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Integration of Nitrogen Sources on Okra (*Abelmoschus Esculentus*) Grown in Sandy Regosols

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ABSTRACT

A study was conducted to study the effect of integration of nitrogen sources on okra (*Abelmoschus esculentus*) grown in sandy regosols. Nitrogen sources farmyard manure, poultry manure, Amutha Karaisal and urea were applied on equal N basis at 135 kg Nha^{-1}. Organic nitrogen (N) sources were used solely and in combination with urea at 50% N from each. And P_2O_5 and K_2O were applied at the rate of 90 kg ha^{-1} by triple super phosphate and muriate of potash respectively. There were eight treatments replicated thrice. Among the treatments, yield was superior in 100% N supplied by poultry manure and next was followed by 50% N from farmyard manure + 50% N from Urea. The influence of AmuthaKaraisal was inferior in yield than other manures. There was no significant difference in average length of pod, but there was significant difference in average number and fresh weight of pod.

Introduction

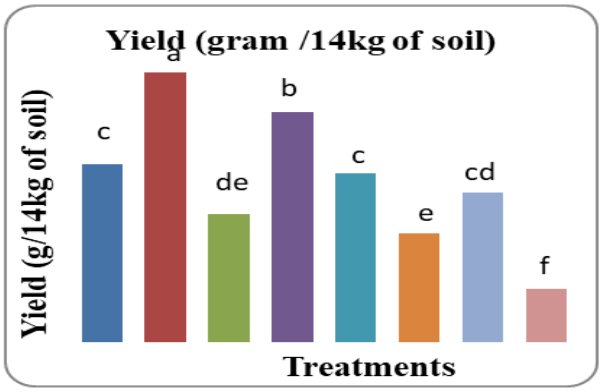
Sandy regosls are the soils having low organic matter content and plant nutrients (Ariyaratne, 2008). Even though it favors the movement of air, water and easy root penetration, it considered marginal for agriculture. Also due to its poor organic matter content and nutrient content it requires management practices for maintaining productivity of the soil.

In order to achieve best production proper technique should be adopted to improve efficient utilization of added nutrients. Wijewardena, (2006) stated that reduction in cation exchange capacity of soils, will leads to reduce nutrient retention capacity of those soils. Organic matter can favor the formation of a stable structure in the soil through a close association of clays with the organic matter. And it increases the retention of soil nutrients in a form available to the plant due to its capacity of exchange cations (CEC of humus ranges from 1-5 meq/g) (FAO, 2000). Mishra, et al., (2005) stated that okra gives good response to different plant nutrients. Against this backdrop, the investigation was conducted to study the performance of okra under integrated nutrient managed cultivation with different types of nitrogen sources.

Materials and Methods

Research was conducted to study the effect of different nitrogen sources on performance of okra under INMS cultivation on sandy regosols. Initially nitrogen sources such as farmyard manure (FYM), poultry manure (PM), AmuthaKaraisal (AK) and urea were analyzed for their nitrogen value and applied on equal N basis at 135 kg Nha^{-1}. Triple super phosphate (P_2O_5) and muriate of potash (K_2O) were applied at the rate of recommendation. The treatments were 100% N by FYM (T1), 100% N by poultry manure (T2), 100% N by AmuthaKaraisal (T3), 50% N from FYM + 50% N from urea (T4), 50% N from poultry manure + 50% N from urea (T5), 50% N from AmuthaKaraisal +50% N from urea (T6), 100% N by urea (T7) and control (Unfertilized) (T8) and replicated thrice. All cultural practices were conducted according to the recommendation of department of agriculture (Anon, 1999) for okra. Amutha Karaisal was prepared by mixing cow dung: cow urine: water: jaggery at the ratio of 10:10:10:1. After 24 hours, it was filtered by a cloth and diluted with water at 1:10 ratio and applied by soil fertigation. Nitrogen content of the organic manures used in the experiment were 0.952%, 1.54%, 0.469% for FYM, PM and Anutha Karaisal respectively.

Results and discussions



Means followed by the same letter are not significantly different

Figure 1. Effect of nitrogen sources on average yield of okra (g/14 kg of soil).

Experiment results revealed that there was significant influence of nitrogen sources on yield of okra as P value is less than 0.05%.

Among the treatments, 100% N by poultry manure recorded significantly highest yield (153.19 gram/ 14kg of soil) and it was followed by 50% N from FYM + 50% N from chemical fertilizer treatment (130.64 gram/ 14kg of soil).

The reason for the highest yield from sole source of N from poultry manure may be due to the excess supply of other

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nutrients especially P and K because even though both were added to each treatment at same amount, the capacity of each manure to supply P and K may differs. Panda, *et al.*, (2008) stated that the basic nutrient content of poultry manure is equal to commercial fertilizers and is not only a good source of NPK but it can serve as a supplier of micro as well as other macro nutrients which required for crop and enrichment of soil. Lathiff and Maraikar (2003) stated that higher vegetable yield (Brinjal, Cabbage and tomato) was recorded with 30 ton per hectare of poultry manure compared with chemical fertilizers alone. It was supported by De Silva, *et al*., (2005) that high amount of Calcium in poultry manure could increase soil pH level and facilitated organic matter decomposition and nutrient release, thus enhances the growth of plant and help to increase the yield. And the contribution of poultry manure to increase the organic matter content of soil may facilitate the development of good physical properties of soil. Agbede, *et al*., (2008) stated that the organic matter should have stabilized soil structure thereby reducing soil bulk density, increasing porosity, and infiltration rate and water retention. It may also favor the better utilization of nutrients by roots.

The treatment received 50% N from FYM + 50% N from chemical fertilizer ranked second (130.64 g/14 kg of soil), it may be due to the combined effect of chemical and organic manures which facilitate continues supply of nitrogen. Jayathilake, *et al*., (2003) recommended that 50% N of the recommended dose of fertilizer could be replaced by FYM.

Results also indicated that 50% N by poultry manure treatment was on par with 100% N by FYM and sole chemical treatment. It may be due to the impact of N sources on nutrient availability, as poultry manure is a rich source of nutrient than FYM. But in both Amutha Kraisal treatments (100% and 50%) yield was significantly lower than other manures used. It may be due to the lower amount of Ca in cow urine (FAO, 2000) which is important for the decomposition of manures (De Silva *et al.,* 2005) and this decomposition is needed for the N availability. Loss of N by ammonia volatilization from both urine and cow dung may be higher in AmuthaKaraisal treatment. Ammonia is susceptible to volatilisation at rates which can vary extensively depending on the crop, cultural conditions, soil properties, dung or urine deposition rates and method of fertilizer application: for slurry from 4 % to over 60 % (Sintermann et al., 2012). Since in urine N is as urea and rapidly changed into ammonia and lost, In the urine of high-producing dairy cows, urea represents 60 to 80% or more of total urinary N (Reynal and Broderick 2005). Cole and Todd (2009) noted that N volatilization losses ranged from 64 to 124% of urinary N excretion, with an average of 79%

By fermentation there are chances of loss of N from cow dung as ammonia, AmuthaKaraisal is a fermented product, and also there was only trace amount of P in the cow urine, where as P content of FYM is higher than that (Dahama, 1999). And also developments of other soil physical properties were lower in AmuthaKaraisal than poultry manure and FYM. And these factors may leads to produce a low production from AmuthaKaraisal treated soil than others. Poyyamoli, (2006) observed a lower yield in AmuthaKaraisal treatment than chemical fertilizer as well as FYM, in rice.

Experiment results revealed that among organic manure chemical fertilizer combinations for nitrogen, 50% N from FYM treatment registered significantly superior yield than 50% N from poultry manure and 50% N from AmuthaKaraisal treatments. It may be due to higher organic matter content of soils received 50% N FYM than other treatments. Increasing organic matter content of soil can improve the soil physical characters (Agbede *et al.*, 2008) and thus help to have a better soil aggregation and leads to good infiltration, aeration and ultimately better root development. And altogether make efficient nutrient absorption as well as increasing organic matter content which can increase the cation exchange capacity of soil (FAO, 2000) and thus increase the nutrient retention of it. So all these may led to have better yield from 50% N by FYM than other treatments.

Yield obtained from control treatment ranked last (30.43 g/ 14kg of soil). This may be due to the unavailability of nutrients. The nutritional requirement of okra which cannot be fulfilled by native soil nutrient and thus can alter all the biometric characters which are highly influencing on yield of okra. This observation was confirmed by Jayathilake *et al*., (2003).

Table 1. Effect of nitrogen sources on okra pods.

Treatments	Mean no. of pods/bag	Mean fresh weight of pod (g/pod)	Mean Length of pod (cm)
T1	8.00 abc	12.75 a	12.45 a
T2	10.67 a	14.38 a	13.74 a
T3	6.67 bcd	11.30 ab	13.04 a
T4	8.67 ab	15.13 a	14.57 a
T5	7.33 bc	13.37 a	13.04 a
T6	5.33 cd	11.94 a	12.06 a
T7	6.33 bcd	13.86 a	11.99 a
T8	4.00 d	7.58 b	11.4 a

Means followed by the same letter are not significantly different

However experiment results indicated that there was significant increment of yield in soils received 50% N from FYM + 50% N from chemical fertilizer than 100% N from FYM. It may be due to the quick and immediate availability of nutrients from chemical fertilizer treatment. And it helps to meet the N requirement of crop at early stage and for the later stage N requirement of okra was sustained by the FYM. But the initial N requirement may not be fulfilled by sole FYM treatment as it requires time to get decomposed and converted to available form. Jayathilake *et al*., (2003) confirmed this that higher onion bulb yield was observed in soil treated with 50% N from FYM + 50% N from chemicals (35.87 ton/ha) than sole application of 20 ton/ ha of FYM (16.85 ton/ha).

The yield obtained in treatment received 50% N from poultry manure was significantly lower than sole poultry manure treatment and ranked third and first respectively. This may be due to, even though N was quickly available in 50% N by poultry manure treatment than 100% N poultry manure at the time of planting; there may be loss of N by means of leaching. Because decomposed form of poultry manure promotes the disappearance of nutrients as it was rained during the cultivation period especially side dressing times causes N loss by means of leaching. And also the yield of okra may be affected by micro nutrient and other major nutrients supply as well as by soil physical properties. As in 50% N by poultry manure treatment the amount of organic manure added was halved from 100% N by poultry manure treatment. So thus performed reduced supply of micro nutrient as well as other major nutrients and poorer development of physical characters of soil and that may contribute to yield reduction in it. Yield obtained in treatment received 50% N from poultry manure was on par with treatment received 100% N from FYM.

Results showed (Table: 1) that significantly higher number of pods per bag was observed in soils treated with 100% N from poultry manure and it was on par with soils treated with 50% N from FYM + 50% N from chemical fertilizers and 100% N from FYM. And it ranged from 10.67 (100% N by poultry manure) to 4.0 (control).

And also in case of average fresh weight of pods, soils treated with nitrogen showed significantly better weight than control, except soils treated with 100% N from AmuthaKaraisal which was on par with control treatment. The average number of pods per bag and average fresh weight of pods were influenced on yield of okra. Jayathilake *et al*., (2003) observed higher bulb weight in onion under 50% N from FYM + 50% N chemical fertilized soil than inorganic fertilized soil.

From the experiment it was observed that there was no significant difference in length of pods due to the addition of different nitrogen sources. It ranged from 14.57 cm to 11.4 cm (Table: 1). Among them higher value was obtained in treatment received 50% N from FYM. Jayathilake *et al*., (2003) observed higher bulb diameter in onion under 50% N from FYM + 50% N from chemical fertilized soil than inorganic fertilized soil.

Conclusion

Significantly highest yield was recorded from treatment of soil received 100% N by poultry manure and followed by 50% N from FYM + 50% N from Urea. AmuthaKaraisal treatment produces significantly lowest yield than other manures. Differences in nitrogen sources do not exhibit significant difference in average length of pod. But difference in treatments showed significant difference in average No. of pods/ 14 kg of soil and average fresh weight of pod.

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