PROFITABILITY OF CUCUMBER/MAIZE MIXTURE UNDER DIFFERENT CROP ARRANGEMENTS AND VARYING RATES OF FARM YARD MANURE AND CONVENTIONAL FERTILIZER IN THE NORTHERN GUINEA SAVANNA OF NIGERIA

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Abstract

Maize productivity is variable and in most cases low. It, therefore, requires a particular crop to be grown with to serve as a buffer. This study examines how cucumber acts as a buffer in stabilizing farm incomes at varying rates of farm yard manure and inorganic fertilizer. Field experiments were conducted for three years on the research farm of the Institute for Agricultural Research, Samaru, Nigeria. The experiments were laid out in a split plot design with the factorial combination of four levels of NPK fertilizer and three rates of farm yard manure (FYM) and two planting geometry. It was observed that both yields and gross margins for cucumber/maize mixture were significantly influenced by crop arrangements, NPK fertilizer rates and farm yard manure rates. The mixture of cucumber/maize at 10 t/ha rate of farm yard manure and 600 kg/ha rate of NPK fertilizer performed belter in terms of yields and economic returns.

Introduction

Maize production like most other crops cultivated in Nigeria, has been increasing for the past 20 years. The demand for maize is primarily for human consumption in various forms and utilization for livestock feeds. It is one of the cereal crops that require substantial amount of nutrients to give reasonable yields. Despite the high level of nutrient requirements, maize is an important crop in Northern Guinea Savanna (NGS) of Nigeria. The rapid expansion of maize production in the NGS was related to the discovery that the zone possessed the greatest potential for the cultivation of crop (Ahmed el al, 1997). The favourable weather in the zone combined with the application of organic fertilizers, boosted yields and made the crop one of the most important food and cash crops in the area (Smith etal, 1989).

Cucumber is a monoecious, annual, herbaceous trailing or climbing plant. It is a tender vine crop adapted to warm climate. Cucumber fruit is eaten fresh as salad vegetable, stewed, boiled or fried. The fruits are, therefore, an important source of income to farmers. The production of cucumber is however, not common among farmers in Nigeria. This is in consonance with its consumption in the country. Its economic importance is not known to majority.

Maize is one of the major cereal crops being grown in the developing world as a component of intercropping system. The aim of intercropping is to enhance total crop productivity by using crop combinations that complement each other in terms of their nutrient requirements and to maximize the often-limited resources of the available soils. This reflects what Loomis and Connor (1992) described as nich differentiation and what Ong and Black (1994) refer to as complementarily in resource utilization. The two most important considerations which determine intercropping combinations are the length of the growing seasons and the adaptation of crops to specific environment (Vandermeer, 1989). In NGS of Nigeria, intercropping are dominated by crops such as maize, sorghum, cowpea and groundnut. The system of intercropping are being practiced using low-input and local stocks of crops, which are prone to attack by insect pests and diseases. This results to low productivity. Generally, maize is the most important of three crops used in the intercropping systems (Mannion, 1995). Sorghum may be second or even third in importance after cowpea.

Maize productivity is variable and in most cases low. It, therefore, requires a particular crop to be grown with to serve as a buffer. Cucumber grown with maize can serve as a buffer for farm income that relies on fluctuating maize yields and prices.

The circumstances of the past years have generated concern over the heavy reliance of modern agriculture on inorganic fertilizers. Food production, farm incomes and food prices are vulnerable to inadequacy in supply and high cost of inorganic fertilizer in Nigeria (Rahman et al, 2002). At the same time, the uncertain national food situation requires alternative resources and practices for food security and self-reliance. Such alternatives should be highly productive and be able to reduce adverse environmental impacts. The use of organic manure on farms with little or no inorganic fertilizer may be one of such alternatives. There is, however, a widely held premise that there is an overwhelming advantage in the use of inorganic over organic fertilizers (Klepper et al,

1977). This study seeks to examine how cucumber can act as a form of protection against maize harvest failure and a buffer to stabilize farmers[1] incomes at varying rates of farm-yard manure and inorganic fertilizer.

Materials and Methods

Field experiments were conducted for three years on the research farm of the Institute for Agricultural Research, Samaru, Nigeria. The soil on the experimental site is a sandy loam, characterized by low pH (5.0 - 6,0), organic matter content ranges from 0.06 - 0.08%, available phosphorus 2.0 - 3.2 ppm and nitrogen 0.03 - 0.05%. The experimental field was ploughed, harrowed and ridged at 0.75m apart. Gross plot size was $24m^2$ and consisted of eight rows 0.75 m apart and measured 4.0 m in length. The four inner rows constituted the net plot ($12m^2$) from which yield assessments were carried out.

The experiment was laid out in a split plot design with the factorial combination of four levels of compound (NPK - 20-10-10) fertilizer, i.e. 0, 200, 400, 600 kg ha^1 and three rates of farm-yard manure - 0, 5, and 10 t ha"[1] as main plots and two planting geometry namely; cucumber and maize in alternate row arrangement, cucumber and maize in alternate stand arrangement as the subplot or sub-treatment. The treatment was replicated three times.

Crowding which was used as source of FYM was incorporated and worked into marked field as per treatment about 2 weeks before planting of seeds. Cucumber variety Beit alpha and maize variety TZBSR were used for the study. The seeds of cucumber and maize were sown al spacing's of 0.75 x 0.75 and 0.50 x 0.75m respectively. Fields were weeded manually using hand hoes to-ensure weed free experimental plots. Growth and yield data of both crops in the mixture were recorded at fortnightly intervals beginning from 4 WAS up till 10 WAS. Harvesting of cucumber commenced at 8 WAS and continued till the crop ended its cycle and died naturally but maize cobs were allowed to dry on the plant and harvested by the 3rd week of October. Data collected subjected to statistical analysis (ANOVA) (Snedecor and Cochran, (1967) separated using Duncan Multiple Range Test (DMRT) (Duncan, 1955). Gross margin was estimated for every treatment to examine the economic implication of varying the rates of application of fertilizers (both organic and inorganic).on the cucumber/maize mixture. Gross margin is expressed as:

GM = TR - TVC

Where, GM = Gross Margin (N/ha) TR = Total Revenue (N/ha) TVC = Total Variable Cost (N/ha)

Results and Discussion

Cucumber and Maize Yields Response

Effects of crop arrangements, NPK fertilizer rates and farm-yard manure rates are shown in Table 1. Cucumber grown in alternate row arrangement with maize produced higher fruit yield (yield difference of 47 per cent) compared to the alternate stand arrangement. Similarly, maize yield under the alternate row reflected 18 per cent yield differences above that obtained from alternate stand. The alternate row arrangement might have permitted minimal intra-specific competition for the factors of photosynthesis, i.e. light, space, nutrients, etc. and higher plant population density which in turn enhanced the crop yield.

Cucumber fruit yield recorded on plots treated with NPK fertilizer at the rate of 200 kg/ha was higher (62 per cent yield gain) than yield recorded on the untreated or control plots (K/ha). Increase in NPK fertilizer rate from 200 to 400 kg/ha resulted in 24 and 45 per cent yield gain for cucumber and maize respectively. Further increase in the NPK fertilizer rate from 400 to 600 kg/ha resulted in no significant increase in cucumber fruit yield (2 per cent yield gain), but maize responded significantly with yield gain of 67 per cent.

Harm yard manure at the rate of 5t/ha induced yield gain of 28 per cent in both cucumber and maize over the zero application. Further increase in the rate of farm yard manure from 5 to 10 t/ha resulted in 54 per cent yield gain in cucumber and no significant increase in maize yield.

Table 1: Yield of Cucumber and Maize at Varying Crop Arrangement and Fertilizer Rates

			Cucumber	Maize

Treatment	Yield (kg/ha)	Yield gain (%)	Yield (Kg/ha)	Yield gain (%)
N1*K Fertilizer (kg/ha)				
0	73019	-	636b	-
200	118335a	62	666b	05
400	1465 5 9a	24	965b	45
600	149902a	02	1608a	67
Slit	11592.0	_	102.4	-
FYM (t/ha)				
0	85913b	-	804	-
5	110214b	28	1031	28
10	169735a	54	1045	01
SE±	10039.0	-	88.7	-
Crop Arrangement				
Alternate stand	81425b		890	
Alternate row	119408a	47	1048	18
SE±	10835.8		93.28	

FYM = Farm yard manure.

Means followed by the same letter within a treatment group are not significantly different at 5% level of significance using Duncan Multiple Range Test (DMRT).

Economic Evaluation

The cost of six variable inputs (cucumber seed, maize seed, NPK fertilizer, farm yard manure, chemicals and labour) constituted the total variable cost for cucumber/maize mixture. The revenue from each of the crops (cucumber and maize) was obtained as a product of farm gate price of one kilogramme of the crop and the yield measured in kilogramme. The farm gate prices of N8/kg and NIOkg for cucumber and maize respectively were used in computing the revenue. Gross margin which measures profitability was estimated as revenue less the total variable costs.

Table 2: Average Costs and Returns Per Hectare for Cucumber/Maize Mixture at Varying Crop Arrangements

Crop Arrangement	Seed Cost (₦)		Fertilizer Cost (₦)		Chemical Cost (₦)	Labour Cost (₦)	TVC (₦)	Revenue (₦)		Total Revenue (₦)	Gross Margin (₦)
	Cucumber	Maize	NPK	FYM				Cucumber	Maize		
Alternate rows	8547	1767	7200	3750	10601	52896	84761	955264	10480	965744	880983
Alternate stands	8547	1767	7200	3750	10601	48087	79952	651400	8900	660300	580348

FYM = Farm Yard Manure.
TVC = Total Variable Cost.

Table 3: Average Costs and Returns Per Hectare for Cucumber/Maize Mixture at Different Rates of NPK Fertilizer

Rates (kg/ha)	Seed Cost (₦)		Fertilizer Cost (₦)		Chemical Cost (₦)	Labour Cost (₦)	TVC (₦)	Revenue (₦)		Total Revenue (₦)	Gross Margin (₦)
	Cucumber	Maize	NPK	FYM				Cucumber	Maize		
0	8547	1767	0	3750	10601	38470	63135	584152	6360	590512	527377
200	8547	1767	4800	3750	10601	50492	79957	946680	6660	953340	873383
400	8547	1767	9600	3750	10601	53017	87282	1172472	9650	1182122	1094840
600	8547	1767	14400	3750	10601	55541	94606	1199216	16080	1215296	1120690

Table 4: Average Costs and Returns Per Hectare for Cucumber/Maize Mixture at Different Rates of Farm Yard Manure

Rates (t/ha)	Seed Cost (₦)		Fertilizer Cost (₦)		Chemical Cost (₦)	Labour Cost (₦)	TVC (₦)	Revenue (₦)		Total Revenue (₦)	Gross Margin (₦)
	Cucumber	Maize	NPK	FYM				Cucumber	Maize		
0	8547	1767	7200	0	10601	43176	71291	687304	8040	695344	624053
5	8547	1767	7200	3750	10601	49122	80987	881712	10310	892022	811035
10	8547	1767	7200	7500	10601	58345	93960	1357880	10450	1368330	1274370

In tins study, cost of seeds and chemicals remained the same for every treatment as same quantities of seeds and chemicals were used at unchanged price. Cost of chemicals consists of costs incurred on cypermethrin, Benlate and seed treatment chemical. In Table 2, cost of labour varied between the two types of crop arrangement for the cucumber/maize mixture. This was attributable to difference in yields which result to different labour requirement for harvesting. Higher gross margin of N880983 per hectare was observed for the alternative row arrangement in consonance with yield recorded.

Table 3 shows economic performance of cucumber/maize mixture under different rates of NPK fertilizer. The total variable cost increases as the fertilizer rates increased from 0 to 600kg/ha. The increase in both fertilizer and labour costs was responsible for the observed increase in the total variable cost It was also discovered that the gross margin for cucumber/maize mixture increased in consonance to the NPK fertilizer rates.

In Table 4, gross margin, revenue, costs of farm yard manure and labour varied positively with the quality of farm yard manure applied for the production of cucumber and maize in mixture. 'fhis phenomenon is also in consonance with the increase in yields of cucumber and maize as a response to the rates of farm yard manure.

Conclusion and Recommendations

Both the yield and gross margins for cucumber/maize mixture were influenced by crop arrangements, NPK fertilizer rates and farm yard manure rates. The mixture of cucumber/rnaize at IGt/ha rate of farm yard manure and 600kg/ha rate of NPK fertilizer performed better in terms of yields and economic returns. Cucumber/maize mixture was profitable under every treatment studied. However, alternate row arrangement of the crops with substantial amount of NPK fertilizer or farm yard manure reflected better economic performance.

This study, therefore, recommends the following:

i. Farmers should be enlightened on the economic importance of cucumber. li. Farmers should be encouraged to grow their crops in mixture with cucumber; especially cereals such as maize and sorghum, in order to avert risk, iii. Further research should be conducted to determine optimal level for the use of resources in cucumber/maize mixture, in order to avoid under - or over-utilization of resources, iv. Fertilizer should be supplied to farmers timely and at affordable rates through their cooperative societies.

v. Where inorganic fertilizer is not available nor sufficient, farmers should be advised to endeavour to use farm yard manure to boost the production of their crops.

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