International Journal of Agriculture, Environment and Bioresearch

Vol. 2, No. 03; 2017

ISSN: 2456-8643

A PILOT PRODUCTION OF DRY SEASON CUCUMBER USING INORGANIC FERTILIZERS IN THE UNIVERSITY OF NIGERIA FARM, NSUKKA, ENUGU STATE, NIGERIA.

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ABSTRACT

This pilot study was on the economics of dry season cucumber production using inorganic fertilizers. It was carried out at the University of Nigeria demonstration farm. The specific objectives of the research were to: describe the system of dry season cucumber production; determine the cost and returns of dry season cucumber production; describe the marketing channels of Cucumber marketing; identify major constraints facing dry season production and marketing of cucumber in the area; and, make recommendations based on findings. The best planting system was direct sowing unlike most other fruit vegetables that will require to be raised in the nursery first, before transplanting. The profitability was determined in two stages; including only the explicit cost items (Direct labour and capital expenses) used and secondly considering both the implicit (Land, Irrigation water, and Water storage facility) and explicit cost items. The cost and return analysis show that the net return per 8 square meters was determined to be (N80.33) for inorganic cucumbers considering only the explicit costs items and (-3,256.67) when implicit costs were included. Production scale and market risks, both affect profitability and economic viability of the dry season cucumber. In view of the low return to scale from the production, more lands should be developed by communities and made affordable to potential and active cucumber farmers. Arable lands along perennial waters could be made communal to remove restrictions placed by family inheritance and finally, the leasable lands should be made cheap.

Keywords: Dry season, Cucumber production, Inorganic fertilizers, Profitability

1.0 INTRODUCTION

Cucumber (*Cucumis sativus*) is an important vegetable and one of the most popular members of the *Cucurbitaceae* family. It is thought to be one of the oldest vegetables cultivated by man with historical records dating back 5,000 years (Wehner and Guner, 2004). The crop is

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the fourth most important vegetable after tomato, cabbage and onion in Asia, and the second most important vegetable crop after tomato in Western Europe (Phu, 1997). In tropical Africa, its place has not been ranked because of limited use.

In Nigeria, There is a general belief that cucumber, cabbage and carrot can only be grown in the northern part of the country, precisely Jos. For this reason, farmers in the South East and other parts of the country are not encouraged to plant these valuable crops. The department of crop Science of the University of Nigeria, Nsukka, then headed by Professor Michael I. Uguru broke this myth which had held South East farmers hostage for years, preventing them from planting these crops. The breakthrough has provided opportunities to interested farmers in the host communities and catchment areas of the University who want to boost their incomes. (Uguru, 2011)

An understanding of the crop moisture requirement and the fertilizer use are important keys to growing healthy and profitable cucumber crop using inorganic fertilizers. The normal culture especially in Nigeria is the planting of cucumber using organic manure only or a combination of organic and inorganic fertilizer. Furthermore, the moisture content in the soil during the rainy season is usually enough for the regular cucumber production. However, in the dry seasons, rainfall may not be enough or even might be totally absent in other to achieve maximum yields. This is when the cucumbers will need to be irrigated.

Conceptually, dry season cucumber refers to cucumber production in months of no-rainfall (in Nigeria it extends from October to April each year). Most important in the factors that contribute to the success of dry season farming is the source or availability of irrigation water. Within this period, the production of cucumber is usually expensive and rather laborious. However, in areas such as Agwu, and Nkanu Local Government areas, in Enugu Agricultural zone, which are endowed with vast expanse of swamp land, the crop can be grown in large scale during the dry season. Some parts of Oji River, Agwu, Udi and Enugu Urban, produce large quantities of spinach and telferia. On the average, farmers are adopting commercial dry season vegetable production both in the rural and sub-urban areas of Enugu Agricultural Zone.

Production of cucumber in Nigeria is quite cheap, efficient and less laborious during the periods of the rainy season. This certainly leads to glut in the cucumber market. Also, due to its level of perish ability and lack of efficient preservation and storage method, there will be colossal wastages; as a result cucumber becomes scarce during the dry season.

In swamp areas or along the water bodies, dry season cucumber cropping will be very feasible. However, areas without swamp lands will depend on pipe borne water (where it is available) for irrigating the farm. Most farmers who grow vegetables generally lack the necessary information on its economics, because there are little or no such studies in existence

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(Waaijenburg 1981). This leads to the misuse or complete waste of human and material resources, which constantly inflate cost, especially during the dry seasons (Nwabueze, 1991). These problems associated with dry season farming inhibit the optimization of dry season cucumber production.

Against this background, this research is carried out to investigate the economics of dry season cucumber production using inorganic fertilizer only. The specific objectives are to:

1. determine the cost and returns of dry season cucumber production in Nsukka Agricultural Zone;
2. describe the marketing channels of Cucumber marketing in the area;
3. identify major constraints facing dry season production and marketing of cucumber in the area; and,
4. make recommendations base on findings.

Dry season production of cucumber requires special attention in that it improves resource efficiency at a time when only few farmers are into production due to lack of water. This work will be beneficial to cucumber farmer because increased adoption of dry season cucumber production will result to an increased level of income for the farmers.

Secondly, research information on the use of inorganic fertilizer alone in the production of cucumber will open new grounds for most farmers who currently have the view that cucumber production can only be carried out using organic manure or a combination of organic and inorganic fertilizers.

This study will also provide information for policy makers on the input – output data of dry-season cucumber production, hence providing important data on dry season cucumber production to facilitate decision making.

Finally, this study provides empirical information on the input-output data of dry season cucumber production, hence providing important data of dry season cucumber production for researchers. There is no doubt that a research of this nature will make a valuable contribution in the practice of dry-season farming in Nsukka Agricultural Zone. This benefit will be harnessed by researchers and farmers who are into dry season cucumber farming.

2.0 MATERIALS AND METHODS

2.1 The Study Area

This research was carried out at the crop science farm of the Department of crop Science, University of Nigeria, Nsukka. Nsukka is located in latitude 050 22’ North and longitude 070 24’ East with annual rainfall ranging from 986-2098 mm (Asadu, 2002). The natural day length for Nsukka is 12-13hours and average annual maximum and minimum temperatures are 29.7^{0}C and

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after 21ºC respectively (Ezedimma, 1971). The relative humidity ranges from 34% to 78% (Monanu, 1975).

Nsukka is a town and Local Government Area in Enugu State. Other towns that share common border with Nsukka are Enugu Ezike, Orba and Obollo-Afor (formerly centre of the palm oil trade), Ede-Oballa, Uzo Uwani and Mkpologwu

The climate is typically tropical, and is made up of two main seasons: rainy season and dry season. The rainy season lasts from April to September with a break sometime in August. The dry season starts from October to March and in some years to April. In the rainy season, the region experiences an average annual precipitation of 1772 mm (M.O.A. Enugu, 1993). Average monthly rainfall in the region is very low (about 7.88 mm) in January but rises through to a peak of about 266.7 mm in June (M.O.A. Enugu, 1993). It declines in July and August, and rises to a peak of over 300 mm in September before declining again in November – December. The dry season last from October to March as earlier stated and has occasional monthly showers of between 29 mm and 60 mm. it is also the season for the dry harmattan wind.

2.2 Layout

The crop was planted in four different seed beds, each of 1m X 2m in dimension. Each of of the bed is to have eight holes, four holes on each row of the bed. Three seeds were sown per hole which was later thinned down to two plants per stand two weeks after planting, giving a projected plant population of 17,778 plants per hectare. This will give a total of sixteen (16) plants per bed and sixty four (64) plants in all.

2.3Data Collection/Recording

The site was cleared of existing vegetation and packing of the debris was carried out before it was marked into plots. Tilling of the soil and raising of the bed was carried out by using hoes on the 5th of November, 2012. Planting was done on 12 Nov 2012 at a spacing of 45 cm x 75 cm.

Fertilizer was applied twice, at two weeks after planting and a week after flowering at the rates of 0.314 kg/bedusing the band placement method. The field was weeded manually using a hoe. Just one weeding was carried out. The crops were sprayed once to protect the plants against insect pests and fungal diseases. Harvesting of the cucumber fruits commenced at six weeks after planting when the fruits had turned deep green in color. Harvesting was done by handpicking the matured fruits two to three times weekly.

The parameters recorded were labor cost on watering, labor cost on land preparation, labor cost on stacking, labor cost on fertilizer application and spraying, labor cost on harvesting,

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cost of seed, cost of fertilizer, cost of chemical, number of fruits harvested, marketing cost and sales.

2.4Data analysis

The profitability will be determined by employing the gross margin analysis tool. The formula for the net profit analysis is given by:

$\pi = TR - TC$

$TC = TVC + TFC$

Where; π = Net profit (₦)

TC = Total cost (₦)

TVC= Total variable cost (₦)

TFC = Total fixed Cost (₦)

3.0 RESULTS AND DISCUSSION

3.1 Description of the Dry Season Cucumber Production System

The dry season period usually starts in October and ends in April in Nsukka, although there has been sharp deviations from this normal recently. At this period, the best planting method is direct sowing unlike most other fruit vegetables that will require to be raised in the nursery first before transplanting.

Land preparation took place on the 5th of November, 2012. Early land preparation was done to enable the plants establish with the remaining moisture in the soil. The presence of moisture and the effect of dew in the evening can be beneficial to the cucumber plants until December or even January. This did not take away the need for artificial irrigation of the plant. A week after the land preparation, the seed was sown, that is on the 12th of November.

Mulching took place soon after direct sowing. The mulching materials were mainly grasses and palm fronds and this was between the 12th of November and 17th of November. At least there was about 80% emergence on the 17th of November, just about 5 days after planting, and there was 100% emergence two days after and that was on the 19th of November.

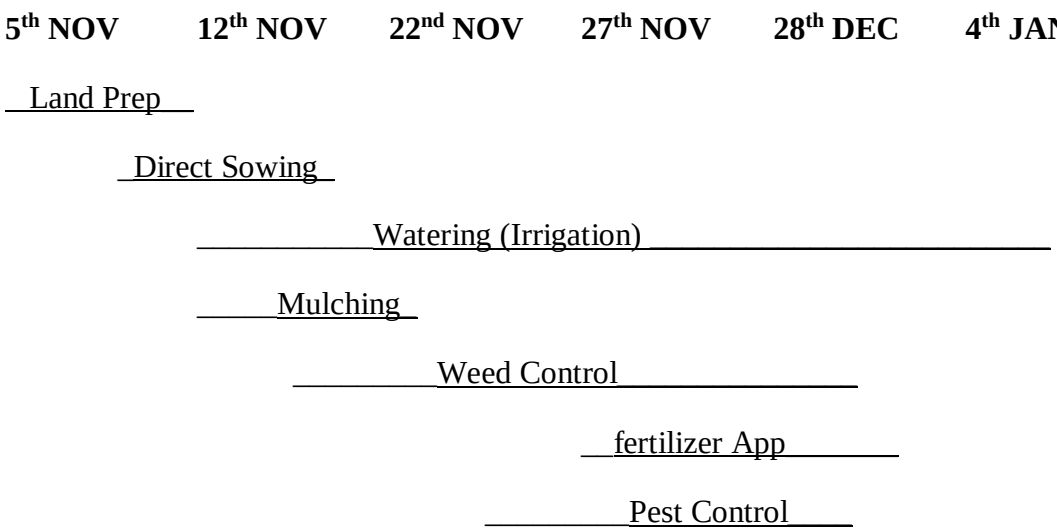

Fig. 3.1: Calendar of Cultural Operations in the Dry Season Cucumber Production

Fertilizer application as in fig. 4.1 was between 27th November and 28 of December, two applications were done with a month interval between them. The applications were done basically after an important physiological process of germination and flowering. Weed control was carried out when necessary between the first fertilizer application and the second. Normally the weeding was done immediately before applying the fertilizer. Pest control on the other hand was carried out at the first month after planting when pest attack came above injury level.

Harvesting of fruits started from 4th of January, which was less than two months after planting and exactly two months after the first cultural operation of land preparation. Harvesting and marketing went hand in hand as most of the sales were based on contract. The harvests were therefore all sold out immediately, essentially because there was ready market for it .

The major and most labour intensive operation was the watering of the cucumber farm. For instance, Fig 4.1 shows that irrigation period was required from immediately after planting till harvesting period. In other to reduce cost, the farm was situated near the source of water. Many farmers usually plant near perennial streams. Watering (Irrigation) can be done twice or once depending on the plant's stage, the retention capacity of the soil and the amount of labour available. In small scale farms or cucumber garden, the gardener carries out the watering within minutes. However, the costs become large when the area of land to be done is also large. Watering in dry season cucumber production formed the major operation.

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3.2 Costs and Returns Analyses

3.2.1 Costs

Cost is regarded as the value of money which is expended for producing something and therefore, it cannot be used anymore as it is unavailable. Cost in regards to this project can be divided into two categories – implicit cost and explicit cost.

Implicit cost in economics, means the opportunity cost that is equal to what has to be given up by a firm for using factors that it neither hires nor purchases. Implicit cost is actually the cost that is the consequence of using the assets, instead of lending, selling or renting them. Implicit cost is also known as implied cost, notional cost or imputed cost.

Implicit costs also show the difference between economic profit and accounting profit. Economic profit means the total revenues less total costs where the total of implicit and explicit costs is total costs. Accounting profit means total revenues less explicit costs. As the economic profit also consists of the opportunity costs, so it will either be equal or less than the accounting profit.

Explicit costs on the other hand, are the direct payments that are given to others while running a business like rent, wages, materials, etc

3.2.2 Explicit Cost Analysis

Labour used in the farm was manual and no form of power operating implement was used. It was supplied by the researcher and supplemented by a few hired labourers. The labour was computed in man-hours.

A man-hour in the zone costs one hundred Naira (₦100). However, women charge ₦50 on the average while child-labour cost ₦40 on the average. Most of the cultural practices were done by the children as they were the most easily reached. However, some cultural practices such as land clearing and land preparation were more costly because the labourers demanded more for such operations compared to irrigating the farm and weeding. Also, the time was approximated to the nearest hour. The detailed costs for the operations are presented in table 4.1 below.

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Table 3.1: operating Cost (per 8m^2) of Dry Season Cucumber Production

Cultural Operation	Labour Used (M/H)	Unit Cost (N)	Total Value (N)
Land clearing	0.33	100	100
Bed preparation	1.47	100	200
Direct sowing	0.27	50	50
Weed control	0.45	100	100
Watering	8.68	40	270
Fertilizer application	0.67	50	50
Pest control (Spraying)	0.16	50	50
Harvesting	0.83	50	50
Total	**12.86**	**540**	**870**

Source: **Field data collected 2012/2013 dry season survey**

The figure below shows the percentage distribution of the total operation cost

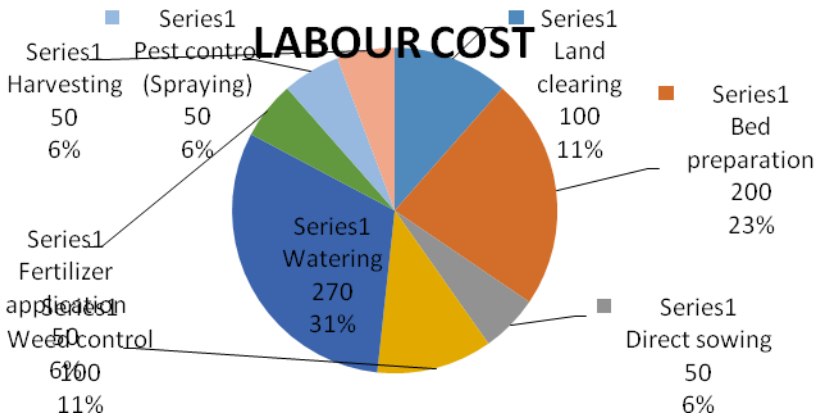

Fig 3.2 Percentage distribution of labour cost

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The fig 1.1 above reveals that the highest cost of labour was spent on watering the crops which was 31% of the entire cost of labour, unlike the cost of direct sowing, fertilizer application, spraying and harvesting which took 6% of the entire labour spending each. This suggests the need for artificial irrigation mechanization for better production efficiency.

Apart from labour, other cost incurred was in the purchase of the input used in the production. The cost analysis for these input are as follows:

Seeds

The seeds (Seeds of F1 cucumber hybrid cv. ALZAAEM,) were purchased in can (wholesale purchase), and the cost of the amount used was estimated from the prevailing price of the total purchase. The wholesale price was N1500, and the can contained about 750 seeds. Two (2) seeds were planted per hole making it a total of 64 seeds that was used. This give the cost of ₦64 for the seed used.

Farm Tools

The major farm implement that was used for the production was the watering can. which was valued at the cost of ₦600 and was depreciated on a straight line depreciation method with no salvage value.

$$\text{Depreciation} = \frac{C - SV}{L}$$

WHERE, C = Cost = N600

SV = salvage value = 0

L = life span (production periods) = 6

Therefore, Depreciation = 600/6 = 100

Fertilizer

The cost of fertilizer was also estimated from the bulk price as purchased from the market. The bulk price was N3150 for 65.94kg. Therefore, for 0.314 kg/bed which gave 1.256 per $8m^2$, it gave a cost of N60

Chemical

This was done by using two spoons full of ZAP into a full knapsack sprayer. The cost however, the cost is estimated by taking directly the amount charged for field area only. This is 250/6 = 41.67

Transportation

This included the amount paid in bringing the input to the farm, as well the cost of transporting the produce to the market for sales. However, since the produce was sold at the farm gate, no cost was incurred in this regard. Therefore the cost of transportation was simply N20. The detailed costs for the operations are presented in table 4.2 below;

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Table 3.2: Variable Cost (per 8m^2) of Dry Season Cucumber Production

Input	Unit Cost (N)	Total Value (N)
Seed	2	128
Fertilizers	48	60
Chemical	-	41.67
Transportation	-	120
Total		**349.67**

*Source:**Field data collected 2012/2013 dry season survey***

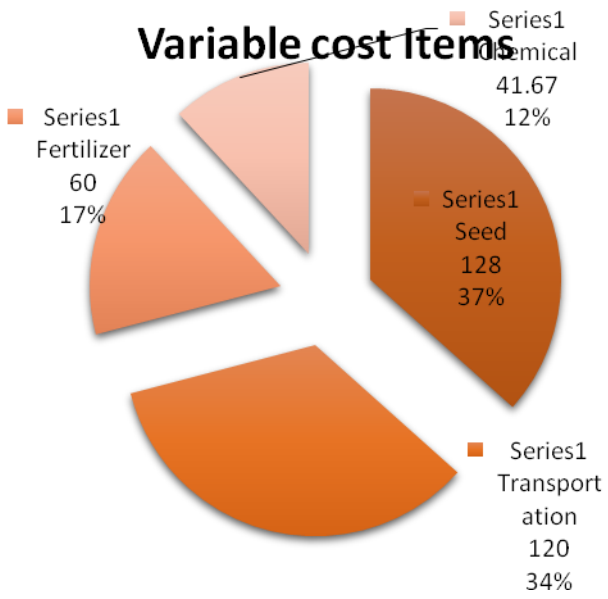

Fig 3.3 Percentage distribution of variable cost

The type of seed used in sowing was a very critical factor for growth performance and yield. From fig 1.2 above, it can be observed that the highest variable cost was spent on seed purchase (29%). Furthermore, because of the small scale nature of the project, it can be observed from the figure above that the cost of transportation (27%) was even higher than the cost of the inputs themselves.

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3.3 Returns (Per $8m^2$)

The total yield of cucumber was 8.782kg at the end of the planting period, this amounted to ₦1400.

3.3.1 Net Farm Income Analysis

3.3.1.1 Net Farm Income Analysis (Including Only Explicit Costs Items)

The quantities of the inputs used in the production of cucumber were computed on exact basis as was used per $8m^2$ plot**.** The total cost was calculated by adding all the individual costs.

The plot size was $8m^2$, the average labour used was 110 man hours (₦870) while the ₦349.67 was expended as variable cost. The total yield of cucumber was 8.782kg (₦1400) at the end of the planting period. The enterprise budget and net margin analysis is presented in the table below;

Table 3.3 Enterprise Budget for cucumber Production Per $8m^2$

		Quantity	Unit (₦)	Total (₦)
1.	**GROSS REVENUE**			
	Fresh Cucumber(Kg)	8.787		1400
	Total Revenue (TR)			**1400**
2.	**VARIABLE COST**			
	Seeds	64	2	128
	Fertilizer		48	60
	Insecticides			41.67
	Labour	12.86	540	870
	Transportation			120
	Total Variable Cost (TVC)			**1219.67**
3.	**FIXED COST**			
	Farm Tools			100
	Total Fixed Cost (TFC)			**100**

Source: ***Field data 2012/2013 dry season cucumber production***

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Gross Margin (GM) = TR – TVC = ₦1400 – ₦1219.67= 180.33

Net Farm Income (PROFIT) = [(TR – TVC) – TFC] =180.33 – 100 = 80.33

% Margin = GM/TVC x 100/1 = 180.33/1219.67 X 100/1=14.79%

3.3.1.2 Net Farm Income Analysis including implicit and explicit cost items

There were basically three(3) implicit costs that were incurred in the course of the production which will be captured below, and the net margin calculated again, to determine the profitability of the project when these cost are included.

Cost of irrigation Water

Production that is sited near the streams and rivers or other such water bodies is the best for dry season farming. This is because there will be no need to spend for the cost of irrigation water. This is why most of the dry season crop productions are more beneficial and economical when carried out near the water bodies. However, for this project, the cost of the water used was evaluated based on the prevailing market cost of water and based on quantity used.

The implicit cost of water used can be determined by valuing at the prevailing cost of ₦1500 per 5000 liters was ₦ 837 (2,790 liters).

Cost of water storage tank

The implicit cost of acquiring and installing the water storage tank #20,000.00 and with the lifespan of 20 years and depreciating on a straight line, the cost can be estimated to be #1000

Rent for farm Land

The cost of land can either be determined using the prevailing cost of renting the land which is an average of #500 per month, giving #1500 for the planting period.

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Table 3.4 Enterprise Budget for cucumber Production Per 8m^2 including implicit cost items

		Quantity	Unit	Total (₦)
1.	GROSS REVENUE			
	Fresh Cucumber	8.787		1400
	Total Revenue (TR)			**1400**
2.	VARIABLE COST			
	Seeds	64	2	128
	Fertilizer		48	60
	Insecticides			41.67
	Labour	12.86	540	870
	Transportation			120
	*Irrigation water			**837**
	Total Variable Cost (TVC)			**2,056.67**
3.	FIXED COST			
	Farm Tools			100
	*Land			1500
	*Overhead tank			1000
	Total Fixed Cost (TFC)			**2600**

Source: ***Field data 2012/2013 dry season cucumber production***

****implicit cost items***

Gross Margin (GM) = TR – TVC = ₦1400 – ₦2,056.67 = **-656.67**

Net Farm Income (PROFIT) = [(TR – TVC) – TFC] = -656.67 – 2600 = **-3,256.67**

3.4 Marketing and Marketing Channels

3.4.1 Marketing of Dry Season Vegetable

In the study area, there are both urban and rural markets, where dry season vegetables could be sold. They include Ogige main market, situated at the center of the town. Afor Obollo

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Market, situated at a point from where one could go to various parts of the country. As this market is along the road, transportation is usually not a major problem. Nkwo Ibagwa is a periodic market located in the rural area, but not far from Nsukka. Orie Orba, which was previously a rural market, has recently been transformed into a modern market. It has a large park which serves many towns and neighboring states. Though a periodic market, it is said to be the largest market in the study area.

The method that was employed in the marketing of the product was a form of contract farming where buyers (mostly students) already book the produce before harvest or they came to purchase at the farm at harvest. This is because of the scarcity of cucumber in the area in the dry season. Also, due to the perishability of the produce and high transport cost, selling the produce at farm gate was preferred in other to reduce marketing cost and loss instead of taking them to those markets.

3.4.2 Marketing Channels of Cucumber

The complex marketing channel of Cucumber is describable from fig 4.3. Cucumber had a different marketing trend from other fruit vegetables because much of what was produced in the zone was sold within the zone. However, most of the produce available in the market at this period is bought from neighboring states especially from the north.

According to some interviewed marketers, the produce was majorly sold directly to the consumers or farm gate buyers as shown in fig 4.4. A few retailers also bought from the wholesalers and later stock the cucumbers into small quantities in bunch of three for N100?

From the marketing experience gathered during the research period, where the production is at a very large scale, a number of contract buyers and farm gate buyers also purchase directly from the producers, (as depicted in figure 4.4) and supplied to schools, hospitals and hoteliers who form the ultimate consumers.

Producer ⟹ consumer (contract buyer or farm gate buyers)

Producer → retailer → consumer

Producer → wholesaler → retailer → consumer

Producer → brokers → wholesaler → retailer con. →

Key:

Major marketing channel →

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Minor marketing channel ⟹

Fig 3.4 Marketing Channels of Cucumber

3.5 Major Problems Associated with Cucumber Production and Marketing

A number of problems constrain the production and marketing of cucumber during dry-season in Nsukka agricultural zone. The major problems are discussed below.

Lack of Steady and Adequate Water Supply

There were days when there was no water either from tap or reservoir, available for irrigating the farm. Sometimes, the tap stops while irrigation is going on. This poses a serious constraint to dry season growing of cucumber as the plant requires steady and consistent water supply. This problem was even more severe due to the high temperature that is observed during the dry season especially during the day.

Fertilization

The project was carried out using inorganic fertilizer as the sole source of fertilization. This poses a constraint due to the fact that it is not advisable to use inorganic fertilizer on the soil before planting or few days after planting when the crops are still tender. Because of this, the plant will lose the initial nutrient required at the initial stage of growth, likewise the good soil structure microbial activity that organic manure gives to the soil.

Furthermore, farmers in the area depends more on inorganic fertilizer such as NPK, Urea and single superphosphate for growing cucumbers. There was high demand for these fertilizers in the zone. Supply was rather low hence very high prices.

Lack and Cost of Transportation

Lack of transportation militated against the evacuation of harvested produce from the farms to the markets. Although there were available markets for the produce at the urban and rural market, the marginal cost incurred was higher than the marginal revenue obtained when sold in the markets, rather than at the farm gate. This also explains why it was preferable to sell the produce at the farm or to the middlemen instead of taking them to the rural or urban markets.

Price and Grading

One of the major problems of growing and marketing vegetable was unsteady price. Price fluctuation discourages farmers because of consequent low price attracted by cucumber.

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Unsteady prices resulted from low turn up of middlemen, against such background, the producer sold off produce at rock-bottom prices to reduce losses.

Furthermore, grading was squarely on size and waft. Both the producer and consumer have no agreed upon measure for grade, so a particular size or weight can be sold at a price today and another price the next day.

4.0 SUMMARY CONCLUSION AND RECOMMENDATION

4.1 Summary

This was a practical study of dry-season cucumber production in Nsukka, using in-organic fertilizer. It was aimed at finding out the economics of production of cucumber in the dry season. The study specifically sought to : describe the system of dry season cucumber production in the Zone; determine the cost and returns of dry season cucumber production in the Zone; describe the marketing channels of Cucumber marketing in the area; identify major constraints facing dry season production and marketing of cucumber in the area; and, make recommendations base on findings.

The planting system utilized was direct sowing unlike most other fruit vegetables that will require to be raised in the nursery first before transplanting. Land preparation was by traditional method, and planting was by direct sowing on a raised bed of 2m X 1m. The source of irrigation water was from the crop science reservoir at the farm site. The seeds were sown a week after the land preparation, the application of fertilizer was done basically after an important physiological process of germination and flowering. Harvesting of the fruits starts less than two months after planting and exactly two months after the first cultural operation of land preparation.

The amount spent on labour, including the cost of land preparation, cost of labour in watering, staking, fertilizer application etc was ₦870, the cost of water used (valued at the prevailing cost of ₦1500 per 5000 liters) was ₦837, the amount of variable cost expended is valued at ₦349.67 and the estimated yield is ₦1400.

There are complex marketing channels of Cucumber having a different marketing trend from other fruit vegetables because much of what was produced in the zone was sold within the zone. However, the method that was employed in the marketing of the product was a form of contract farming where buyers (mostly students) already book the produce before harvest or they came to purchase at the farm at harvest.

The major challenges identified to hinder production and marketing during this period were as follows:

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1. instability of water supply
2. storage
3. pricing (fluctuations)
4. economics of scale

4.2 Conclusion

Cucumber production in the zone during dry season was laborious but technically lucrative only if embarked on a large scale. This is informed by the profit margin associated with the production carried out, having a net income of ₦80.33 per $8m^2$. Therefore, this enterprise is recommended to farmers but only at a large scale and availability of water source.

Also, improvement is needed in the areas of irrigation cost and marketing to make the production more attractive.

4.3 Recommendation

Having discussed some of the findings and major constraints of growing cucumber in the dry season in the zone, the following recommendations are made.

In view of the low return to scale from the production, more lands should be developed by communities and made affordable to potential and active cucumber farmers. Arable lands along perennial waters could be made communal to remove restrictions placed by family inheritance; the leasable lands should be made to be cheap. Extension service should be directed toward improved cultural operations like land rotation, alley cropping etc.

Irrigation is vital in dry-season farming. The communities should arrange to acquire irrigation facilities through the farmers' groups or Town development Unions. There is need to dam some major perennial streams like Ajali, Nyaba, Mamu, Iyoko, Iyaakwa in the zone and surrounding areas.

Type of seed like the researcher has discovered is essential for good output of cucumber. Researchers in the Agricultural Research Institutes should work hard towards breeding early mature, high yield, pest/disease resistant varieties. The extension arms of the ministry of Agriculture, and Agricultural development Programme could assist in the distribution to farmers in the zone.

The growers could address the cost of input especially fertilizer, by stocking appropriate fertilizer for the dry season cropping at the end of each rainy season. In the face of scarcity of inorganic fertilizer because of their high cost, the farmers could resort to complementing with organic fertilizer such as animal dung, compost, and kitchen wastes. Extension agents could extend information regarding fertilizer procurement to growers as early as possible towards the

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end of rainy season. It may be easier if producer co-operate societies would purchase fertilizer and stock for sale to members.

To reduce losses from price fluctuation, the government can arrange for contract purchase or buy off excess product to encourage the growers. In the same vein, private investors could establish agro-industries that can use cucumber as raw materials. The extension services should come up with extension package on storage and preservation.

Any programme that would improve the educational background of cucumber growers will aid the information collection, management, and utilization by farmers. It will help the farmers to solve their socio-economic problems and agronomic practices on the farms. Extension agents should teach the farmers while government should establish adult education centers in village.

With the above recommendation, growing cucumber in the dry-seasons in the zone would be made less laborious, attractive, and more lucrative.

4.4 Areas of Future Research

Issues recommended for future evaluation in dry season cucumber production includes;

1. effects of access to credit on cucumber production and distribution
2. effects of scale on profitability
3. establishing basic grades and standards in cucumber marketing in the study area
4. effect of prices on cucumber demand and supply
5. constraints to the establishment of a viable cucumber production and marketing in the study area.

ACKNOWLEDMENT

We are grateful to The African Network for Agriculture, Agroforestry and Natural Resources Education (ANAFE) Nairobi, Kenya for providing financial support to this research; Prof A. I. Achike, the project supervisor; to the Head, Department of Crop Science, Faculty of Agriculture, University of Nigeria, Nsukka, Prof M.U. Uguru for providing the land area where this research took place; and to Dr A. E. Enete who provided valuable comments and suggestions. The corresponding author bears sole responsibility for any errors or omissions.

REFERENCES

[1]Asadu C. L. A (2002) *Fluctuations in the characteristics of an important short tropical season, August Break in Eastern Nigeria.* Discovery and Innovation 14(1/2). IITA, England.

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ISSN: 2456-8643

[2] Ezedimma (1971) Unpublished. In: Momoh, O.M. (2005) *Genetic and phenotype evaluation of the Nigerian heavy chicken ecotype and its crossbreds with light ecotype*. Ph.D Thesis, University of Nigeria Nsukka. 41-104.

[3] Mananu, P.C. (1975) *Temperature and sunrise. In: Nigeria in Maps:* Eastern State. Ed. Ofomata, C.E.K. Benin City. Ethiope Publishing House 32-46

[4] Uguru I. Michael (2011). Culled from the Daily Sun, Monday July 25, 2011. Page 33

[5] M.O.A. Enugu (1993). *A survey on Enugu state climatic conditions project; department of environmental science.* University of Nigeria

[6] Nwabueze, M.O (1991). *The Economics of Dry Season Vegetable Production in Enugu Agricultural Zone of Enugu State, Nigeria*. unpublished M.sc thesis-department of Agricultural Economics, University of Nigeria, Nsukka

[7] Phu NT (1997). *Nitrogen and potassium effect on cucumber yield*. AVI 1996 report, ARC/AVRDC Training Thailand.

[8] Waaijenburg, H. (1981): *vegetable gardening in the tropics*. Technical centre for agriculture and rural co-operation, CTA, Agrodok 9.