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Short Communication

Seed yield of *Abelmoschus esculentus* L. as influenced by the combined use of inorganic and organic fertilizers

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Abstract

This study was done to evaluate the seed yield of okra (Abelmoschus esculentus L.) plants managed with inorganic and organic fertilizers on sandy regosol. In this experiment, the inorganic and organic fertilizers were applied as basal applications and also recommended inorganic fertilizers as topdressing were applied at 30 days after planting to all experimental plots. The results revealed that number of mature fruits per plant, number of seeds per fruit and air dry weight of seeds per fruit were increased by 45.9%, 29.2% and 34.9% respectively in the selected treatment (mixture of 6 t/ha cow and 4 t/ha poultry manures) when compared to inorganic fertilizer as control treatment. The selected treatment gave remarkably (P<0.05) higher seed yield (1.18 t/ha) among tested treatments. Hence, combined use of organic fertilizers at optimum level was better than inorganic fertilizer as basal application for obtaining high seed yield of okra with less environmental pollution on sandy regosol.

Keywords: Basal application, okra, organic fertilizer, seed yield.

Introduction

Okra is commonly cultivated in Eastern part of Sri Lanka. The essential amino acids are available in okra thus it is an important vegetable in human diet. Immature fruits can be consumed in various forms and also the dried seeds are used as planting materials in Sri Lanka. Okra mucilage is used for medicinal application[1]. With increasing population in the tropics, food production has to increase on the existing land by way of better nutrient supply and recycling[2]. Plant nutrients are from organic or inorganic sources. In conventional agriculture, inorganic fertilizers are applied to the soil but its continuous use also has negative effects on the environment[3,4]. Nitrate leaching, groundwater pollution, degradation of soil structure, decrease surface water infiltration[5], quick degradation of soil physical, chemical and biological properities[6] are sometimes associated with the use of inorganic fertilizer.

Animal manures are good source of organic fertilizers and generally they improve soil structure and its fertility. The use of organic and inorganic manures provides good environmental conditions for the crop growth and their development. Food crop growers are therefore turning utilization of poultry manure as an alternative supply of organic manure. The poultry manure is a good source of nitrogen but has some liming value therefore it may increase the soil pH slightly[7]. The total N and P contents are the highest in poultry manures among all animal manures[8]. The 30% of the nitrogen from poultry manure is in urea or ammonium form which is swiftly available similar to commercial mineral fertilizers[7]. Addition of poultry manure enhances the crop yield [9]. The use of cattle and poultry compost released more than 30 percent nitrogen and also reduced nitrate leaching to deeper soil layer[10]. This work was aimed to study the potential use of organic fertilizers as a basal fertilizer replacement for inorganic fertilizers and to examine the impact of organic fertilizers on seed yield of okra.

Methodology

This work was done in a Randomized Complete Block Design with seven treatments. They are recommended inorganic fertilizer (T1) and organic fertilizers (T2-T7) as basal fertilizer application (Table-1). Each treatment had three replications.

The land was ploughed by using two wheels tractor and harrowed well by using mammoty before planting. The harrowed land was leveled and then twenty one plots were constructed. The both manures were collected in the Eastern regions and they were air dried. After that, the poultry manure was sieved to take away the unnecessary materials. According to the required quantity of the organic manures as indicated in Table-1, cow and poultry manures (10 t/ha) were applied to each plot for treatments T2-T7 two weeks before planting and the required amount of recommended inorganic fertilizers were applied to treatment T1 (control treatment) plots as basal fertilizer for okra cultivation.

Okra seeds of Haritha variety were planted at 60cmx60cm spacing[11]. After 14 days of sowing, two healthy seedlings per hole were maintained by removing the additional seedling. Urea

and muriate of potash were applied 30 days after planting as top dressing for all treatments (T1 to T7). Further, cultural practices were performed according to their commendation of Department of Agriculture. The mature fruits were harvested until 7th picking and number of mature fruits per plant was counted at the time of harvesting. The dry weights of mature fruits and seeds were taken after drying in room temperature as well as oven at 105°C over night. Seed yield was calculated on basis of air dry weight. The collected data were analyzed using SAS 9.1 version and the treatment means were compared according to DMRT at P=0.05.

Table-1: Basal fertilizer application in this experiment.

Treatments	Inorganic fertilizers (kg/ha)	Cow manure (t/ha)	Poultry manure (t/ha)
T_1	Urea-150kg/ha Triple Super Phosphate-200kg/ha Muriate of Potash-75kg/ha	0	0
T_2	0	10	0
T_3	0	8	2
T_4	0	6	4
T_5	0	4	6
T_6	0	2	8
T_7	0	0	10

Results and discussion

Number of mature fruits: According to the statistical analysis, there was remarkable difference in number of harvested mature fruits (Table-2). The maximum value (6.17) was recorded in T4 and the minimum value (4.00) in T2. T4 considerably (P<0.05) boosted the number of fruits than other treatments except poultry manure alone (T7). It may be due to high percentage of flowering in T4 that improved seed yield. Flowering percentage in T1 and T4 decreased with over the time and higher percentage was in T4 than control treatment (T1) at the initial stage of flowering. The nitrogen in cow and poultry manures may enhance more number of flower and fruit formations.

Number of seeds: Remarkable (P<0.05) variation in number of seeds per mature fruit were noted (Table-2). There were increasing and decreasing trend observed in number of seeds per fruit. The maximum value of 60.0 was exhibited in T4. Statistically there was no difference between T1 and T2 whereas T4 showed significant difference from others. The maximum number of seeds per fruit is preferred by farmers due to market demand.

Dry weight of mature fruit: Table-3 shows the dry weight of fruits per plant in each treatment. There was no remarkable in the oven dry weight of fruit. However, there was remarkable variation in the dry weight of fruits per plant. Significantly highest dry weight (36.59g) of fruits per plant was recorded in T4 followed by 27.88g in T7. The minimum value of 17.76g was recorded in T2. Inorganic treatment T1 had produced considerably (P<0.05) low weighted fruits among tested treatments except T2.

Table-2: Seed yield components of okra as affected by organic manures.

Treatments	Number of mature fruits per plant	Number of seeds per fruit	Air dry weight of seeds per fruit	Seed yield (t/ha)
T1	4.23 ± 0.17 de	46.47 ± 0.59 d	2.55 ± 0.07 d	0.60 ± 0.08 d
T2	4.00 ± 0.06 e	44.99 ± 0.92 d	2.44 ± 0.03 d	0.54 ± 0.01 d
T3	4.33 ± 0.17 d	52.30 ± 0.81 c	2.87 ± 0.25 cb	0.69 ± 0.03 cd
T4	6.17 ± 0.17 a	60.05 ± 1.21 a	3.44 ± 0.19 a	1.18 ± 0.04 a
T5	4.67 ± 0.17 cd	56.07 ± 1.26 b	3.11 ± 0.10 b	0.81 ± 0.01 bc
T6	4.83 ± 0.17bc	54.03 ± 0.38 b	2.99 ± 0.27 cb	0.80 ± 0.07 bc
T7	5.50 ± 0.50 ab	54.52 ± 0.39 b	3.06 ± 0.28 cb	0.93 ± 0.01 b
F test	*	*	*	**

F test: *- P < 0.05; **- P < 0.05. Means followed by the same letter in each column are not remarkably different according to DMRT at 5% level.

Table-3: Seed weight and Seed: Pod ratio of okra grown in organic manures.

Treatments	Oven dry weight of mature fruit (g)	Oven dry weight of mature fruits per plant (g)	Oven dry weight of seeds per plant (g)	Seed : Pod ratio (Oven dry basis)
T1	4.43 ± 0.30	18.74 ± 0.41 d	9.05 ± 0.14 c	1:2.1
T2	4.44 ± 0.04	17.76± 0.50 d	8.24 ± 0.06 c	1:2.1
T3	5.30 ± 0.29	22.95 ± 0.49 c	10.69 ± 0.05 b	1:2.1
T4	5.93 ± 0.11	36.59 ± 0.08 a	17.77 ± 0.26 a	1:2.1
T5	5.47 ± 0.27	25.54 ± 0.59 cb	12.28 ± 0.12 ab	1:2.1
T6	5.27 ± 0.17	25.45 ± 0.29 cb	12.41 ± 0.28 ab	1:2.0
T7	5.07 ± 0.52	27.88 ± 0.22 b	14.24 ± 0.20 ab	1:2.0
F test	ns	*	*	-

F test: ns- $P < 0.05$; *- $P < 0.05$; **- $P < 0.05$. Means followed by the same letter in each column are not significantly different according to DMRT at 5% level.

Dry weight of seeds: According to the statistical analysis, there was remarkable variation ($P<0.05$) in dry weight of seeds per mature fruits. The maximum value (17.77g) was measured in T4 and the minimum value (8.24g) was recorded in T2. Statistically T4 was on par with that of T7 and the ratio of seed-pod (dry weight basis) is about 1:2.

Seed yield: The air dry weight of seeds per mature fruit was significantly influenced by the cow and poultry manures and their combinations. The maximum air dry weight (3.44g) of seeds per fruit was attained in T4 followed by 3.11g in T5. The minimum value (2.44g) was noted in T2 (Table-2). Statistically there was no difference ($P>0.05$) between T1 and T2. Generally the weighed seeds show high germination percentage. The treatment T4 (cow and poultry manures applied at 6 and 4t/ha respectively) gave maximum seed yield (1.18t/ha). The treatment (T2) gave minimum seed yield (0.54t/ha).

Discussion: The use of cow and poultry manures not only increases the soil fertility but also it is an important in soil physical and chemical properties. Moreover, they contain macro and micro nutrients for growing plants. Good seeds are required for booming crop production programs. The quality seeds germinate uniformly and subsequently develop root and shoot rapidly. As a result, it increases crop yield per unit area. In this experiment, the increase in seed yield may be due to the fact that cow and poultry manures which may improve availability of plant nutrients subsequently it leads to increase photosynthesis and translocation of photosynthates[12]. This useful result of organics may be because of the availability of plant nutrients for longer period. The strong microbial activity enhances the availability of soil nutrients for better development of fruits. Organic manure increases productivity and seed quality of chilli[13] and vegetable cowpea[14]. The improved fruit weight and seed yield could be attributed to the result of plant nutrients by the adding of cow manure for increasing uptake of N, P and K[15]. In this experiment, the mixture of cow (6t/ha) and poultry (4t/ha) manures (T4) gave the highest okra seed yield among the tested treatments.

Conclusion

The application of cow and poultry manures significantly increased seed yield. Results showed that organic manure is a better source of plant nutrients for improving seed yield of okra particularly if applied mixture of 6 t/ha cow manure plus4 t/ha poultry manure. The use of both cow and poultry manures was better than inorganic fertilizer as basal application in okra cultivation.

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