An Economic Analysis of Split Application of Organo-mineral Fertiliser on Okra in Humid Forest Zone of Nigeria.

Akanbi, W.B; [1] Adediran, J.A[2], Olaniyan, A.B[3*] and Togun, A.O.[4]

1. *Ladoke Akintola University of Technology, Department of Agronomy, Nigeria*
2. *Institute of Agricultural Research and Training, Soil and Water Management, Nigeria.*
3. *University of Ibadan, Department of Agronomy, Nigeria*
4. *University of Ibadan Department of Crop Protection and Environmental Biology, Nigeria*

*** Corresponding author**

ABSTRACT

Field experiments were carried out during cropping seasons on a sand loam soil, with okra (*Abelmoschus esculentus* Moench) at the Institute of Agricultural Research and Training, Ibadan Nigeria to evaluate the economic viability of split application of organo-mineral fertilizer on okra. The study involved the use of organic based fertilizer split applied at different rates. The treatment consisted of (i) 4 tonnes/ha compost applied once (ii) 2 – split application of 4 tonnes/ha compost (iii) 3 split application of 4 tonnes/ha compost (iv) Single application of 2 tonnes/ha compost with 30kg N/ha (v) 2 split application of 2 tonnes /ha compost + 30kg N/ha (vi) 3 split application of 2 tonnes /ha +30kg N/ha (vii) Recommended dose of inorganic fertilizer and (viii) control (no fertilizer application).

The three agro- economic indicators: increased yield, increased net returns and benefit cost ratio were employed in determining the suitability of split application of organic and inorganic fertilizer. Results showed that the most profitable practice was the 2 split application of 2t/ha compost enriched with 30 kg N/ha. The treatment produced a favourable 1.9: 1 benefit: cost ratio, increased net returns of between 20.2% and 74.3% per hectare and gave maximum profit per naira above other treatments hence its recommendation as a modest cultural practice. Fortifications of compost with mineral fertilizer reduced the cost of production, increased the net return and produced higher benefit: cost ratio. It is concluded that 2-split application of 2t/ha compost + 30kg /ha is economically suitable for okra production in the humid forest zone of Nigeria.

Key words: Economic analysis, fertilizer, okra, organic manure, split application.

INTRODUCTION

Data on economics of horticulture are rare in developing countries. This is partly because horticultural crops are generally cultivated by most farmers as minor crops (IITA; 1982, Adeniyi, 2001), which could be interplanted with 'major' root, and cereals crops in their farms (Fawusi, 1985). Okra is well fitted into cropping system in Nigeria. Farmers grow it under traditional

mixed cropping system without considering their adaptability to the system and their economic suitability.

The importance of use of organic manure or mineral fertilizers in tropical agriculture and in increasing world food production had been thoroughly discussed (Aliyu and Olanrewaju, 1996; Abad *et al*; 1997). In most cases, single applications of these organic manure or mineral fertilizers are carried out (Babatola and Olaniyi, 1997; Akanbi and Togun, 2002). There is little attention on combine effect of organic and mineral fertilizers. The little available information on the crop response to joint application of chemical fertilizer and organic manure centered on the agronomy of production (Adeniyi, 2001, Akanbi and Togun, 2002). With the current move towards increased food production in Nigeria, it has become necessary to study how yield of okra is affected by time of application of organic and inorganic fertilizers so as to allow a good economic comparison between the two fertilizer types and their time of application.

In this paper, efforts were made to evaluate the economic viability of split application of organo-mineral fertilizer on okra. The specific objectives were:

i. to monitor labour and other input in okra production under different fertilizer types and various time of application, and
ii. to identify the most profitable fertilizer type and time of applying the fertilizer.

MATERIALS AND METHODS

Two experiments were carried out during 1998 and 1999 cropping season on a sand loam soil, with the okra (*Abelmoschus esculentus* Moench) at the Institute of Agricultural Research and Training, Ibadan, Nigeria (7^o 33"N, 3^o 56' E, 240m) to evaluate the economic viability of split application of organo – mineral fertilizer on okra. The site was a well drained sandy loam soil with 1.1% organic matter; 0.21% total N; 5.7 ppm available P (Bray's P_1); 1.47 cmol /kg Ca; 0.29 cmol /kg K and pH 5.8 (1: 1 soil: water ratio) for 1998 and 1.3% organic matter; 0.22% total N; 5.9 ppm available P; 0.86 cmol /kg Ca; 0.26 cmol /kg K and pH 6.1for 1999.Mature compost with total nitrogen of 2.41% was used , chemical analysis of the compost had earlier been reported (Akanbi and Togun, 2002).

The eight treatments tested in each of the field trials were:

T_1 = Single application of 4t. /ha compost at planting (0 week after planting)(WAP)

T_2 = 2 – split application of 4t. /ha compost at planting and 3WAP.

T_3 = 3 – split application of 4t. /ha compost at planting, 3 and 5 WAP.

T_4 = Single application of 2t. /ha compost + 30 kg N /ha at planting.

T_5 = 2 – split application of 2t. /ha compost + 30 kg N /ha at planting and 3WAP.

T_6 = 3 – split application of 2t. /ha compost + 30 kg N /ha at planting, 3WAP and 5WAP.

T_7 = Recommended dose of mineral fertilizer (60 kg N + 30kg P_20_5 + 20 kg K_20 /ha).

T_8 = No fertilizer (control plots).

The experimental design was randomized complete blocks with three replications. The experimental area measured 25m x 12m while the plot size was 1.8m x 1.8m ($3.24m^2$). The crop was spaced out at 60 cm x 30cm to give a population density of about 55,555 plants per hectare.

Okra variety NHAe 47 – 4 which is an early maturing, short robust fruit and well adapted and accepted in the south western Nigeria was used. Three seeds per hole of okra seeds were sown and later thinned at 2WAP to one. Weeds were manually controlled while application of karate at the rate of 2ml /L. water controlled the flea beetle insect pest. Spraying commenced 2WAP until anthesis

Nine harvests were recorded in the first trial while the fruit were harvested 12 times for second trial. All harvests were made at interval of 5 days before the termination of the experiment. Twelve plants per plot were sampled for yield analysis and all plants sampled were taken from the middle of each plot.

An economic analysis of the farm operations used in producing the economic yield (fruit) of the okra under different fertilizer type and time of application was carried out. The farm budgeting based on averages of market retail prices for the periods considered was used for the analysis. The benefit: cost ratio and Naira profit per Naira spent on fertilizer were obtained with the formula used by Harphool *et al*., (1996).

RESULTS

Data presented in Table 1 showed the costs of production of okra grown under different fertilizer types and different period of application. The results showed that labour cost accounted for more than 40% of the total cost in all the treatments while the cost of composts when used accounted for between 50% in 4t. /ha compost treatment to 31% in the treatment in which 2t. /ha

compost was enriched with chemical fertilizer. The use of high-level compost on okra was responsible for the high cost of production in the treatments where 4t. /ha compost was applied. The lowest cost of production (₦44, 800 /ha) among the organic based treatments was recorded for single application of 2t. /ha compost + 30kg N /ha treatment while the highest (₦52, 400 /ha) was obtained with 3 – split application of 4t. /ha compost. The use of mineral fertilizer recorded ₦37, 800 as the cost of production while the control treatment recorded the least. Okra grown with single application of organic based fertilizer was produced at an average cost of #48, 400 per hectare. The more the splitting of the fertilizer the higher the production cost.

The average okra fruit yield response to the various fertilizer types and time of application as presented in Table 2 indicated that application of 2t. /ha compost + 30kg N /ha had the best fruit yields. Okra plants grown with 2t./ha + 30kgN/ha split applied twice gave the maximum okra fruit yield (10700kg/ha) which was 27%, 20%,23%,19%,9%,36% and 83% greater than yields obtained from single application of 4t./ha compost, 2 split application of 4t./ha compost, 3 split application of 4t./ha compost, single application of 2t./ha compost +30kgN/ha, 3 split application of 2t./ha compost +30kgN/ha, use of NPK mineral fertilizer and control treatment respectively.

With regard to economic performance the result of the fertilizer treatments indicated that the maximum gross returns (# 85, 600 /ha), net returns (# 40, 600) and benefit: cost ratio (1.9: 1) were obtained when 2t. /ha compost + 30kg N were applied at planting and 3 weeks after sowing compared to all other combinations. The highest profit (# 2.56) per Naira invested among the fertilizer type and time of application was recorded in the treatment. The result on the average also showed that the most profitable fertilizer type was the joint application of 2t /ha compost plus 30kgN/ha. This treatment gave the highest gross return of #77, 6000 per hectare, an increase of 15.5 and 28.9% above the value obtained with application of 4t /ha compost and the use of recommended NPK fertilizer, respectively. Its benefit: cost ratio of 1.8: 1 and highest profit per Naira invested (# 2.72 /Naira) also favors the combination.

DISCUSSION

Fertilization of okra with 4t /ha compost was not very beneficial, since okra production cost with this treatment was very expensive. This is as a result of high cost of production and application of compost. The more we have compost in the system, the less the net farm returns. This observation is in line with the report of Abad *et al* (1997) and Akanbi (2002). Both reports indicated that for maximum economic returns, the use of compost should be limited to high value crops. It is note worthy here that contrary to expectation the 2- split application is more

beneficial compared to other method of application. The yield obtained with this method of fertilizer application was high enough to compensate the extra money expended on second fertilizer application. This same reason accounted for higher net return of okra plants fertilized with 2t .ha compost + 30kg N /ha when compared to what was obtained with the use of conventional NPK mineral fertilizer. This agreed with the observation of Harphool *et al* (1996) and Akanbi and Togun (2002). Akanbi and Togun (2002) opined that combine application of organic and inorganic fertilizer is more beneficial as the practice reduces the amount required of both fertilizer types.

CONCLUSION

Based on the yield response and economic indicators, it pays better to apply combination of 2t. /ha compost + 30kg. N /ha for okra fertilization in the humid forest zone of Nigeria. This treatment produced a favourable 1. 8:1 benefit: cost ratio and had an increased in net returns of 59 and 47% above the 4t. /ha compost and use of recommended NPK mineral fertilizer treatment, respectively. The efficiency of the conjunctive application of this organic and inorganic fertilizer could be improved by split application at planting and 3 weeks after planting.

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Table 1: Cost of production of okra under various time of application of organic based fertilizer (Naira* per hectare)

Treatment	Cost item						
	Fixed cost	Labour	Seeds	Insecticide	Compost	Mineral fertilizer	Total
Treatment							
Single application of 4t./ha compost	2,200	19, 600	3,400	800	26,000	-	52,000
2-split application of 4t./ha compost	2,200	19,800	3,400	800	26,000	-	52,200
3-split application of 4t./ha compost	2,200	20,000	3,400	800	26,000	-	52,400
Single application of 2t./ha compost +30kg N/ha	2,200	19,400	3,400	800	13,000	6,000	44,800
2-split application of 2t./ha compost+30kgN/ha	2,200	19,600	3,400	800	13,000	6,000	45,000
3-split application of 2t./ha compost+30kgN/ha	2,200	19,800	3,400	800	13,000	6,000	45,200
Recommended dose of mineral fertilizer	2,200	19,400	3,400	800	-	12,000	37,800
Control (no fertilizer).	2,200	18,600	3,400	800	-	-	25,000
Average cost of Fertilizer materials used							
4t/ha compost	2,200	19,800	3,400	800	26,000	-	52,200
2t/ha +30kgN/ha	2,200	19,600	3,400	800	13,000	6,000	45,000
Recommended NPK fertilizer	2,200	19,400	3,400	800	-	12,000	37,800
Control(no fertilizer)	2,200	18,600	3,400	800	-	-	25,000

* Average of 2 cropping seasons; ₦115=$1

*Table 2: An economic analysis of split application of combination of organic and inorganic fertilizer in okra**

Treatment	Yield (kg /ha)	Gross return (₦ /ha)	Cost of production	Net return (₦/ha)	Benefit: cost ratio	Naira profit / Naira spent on fertilizer
Fertilizer type						
Single application 4t. /ha compost	7,800	62,400	52,000	10,400	1.2:1	0.77
2-split application of 4t./ha compost	8,600	68,800	52,200	16,600	1.3:1	1.00
3-split application of 4t./ha compost	8,200	65,600	52,400	13,200	1.2:1	0.84
Single application of 2t./ha compost+30kgN/ha	8,700	69,600	44,800	24,800	1.6:1	1.79
2-split application of 2t./ha compost +30kgN/ha	10,700	85,600	45,000	40,600	1.9:1	2.56
3-split application of 2t./ha+30kgN/ha	9,700	77,600	45,200	32,400	1.7:1	2.13
Recommended NPK fertilizer	6,900	55,200	37,800	17,400	1.5:1	2.19
Control(no fertilizer)	1,800	14,400	25,000	(10,600)	0.5:1	0.00
			Average			
4t/ha compost	8,200	65,600	52,200	13,400	1.2:1	0.87
2t/ha compost	9,700	77,600	45,000	32,600	1.8:1	2.72
Recommended NPK fertilizer	6,900	55,200	37,800	17,400	1.5:1	2.19
Control(no fertilizer)	1,800	14,400	25,000	(10,600)	0.5:1	0.00

* Average of 2 cropping seasons; value in brackets means negative /loss; okra fruit market retail price was # 8 /kg over the period of the experiments;₦115=$1.