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ECONOMIC ANALYSIS OF THE EFFECT OF ORGANO-MINERAL FERTILIZER ON TOMATO YIELD COMPONENT IN HUMID FOREST ZONE OF NIGERIA

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ABSTRACT

Field experiment were carried out during 2003/2004 cropping seasons (early and late), with tomatoes (Lycopersicum esculentum mill) at the Federal College of Agriculture and Edu village in Akure to evaluate the economic viability of different types and levels of manure. The first experiment compared 100Kg ha^{-1} N-P-K 20-10-15, and 25t ha^{-1} each of the cattle, goat, pig and poultry, where poultry and goat manure had the best impact. The second experiment compared five levels of poultry and goat manures (0,10, 25, 40 and 50tha^{-1}) separately. Result showed that late crop was more profitable than early crop because of excessive moisture and FECA site better than Edu because the former was better in terms of soil structure before the application of manure. Result further showed that, as higher level of manure was applied, yield increased up to 25t ha^{-1}. It was concluded that poultry and goat manure applied separately were generally more profitable at 25t ha^{-1}.

Key words: **Economic analysis, organo-mineral fertilizer, tomato yield**

INTRODUCTION

Tomato is one of the most important vegetable crops in Nigeria. Over 95% of land area in southwest Nigeria has low to medium levels of phosphorus (P) to support tomato production. Tomato yields are as much as 13.5 and 21t ha^{-1} in tropical Africa and other part of the world respectively but in Nigeria, the yield is as low as 10t ha^{-1} (F.A.O, 1993), the demands of tomatoes for N, P and K are high and studies in south west Nigeria showed that tomato yield was significantly increased by application and availability of N, P, K, Ca and Mg fertilizers (Adekiya and Ojeniyi, 2002). Studies on the economic analysis on the application of inorganic and organic fertilizer to horticultural crops such as tomato are not common in literature. This is partly because most farmers generally cultivate horticultural crops, as an intercrop with major crops. The importance of the use of organic and inorganic manure in tropical agriculture in increasing world food production has been thoroughly discussed (Aliyu and Olanrewaju, 1996).

The use of inorganic fertilizer is expensive for the resource poor farmers, besides the scarcity of the fertilizer. Results of studies carried out in Southwest of Nigeria emphasized agronomic potentials of livestock manures such as (cow, poultry) and oil palm sludge as soil amendments especially on acid soils in which inorganic N and P fertilizer may have adverse effect on soil by increasing its acidity. (Doran et al, 1996; Opara- Nadi et al, 2000). Animal wastes decompose and contribute organic matter, thereby increasing the overall fertility of the soil. Soil fertility has been the limiting factors in development of sustainable tropical agriculture (Mbagwu and Ekwealor, 1990).

Thus, in this study, effort was made to evaluate and compare the economic viability of the effect of different types and levels of manure on tomato. It is expected that the study will advance knowledge on the use of locally available, affordable and environmentally friendly organic waste for enhancing the profitability of tomato production.

METHODOLOGY

Two field experiments were carried out during 2003 and 2004 cropping seasons (early and late) on loamy soils with tomatoes (*Lycopersium esculentum . mill*) at the Federal college of Agriculture and Edu village all in Akure, to evaluate the economic viability of application of livestock manure on tomato. The first experiment (2003) compared 100Kg ha^{-1} N-P-K (20-10-10), 25t ha^{-1} of cattle, goat, pig and poultry and amended (control) plot.

The second experiment (2004) compared five levels of poultry and goat manures (0,10,25,40 and 50t ha^{-1}) in 2004 separately. The experimental design used was randomized complete blocks with three replications. Each plot measured 5 × 5m ($25m^2$), the tomato was spaced out at 75 × 50cm to give a population density of 26,666 plants per hectare.

Tomato variety (Roma VF), which is vigorous, determinate, disease resistance variety and widely grown in Akure area was used. The seeds were nursed for 21 days (Bernary, 1995) and transplanted in the evenings at 4-6 leaf stage (10-12cm tall). The treatment was applied on soil surface beside each plant two weeks after transplanting. One meter splitted bamboo stems were used as stake and twine was used to tie the tomato loosely to the stakes at an interval of 30cm. Manual weeding was done twice and thrice for early and late season crops respectively at three week interval after manure application.

Data were collected on plot basis and ten tomato stands were selected from the middle of each plot for this purpose. Harvesting was carried out at five days interval. The yield was determined with a salter scale.

Gross margin analysis was used to determine the economic viability.

GM = TR- TVC

Where

GM= Gross Margin

TR= Value of farm output

TVC= Total variable cost

RESULTS AND DISCUSSION

The gross margin measures the contribution of that enterprise to the farm total profit. Given the fixed costs on a farm, the larger the total gross margin from all the enterprises on the farm, the larger the farm profit. The relative economic performance of each of the treatments was gauged by calculating the gross margin.In this study, there is an array of level of treatments to select, and the levels was ranked in order of magnitude of their gross margins i.e the higher the magnitude of gross margin, the better the treatment.

Table 1 shows the breakdown of the expenses from each of the treatment and tables 2,3 and 4 present the gross margin of the use of manures. The gross margin variability was lowest with cattle manure (Table 2). The economic analysis also revealed that poultry

manure would guarantee more profit, followed by goat. The exception was at Edu during the early season, where NPK had highest gross margin of N58,000.00. The higher gross margin recorded for poultry and goat in this work could be due to their lower C: N ratio when compared with the other manures. It could also be due to the supply of more nutrients than NPK fertilizer. Wang et al (1999) observed that addition of manure compost to the soil increased total organic matter, macro-nutrients (N, P, Mg, Ca and K) and micro nutrient (Cu, Zn and Mn).

Compared to Edu, FECA was more profitable for late season. Thus soil structure and fertility of FECA could be better than that of Edu before the application of manures. As expected, the late crop was more profitable in all the cases for both sites than the early crop because tomato tends to perform better with less rainfall and more sunshine.Poultry and goat manures applied separately were generally more profitable at $25tha^{-1}$ (Table 3 and 4) and beyond this dosage gross margin decline. This could be due to the excessiveness of N in the soil, which favours vegetative growth to the detriment of fruiting. However, the highest gross margin was obtained in FECA at $40tha^{-1}$ during the early season. This trend was further reinforced by tables 5 to 7 where percent increase in gross margin due to usage of livestock manure on tomato was displayed.

CONCLUSION

Based on economic indicators, it pays better to apply poultry and goat manure to tomato because both will guarantee higher returns (Gross margin) when compared with the application of other manures. The optimum results could be obtained by applying $25tha^{-1}$ on tomato

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Table 1: Expenses incurred under various application of inorganic and organic manure of tomato

	Control	Poultry	NPK	Cattle	Goat	Pig
Fertilizer	-	-	2075	-	-	-
Ploughing	2500	2500	2500	2500	2500	2500
Fuel	1625	1625	1625	1625	1625	1625
Harrowing	2500	2500	2500	2500	2500	2500
Weeding	37500	37500	37500	37500	37500	37500
Transportation	-	12,500	12,500	12,500	12,500	12,500
Fertilizer App	-	5000	5000	5000	5000	5000
Splitting of Bamboo	26000	26000	26000	26000	26000	26000
Harvesting	5000	5000	5000	5000	5000	5000

Table 2: Gross margin of use of organic and inorganic manure on tomato

Treatment	Early Season		Late Season	
	FECA	EDU	FECA	EDU
Control				
Revenue	107,000.00	121,000.00	121,250.00	167,500.00
Expenses	75,125.00	75,125.00	75,125.00	75,125.00
Gross margin	31,875.00	45,875.00	46,125.00	92,375.00
NPK				
Revenue	139,000.00	151,000.00	146,250.00	218,750.00
Expenses	92,200.00	92,200.00	92,200.00	92,200.00
Gross margin	42,800.00	58,800.00	56,125.00	126,550.00
Cattle manure				
Revenue	127,000.00	137,000.00	148,750.00	158,750.00
Expenses	92,625.00	92,625.00	92,625.00	92,625.00
Gross margin	34,375.00	44,375.00	56,125.00	66,125.00
Goat manure				
Revenue	155,000.00	144,000.00	225,000.00	226,250.00
Expenses	92,625.00	92,625.00	92,625.00	92,625.00
Gross margin	62,375.00	51,375.00	132,350.00	173,625.00
Pig manure				
Revenue	140,000.00	136,000.00	166,250.00	308,000.00
Expenses	92,625.00	92,625.00	92,625.00	92,625.00
Gross margin	47,375.00	43,375.00	73,625.00	215,375.00
Poultry manure				
Revenue	167,000.00	145,000.00	267,500.00	362,500.00
Expenses	92,625.00	92,625.00	92,625.00	92,625.00
Gross margin	74,375.00	52,375.00	174,875.00	269,875.00

Table 3: Gross margin of use of different levels of poultry manure on tomato (N)

Treatment	Early Season		Late Season	
	FECA	EDU	FECA	EDU
0t ha^{-1}				
Revenue	133,750.00	85,000.00	164,000.00	189,000.00
Expenses	75,125.00	75,125.00	75,125.00	75,125.00
Gross margin	58,625.00	9,875.00	88,875.00	113875.00
10t ha^{-1}				
Revenue	192,500.00	173,750.00	271,000.00	287,000.00
Expenses	92,625.00	92,625.00	92,625.00	92,625.00
Gross margin	99,875.00	81,125.00	178,375.00	194,375.00
25t ha^{-1}				
Revenue	297,500.00	253,750.00	316,000.00	397,000.00
Expenses	100,125.00	100,125.00	100,125.00	100,125.00
Gross margin	197,375.00	153,625.00	215,875.00	296,875.00
40t ha^{-1}				
Revenue	213,750.00	126,250.00	227,000.00	260,000.00
Expenses	107,625.00	107,625.00	107,625.00	107,625.00
Gross margin	106,125.00	18,625.00	119,375.00	152,375.00
50t ha^{-1}				
Revenue	140,000.00	136,000.00	166,250.00	308,000.00
Expenses	92,625.00	92,625.00	92,625.00	92,625.00
Gross margin	47,375.00	43,375.00	73,625.00	215,375.00

Table 4: Gross margin of use of different levels of goat manure on tomato (N)

Treatment	Early Season		Late Season	
	FECA	EDU	FECA	EDU
0t ha^{-1}				
Revenue	181,250.00	195,000.00	145,000.00	107,000.00
Expenses	75,125.00	75,125.00	75,125.00	75,125.00
Gross margin	105,125.00	119,875.00	69,875.00	31,875.00
10t ha^{-1}				
Revenue	232,500.00	260,000.00	185,000.00	157,000.00
Expenses	92,625.00	92,625.00	92,625.00	92,625.00
Gross margin	139,875.00	67,375.00	92,375.00	64,375.00
25t ha^{-1}				
Revenue	255,000.00	253,750.00	316,000.00	397,000.00
Expenses	100,000.00	100,125.00	100,125.00	100,125.00
Gross margin	54,875.00	237,375.00	180,875.00	131,875.00
40t ha^{-1}				
Revenue	336,250.00	271,250.00	269,000.00	215,000.00
Expenses	107,625.00	107,625.00	107,625.00	107,625.00
Gross margin	228,625.00	163,625.00	161,375.00	107,375.00
50t ha^{-1}				
Revenue	333,750.00	223,750.00	258,000.00	202,000.00
Expenses	112,625.00	112,625.00	112,625.00	112,625.00
Gross margin	221,125.00	111,125.00	145,375.00	89,375.00

Table 5: Percent increase in gross margin due to the usage of livestock manures on tomato (2000)

Treatments	Early Season		Late Season	
	FECA	EDU	FECA	EDU
NPK	147	128	117	137
Cattle	108	97	122	72
Goat	196	112	287	188
Pig	149	96	160	233
Poultry	233	114	379	292

Table 6: Percent increase in gross margin due to the usage of different levels of poultry manures on tomato (2001)

Treatments	Early Season		Late Season	
(t ha^{-1})	FECA	EDU	FECA	EDU
10	170	822	201	170
25	337	155	243	260
40	181	188	134	134

50	149	201	113	119

Table 7: Percent increase in gross margin due to the usage of different levels of goat manure on tomato (2002)

Treatments	Early Season		Late Season	
(t ha^{-1})	FECA	EDU	FECA	EDU
10	133	132	132	202
25	147	198	259	414
40	217	136	231	337
50	210	93	208	280