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Keywords: Finger millet, Oilcake, RBD, Grain yield, Straw yield.

Introduction

Finger millet (Eleusine coracana) is the oldest food and first cereal grain used for domestic purpose. Cultivated Finger millet was domesticated about 5000 years ago from the wild was then also farmed in the lowlands of Africa. It is one of the oldest crops India is referred as “nrtta-kondaka” in the ancient Indian Sanskrit literature, which means “Dancing grain”, was also addressed as “rajika” or “markatak” (Achaya, 2009). “Earliest report of finger millet comes from Hallur in Karnataka of India dating approximately 2300 BC” (Singh, 2008). “Organic farming practices are gaining importance as farmers realized benefits in terms of soil fertility, soil health and sustainable productivity. Most of the research on organic production of finger millet was applied with utilization of FYM, green manures, compost, neem cake, etc (Arif et al., 2014; Kulkarni et al., 2018). Less number of researches was done on the effect of liquid organic manures like panchagavya, jeevamrutham, and beejamrutham alone or together with solid organic manures in finger millet organic liquid formulations like jeevamrutham and panchagavya helps for quick build-up of soil fertility through enhanced activity of micro flora and fauna” (Deva Kumar et al., 2008).

The purpose of this research is to evaluate the effect of combination of organic fertilizer on the yield performance of the finger millet (*var.VL Mandua 379*).The study aims to identify optimal combination that maximize yield. The application of organic manure fertilizer adequate supply nutrients from the organic sources, leading to increase in the metabolic and translocation of nutrients to plants, which improves the nutrient uptake of the plants, rather than in organic one. Moreover, the combination of organic fertilizer improves the soil fertility because soil is the mother universe and balance nutrient supply to plants.

Materials and Methods

The experiment was conducted during the Kharif season of 2023 at Himalayan University in Itanagar. The Crop Research Farm is located in Jollang at the university campus, situated at 27.14°N latitude and 93.62°E longitude, and an altitude of 320 meters above sea level. The site belongs to the Eastern Himalayan region, and the agro-climatic zone falls under the subtropical zone of Arunachal Pradesh.

Table 1: Physio-chemical properties of soil in the experimental field, Himalayan University.

Particulars	Value	Methods Employed
Sand (%) Silt (%) Clay (%)	54.2% 29.5% 16.3%	International pipette method (Piper, 1966)
Soil texture	Sandy loam	
Soil pH	4.2	Potentiometric method (Piper, 1966)
Organic carbon	1.59%	Walkely and Black wet oxidation method (Jackson1973)
Electrical conductivity	0.452 dS/m	Conductivity bridge (Jackson 1973)
Available Nitrogen	613.5 Kg/ha	Alkaline permanganate method (Subbaiah and Asija, 1956)
Available Phosphorus	4.86 Kg/ha	Bray"s method (Jackson, 1973)
Available Potassium	218.4 Kg/ha	Flame photometer method (Jackson, 1973)

The treatments include T1- Control ,T2- Castor oilcake at 2.5kg/ha+ Poultry manure at 2.5kg/ha,T3- Bone meal at 2.5kg/ha + Poultry manure at 2.5kg/ha,T4- Mustard oilcake at 2.5kg/ha + Goat manure at 2.5kg/ha,T5- Bone meal at 2.5kg/ha + Neem oilcake at 2.5kg/ha + Fym at 2.5kg/ha,T6- Neem oilcake at 2.5kg/ha + Goat manure at 2.5kg/ha, T7- Mustard oilcake at 2.5kg/ha + Poultry manure 2.5kg/ha, and T8- Bone meal at 2.5kg/ha + Goat manure at 2.5kg/ha. All the manures were top dressed. The experiment was laid out in a Randomized Block Design (RBD) in the year 2023. Various methods for calculation of yield parameters were used. For finger length (cm) five ears were harvested and finger length was noted. The length of the ear was noted from the base spikelet till the longest finger and mean values were calculated. The 1000 seeds from five fresh cobs were obtained immediately after harvest, weighed and the average was calculated for the test weight in g. The net plot was marked, harvested separately and dried. After threshing, grains were separated, clean and weighed, later the grain yield per net plot was calculated on t ha^{-1}. The straw from net plot area was cut close to the ground level and was left for sun dry in the field, later it was weighed and computed as straw yield in t ha^{-1}. The harvest index (%) was calculated using the formula (Donald, 1962).

$$\text{Harvest index (HI)} = \frac{\text{Economical yield (kg ha}^{-1})}{\text{Biological yield (kg ha}^{-1})} \times 100$$

Statistical analysis

The experiment was laid out in a Randomized Block Design. The data recorded during investigation were subjected to statistical analysis as per method of analysis of variance (ANOVA). The significance and non-significance of the treatment effect were judged with the help of „F" variance ratio test. Calculated „F" value (variance ratio) was compared with the table values of „F" at 5% level of significance. If calculated value exceeded the table value, the effect was significant.

Results

Finger length and test weight

According to the recorded data (Table 2) Finger length (cm) and test weight (g) at the harvest shows that there is was a significant effect of different treatments on the test weight (g) and finger length (cm). Among the treatments significantly higher finger length (6.5cm) were observed in the treatment T_5 treatment (Bone meal at 2.5kg/ha + Neem oilcake at 2.5kg/ha + Fym at 2.5kg/ha) which remained on par with T_3 treatment (Bone meal at 2.5kg/ha + Poultry manure at 2.5kg/ha) (6.3cm), whereas the lower finger length (4.8cm) were recorded with the absolute control (T_1).

Similarly significantly higher test weight (3.1g) were recorded in the treatment T_5 (Bone meal at 2.5kg/ha + Neem oilcake at 2.5kg/ha + Fym at 2.5kg/ha) which remained on par with T_3 treatment (Bone meal at 2.5kg/ha + Poultry manure at 2.5kg/ha) (3.01g). The lowest test weight (2.1g) was recorded with the absolute control (T_1).

Table 2: Effect of organic manures on finger length (cm) and test weight (g) of finger millet.

Treatment combinations	Finger length (cm)	Test weight (g)
T_1- Control	4.8	2.1
T_2- Castor Oilcake at 2.5kg/ha + Poultry Manure at 2.5kg/ha	5.8	2.61
T_3- Bone Meal at 2.5kg/ha + Poultry Manure at 2.5kg/ha	6.3	3.01
T_4- Mustard Oilcake at 2.5kg/ha + Goat Manure at 2.5kg/ha	5.4	2.48
T_5- Bone Meal at 2.5kg/ha + Neem Oilcake at 2.5kg/ha + FYM at 2.5kg/ha	6.5	3.1
T_6- Neem Oilcake at 2.5kg/ha + Goat Manure at 2.5kg/ha	6.1	2.8
T_7- Mustard Oilcake at 2.5kg/ha + Poultry Manure at 2.5kg/ha	5.6	2.56
T_8- Bone Meal at 2.5kg/ha + Goat Manure at 2.5kg/ha	5.2	2.39
F test	S	S
S.Ed (±)	0.15	0.11
CD (=0.05)	0.34	0.25

Grain yield and straw yield

The grain yield (t ha^{-1}) and straw yield (t ha^{-1}) was recorded at harvest is presented in table 3. According to recorded data there was a significant effect of different treatments on the grain yield (t ha^{-1}) and straw yield (t ha^{-1}). The highest grain yield at harvest (4.02 t ha^{-1}) was recorded with the treatment T_5 (Bone meal at 2.5kg/ha + Neem oilcake at 2.5kg/ha + Fym at 2.5kg/ha) which remained on par with T_3 treatment (Bone meal at 2.5kg/ha + Poultry manure at 2.5kg/ha) (3.85 t ha^{-1}), whereas the lowest grain yield was recorded with the absolute control (T_1).

It was observed that the same trend was continued for straw yield (t ha^{-1}) at harvest (7.9 t ha^{-1}) was recorded with T_5 (Bone meal at 2.5kg/ha + Neem oilcake at 2.5kg/ha + Fym at 2.5kg/ha) which remained on par with T_3 treatment (Bone meal at 2.5kg/ha + Poultry manure at 2.5kg/ha) (7.8 t ha^{-1}) whereas the lowest straw yield (t ha^{-1}) was recorded with the absolute control (T_1).

Table 3: Effect **of organic manures on grain yield (t ha^{-1}) and straw yield (t ha^{-1}) of finger millet.**

Treatment combinations	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
T_1- Control	1.83	3.64
T_2- Castor Oilcake at 2.5kg/ha + Poultry Manure at 2.5kg/ha	3.63	7.62
T_3- Bone Meal at 2.5kg/ha + Poultry Manure at 2.5kg/ha	3.85	7.8
T_4- Mustard Oilcake at 2.5kg/ha + Goat Manure at 2.5kg/ha	3.43	7.43
T_5- Bone Meal at 2.5kg/ha + Neem Oilcake at 2.5kg/ha + FYM at 2.5kg/ha	4.02	7.9
T_6- Neem Oilcake at 2.5kg/ha + Goat Manure at 2.5kg/ha	3.72	7.7
T_7- Mustard Oilcake at 2.5kg/ha + Poultry Manure at 2.5kg/ha	3.52	7.54
T_8- Bone Meal at 2.5kg/ha + Goat Manure at 2.5kg/ha	3.37	6.98
F test	S	S
S.Ed (±)	0.15	0.14
CD (=0.05)	0.32	0.29

Harvest index (%)

The harvest index (%) recorded at harvest is graphically represented in fig 1.

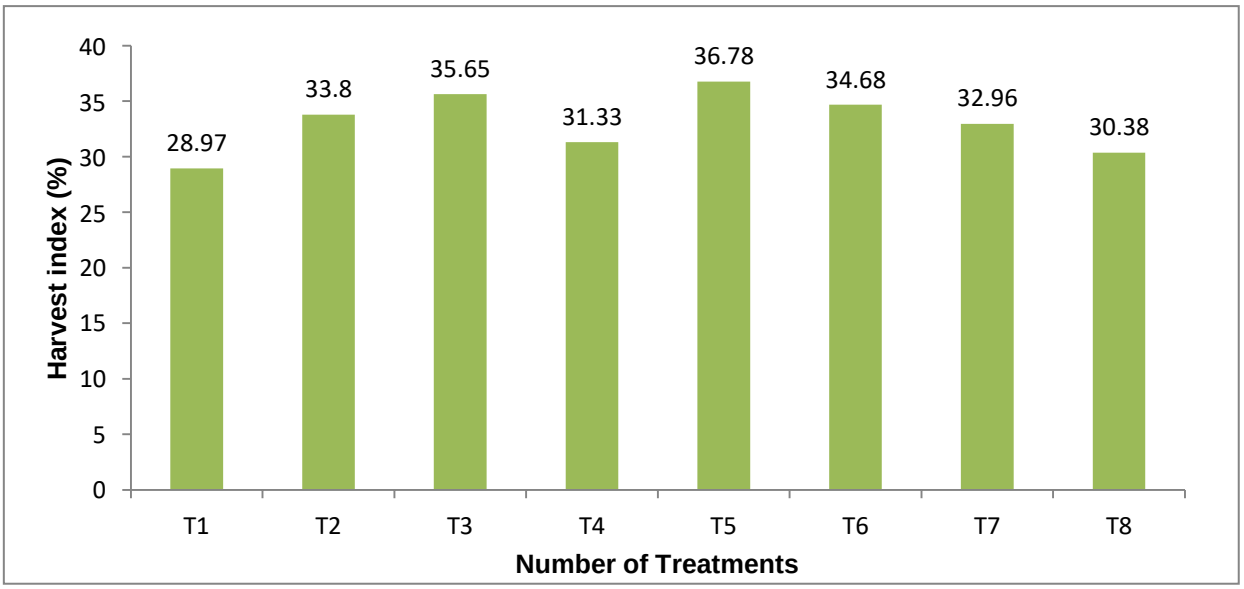

Fig 1: Effect of organic manures on harvest index (%) of finger millet.

Discussions

The probable reason for recording higher finger length of finger millet under treatment T_5 (Bone Meal at 2.5kg/ha + Neem Oilcake at 2.5 kg/ ha + FYM at 2.5 kg/ha) may be due to the application of bone meal, as it provide phosphorus and calcium to plant along with a largely inconsequential amount of nitrogen which stimulates meristematic and physiological activities which increase photosynthesis rate leading to increase in finger length. The similar finding was documented by Prathima *et al.* (2018). The least value of finger length of finger millet was recorded in T_1 (Control) it might be because of low nutrition to plant of the particular treatment.

Recording higher test weight under treatment T_5 (Bone Meal at 2.5kg/ha + Neem Oilcake at 2.5 kg/ ha + FYM at 2.5 kg/ha) is might be due adequate supply nutrients from the organic sources, leading to increase in the metabolic and translocation of nutrients to the seeds, which results in the higher test weight of the seeds. Similar finding was documented by Suresh *et al*. (2017). The lowest test weight value was found in the treatment which did not receives any fertilizers i.e. T_1 (Control).

The probable reason for recording higher grain yield under treatment T_5 (Bone Meal at 2.5kg/ha + Neem Oilcake at 2.5 kg/ ha + FYM at 2.5 kg/ha) is due to due integration of all three organic manures. Neem oilcake increases the soil fertility, and improves nutrient uptake of the plants, whereas bone meal and fym are rich in plant nutrients which lead them to high in the grain yield. The same result was reported by Ananda *et al*. (2017).The lowest value was recorded in the treatment where no fertilizer was applied i.e. T_1 (Control)

The higher straw yield under treatment T_5 (Bone Meal at 2.5kg/ha + Neem Oilcake at 2.5 kg/ ha + FYM at 2.5 kg/ha) is due to balance nutrient supply to plants by bone meal and fym. Neem oilcake increases plant growth and nutrient uptake of finger millet in presence of both bone meal and fym which leads to increase in higher straw yield of the plants. Similar finding was reported by Pallavi *et al*. (2017). Lowest straw yield was recorded in the treatment T_1 (Control) is due to low nutrition to plant because of no application any fertilizers.

Harvest index is an important parameter that indicates how effectively a plant partitions dry matter to its economically valuable parts. The probable reason for recording higher harvest index (%) of plant under treatment T_5 (Bone Meal at 2.5kg/ha + Neem Oilcake at 2.5 kg/ ha + FYM at 2.5 kg/ha) is due to integration of organic manures, (Jagtaran *et al*., 2018) also found that combination of such manures also improves the yield and yield attributes of the finger millet.

Conclusion

Considering the salient findings in perspective, the study revealed that integrating organic manures into finger millet cultivation can lead to significant improvement in yield attributes. The combinations of Bone meal at 2.5kg/ha + Neem oilcake at 2.5kg/ha + Fym at 2.5kg/ha (T_5) was found to be best for maximizing yield parameters (finger length, test weight, grain yield, straw yield) of the finger millet. It is observed that harvest index (%) was also found to be significant in the treatment with the combination of Bone meal at 2.5kg/ha + Neem oilcake at 2.5kg/ha + Fym at 2.5kg/ha (T_5).

Competing interests

The authors have declared that no competing interest exists.

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