Evaluation of Organic and Inorganic Fertilizers on the Yield and Yield Components of Cucumber under different Irrigation Regimes and Cropping Seasons

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Abstract: ***Organic manure (OM) and inorganic fertilizer (NPK) were evaluated on the yield and yield components of cucumber under different irrigation regimes and cropping seasons at Isampou, Bayelsa State, Nigeria. The experimental design was split plot fitted into randomized complete blocks. Irrigation regimes (20,000; 25,000 and 30,000 l ha^{-1} day occupied the main plots while PM5t + ha^{-1} + NPK 200 kg ha^{-1}) were assigned sub-plots. These treatments were replicated four times culminating into 12 treatment combinations. Irrigation rates did not seem to have significant relative effect on growth and yield of cucumber across the cropping periods. Cucumber vines generally were longest in OM treated plots in all water levels. In the second planting OM treated plots at 20,000; 25,000 and 30,000l ha^{-1}day produced the longest vines. But NPK + OM had the longest vine for the second and third plantings. NPK + OM amended plots consistently produced the highest cucumber fruit yieldat 25,000 and 30,000 l ha^{-1} water levels (5.59 and 5.74tha^{-1}) during the first cropping period. While control plots consistently produced the lowest cucumber fruit yield for the first, second and third cropping period respectively (3.81, 4.41 and 3.98tha^{-1})***

Keywords: Cucumber, Poultry Manure, NPK, Water Levels, Cropping Periods

1. Introduction

Cucumber (*Cucumis sativa L.)* which is one of the monoecious annual crops of the cool climates belongs to the Cucurbitaceae family comprising of 70 genera and 750 species. (Thao, 1998; Best, 2000). According to Shetly and Wehner (2002a), the fruit of cucumber, which is soft and succulent is consumed raw (salad) or cooked with other vegetables.

The nutritional composition of cucumber fruit per 100g edible portion is carbohydrate (3%), protein (1%) total fat (0.5%) and dietary fiber (1%). (USDA, Nutritional Nutrient Data Base 2014). The fruit is a veritable source of vitamins such as magnesium, potassium, manganese, phosphorus, calcium and zinc as well as a number of Phyto-nutrient. (Carotene-B, Xanthein – B and Lutein) which add and enrich the diets of the people living in the tropical regions (Vimale*et al*. 1999). The crop is grown worldwide and according to Tatlioglu (1993) and ranks fourth in the list of economic vegetables in Asia after tomato and cabbage and onion. The level of agricultural productivity in the humid zone greatly depends on these two critical factors – rainfall and solar energy (Dalahaut and Newenhouse 1998).

Integrated nutrient use has assumed great significance in recent years in vegetable production for two reasons. Firstly, the need for continued increase in per hectare yields of vegetables requires that applications of nutrients increase. Not enough chemical fertilizers is available in many developing countries to meet crop nutrient requirements. Secondly, the results of a large number of experiments on manures and fertilizers conducted in several countries revealed that neither chemical fertilizers alone, nor organic sources used exclusively can sustain the productivity of the soils under highly intensive cropping systems. (Singh and Yadav, 1992; Holimer (1998) and Truggelmann (2000).

Our agriculture especially in the South of Nigeria is rain fed. This means that our agricultural activities depend on natural precipitation. Normally, between the months of November through March there is generally dry spell in Nigeria. Proper water management is one of the most crucial factors for successful cucumber production since most varieties are in general; very sensitive to any kind of water stress, either to drought or to water logging. Regulation of water application for crop production is therefore essential in order to strike a balance between increased production on one hand, and soil moisture potential, surface run off and soil loss on the other hand.

This study was therefore aimed at determining the effect of irrigation regimes and evaluating the effect of organic and in-organic fertilizers on growth and yield of cucumber.

2. Materials and Methods

Study Area and Experimental Details

The study was conducted in Isampou area of Ekeremor Local Government Area of Bayelsa State, Nigeria. Bayelsa State is dissected centrally by longitude 60^{o} East and latitude 40^{o} North. The mean annual rainfall is variable but ranges between 2,000 to 2,703mm (FARD, 1981; FAO 1984) and spread over 8 months of the year between the months of March and November, which coincide with wet season.

The annual temperature ranges from an average minimum of 21.5°C to an average maximum of 31.0°C. (FARD, 1981).

Treatments

Factors A: Three Water Regimes:
1) 20,000 l ha^{-1} day
2) 25,000 l ha^{-1} day
3) 30,000 l ha^{-1} day

Factor B. Organic Amendments
1) Control
2) NPK fertilizers alone (200$kgha^{-1}$)
3) Poultry manure alone (5 tha^{-1})
4) NPK fertilizers (200$kgha^{-1}$) + Poultry manure (5tha^{-1})

Soil Sampling and Analysis

A composite soil samples at the depths of 0-15cm and 15-30cm was taken randomly from selected points within each of the experimental site before and after cropping. These were air dried; passed through a 2mm sieve and analyzed for particles sizes; pH, total N, available P, organic matter, exchangeable K, respectively. All soil analysis were done according to procedures outlined by Tel and Rao (1982). The soil PH was done using the method described by Almu and Audu (2001).

Total N was determined by the semi-micro Kjeldahl digestion method as modified by Tel and Rao (1982), while available P was determined by the Bray and Kurtz No. 1 method (Tel and Rao, 1982). Exchangeable K was extracted with neutral normal ammonium acetate buffered at PH 7.0 potassium (K). In the extract was measured by flame Photo-meter (Tel and Rao, 1982). Organic carbon (c) was extrapolated from organic c by multiplying its value with van Bemmeller constant of 1.72 (Allison, 1982).

Data Collected

Growth Parameters: Vine length was measured at 14,21,28,35 and 42 DAP (cm) respectively.

Yield and Yield Components
Fruit length, and girth and fruit weight ha^{-1} were determined. Cucumber fruits were harvested and weighed fresh twice weekly for first month beginning from the 10th WAP. Summation of these yields will give the total yields.

Experimental Design
A split plot design fitted into Randomized Complete Blocks (RCB) was used. Irrigation regimes (20,000, 25,000 and 30,000 ha^{-1}day occupied the main plots while soil amendments (poultry manure PM 5 t ha^{-1}) were assigned sub plots. These treatments were replicated four times culminating into 12 treatment combinations.

Data Analysis
Data from the experiment were subjected to analysis of variance (ANOVA). Observable differences amongst treatment means were separated using Duncan Multiple Range Test (DMRT) according to the procedure of statistical Analysis Systems (SAS) (1999).

3. Results and Discussion

Soil Physico-chemical properties of the experimental plots.Composite soil samples at the depths of 0-15cm and 15-30cm were taken randomly from selected points within each of the experimental site before cropping. Results obtained from the soil analysis are presented in Table 1.

The soils were generally very strongly acidic with pH of 4.20 at the top horizon while the sub-surface pH was 4.22. Soil analysis results indicated that textural class in the experimental site was silt loam irrespective of horizon.

Values of organic matter, % total N. Available P, and potassium in the experimental site were 4.20, 0.93, 0.02, 10.51 and 0.18 respectively.

While corresponding values at the sub surface horizon were 4.22, 0.90, 0.01, 9.06 and 0.11 for organic matter % total N, available P (mg kg^{-1}) and potassium (c*mol kg*$^{-1}$) respectively.

Table 1: Chemical properties of soils of the experimental area before the cropping period

	Soil pH		Organic matter (%)		% total N		Available P(mg kg^{-1})		Potassium (cmol kg^{-1})		Textural class	
	0-15cm	15-30cm	0-15cm	15-30cm	0-15cm	15-30cm	0-15cm	15-30cm	0-15cm	15-30cm	0-15cm	15-30cm
Initial	4.20	4.22	0.93	0.90	0.02	0.01	10.51	9.06	0.18	0.111	Silt loam	Silt loam

4. Growth Parameters

Cucumber Vine Length (cm).
Influence of organic and inorganic fertilizer and their combinations on cucumber vine length for the various treatments varied significantly (P<0.05), (Figs:1a, b & c).

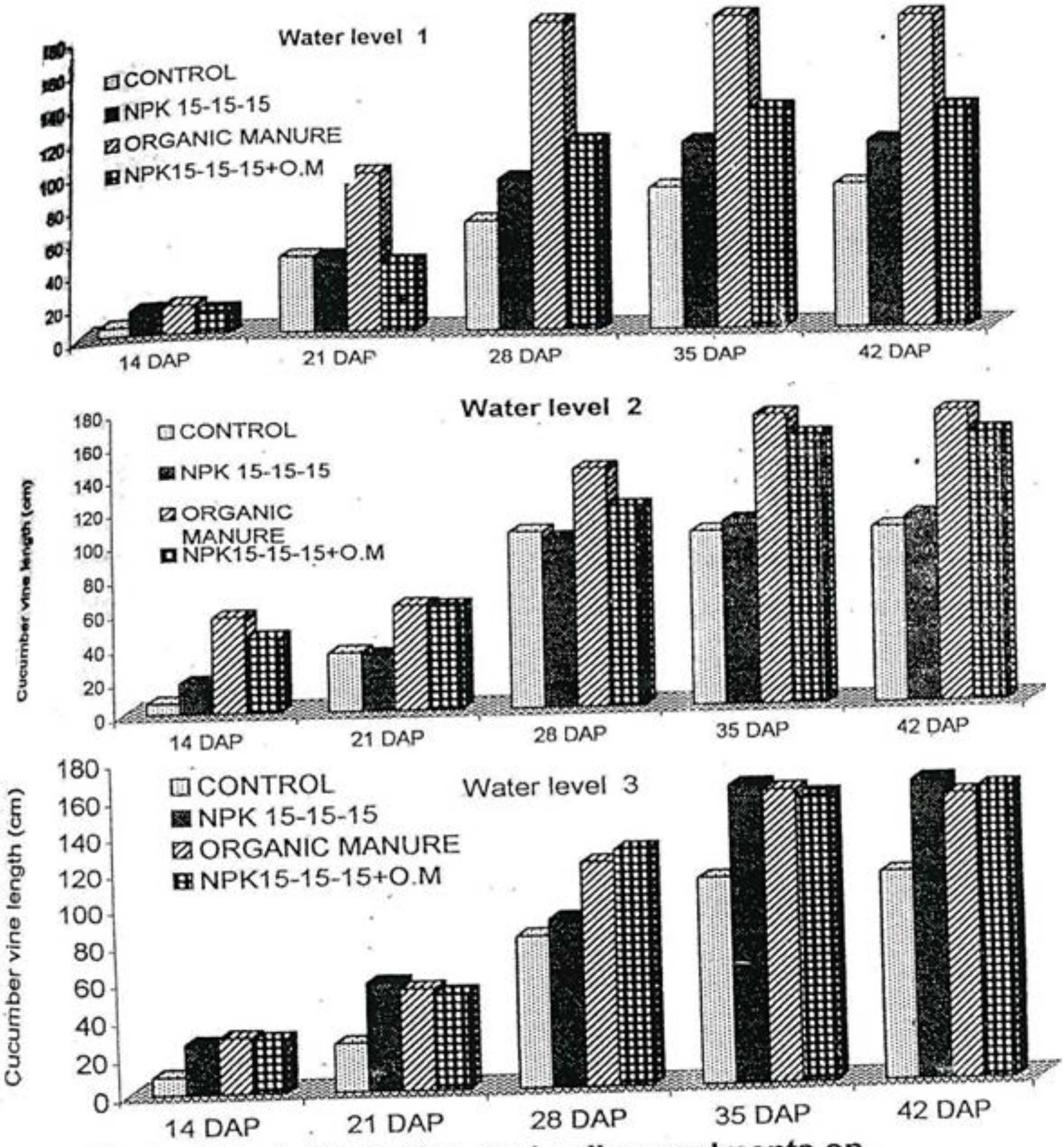
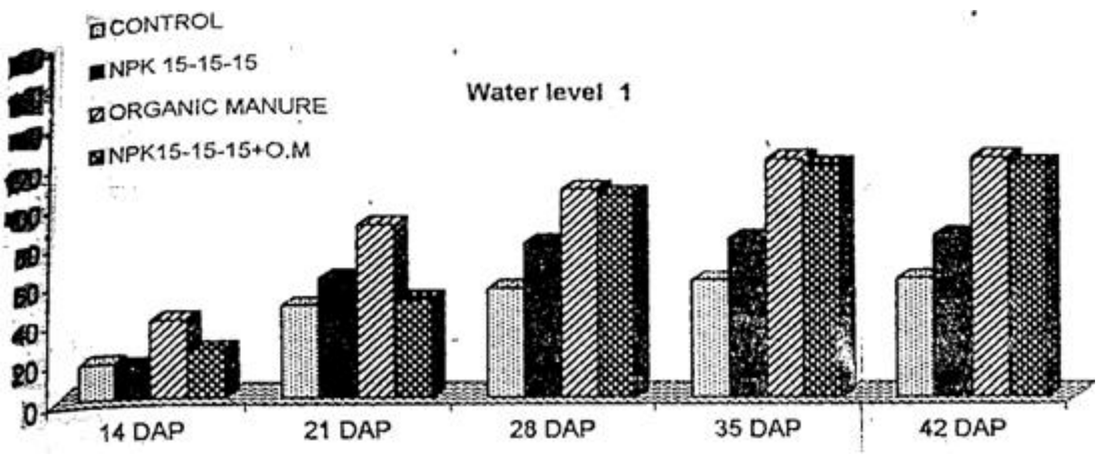


Fig 1a:Effect of irrigation and soil amendments on Cucumber vine length at three water levels during year 1



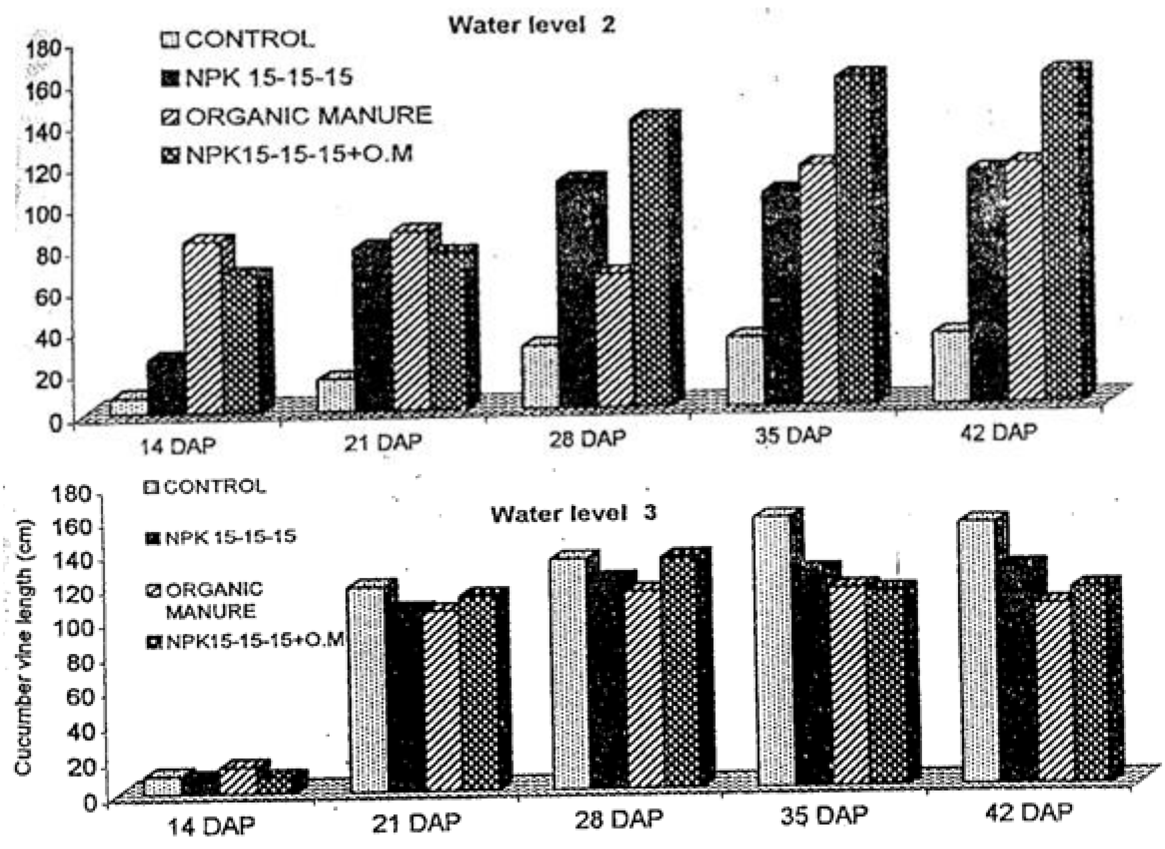
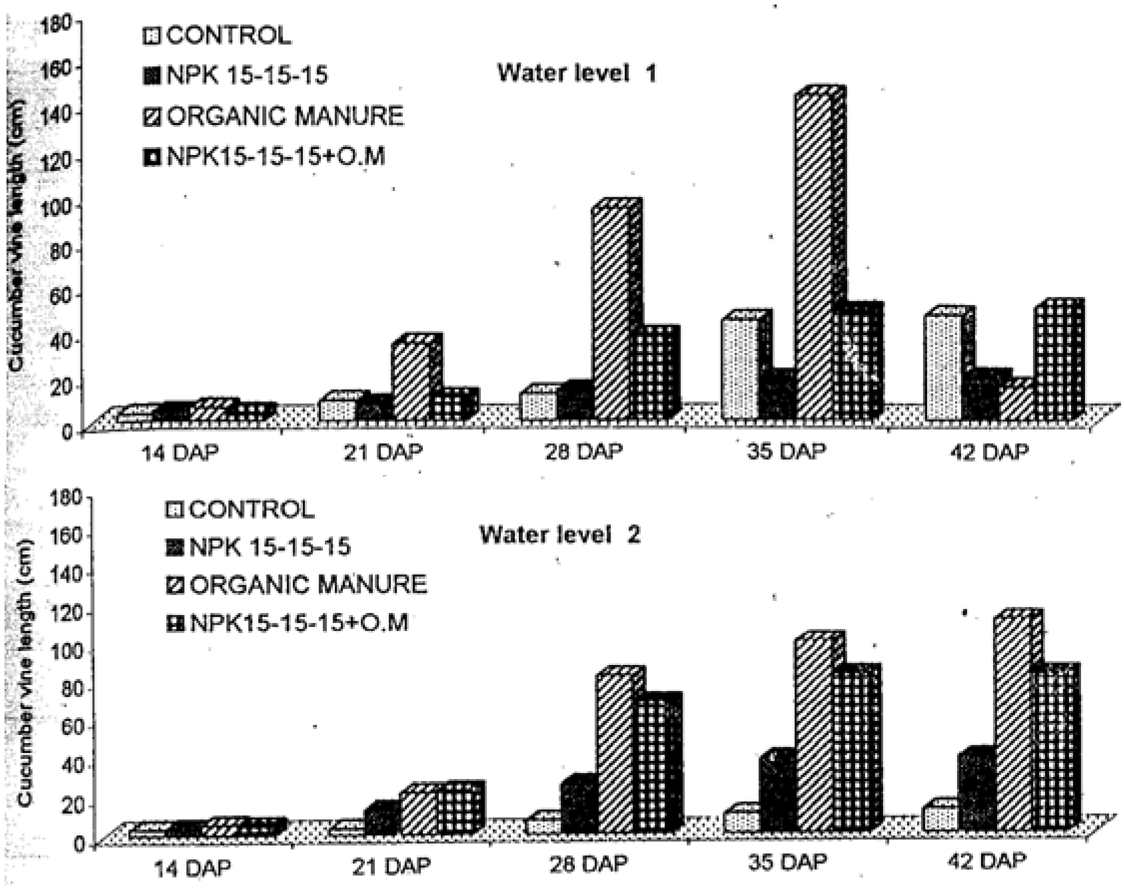


Fig 1b:Effect of irrigation and soil amendments on Cucumber vine length at three water levels during year 2



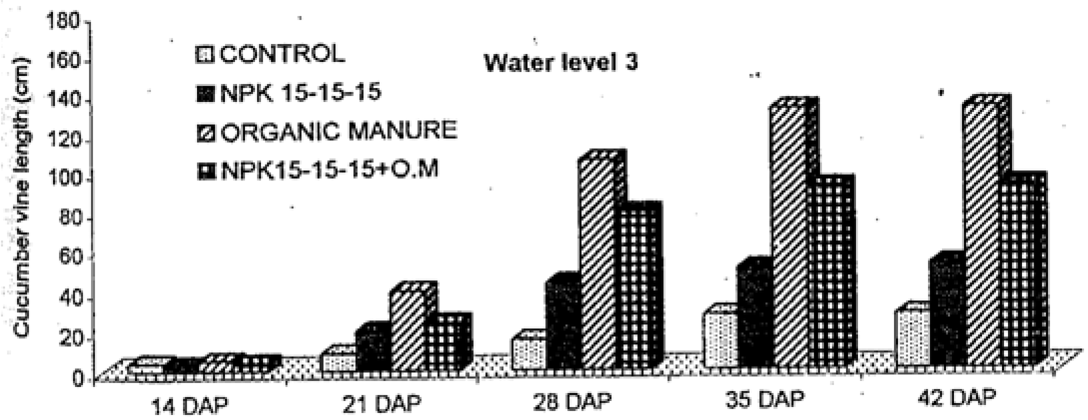


Fig 1c:Effect of irrigation and soil amendments on Cucumber vine length at three water levels during year 3

The addition of organic manure (OM) consistently produced the longest cucumber vines at 14, 21, 28, 35 and 42 (DAP) (16.8, 92.57, 177.25, 202.10 and 203.10cm respectively).

At the first cropping period and at the first water level, cucumber vine length increased from 14 DAP and attained its plateau at 35 DAP, though growth between 35 DAP and 42 DAP was relatively very minimal. This trend was repeated in the second and third water levels for all the different cropping periods. This was followed closely by NPK + OM (83.66) and NPK (72.75cm). Control plot produced the shortest cucumber vine length of (55.0cm).

Considering cucumber vine length at the second cropping period and at 14 DAP cucumber vine length varied highly. Cucumber vines were longest in organic manure plots (29.16cm), but shortest in control plots (9.10cm).

This result agreed with the study by Greulach (1973) which states that if plant growth is plotted on a Cartesian (Linear) graph against time and shaped or sigmoid growth curve usually results. The curve shows two most important points of change in growth rate that is the point of inflection which indicates a sudden sport in vegetative growth and deflection represents the slowing down, of vegetative growth and initiative of reproductive phase.

Generally, organic manure treated plots gave the highest cucumber vine length. This was followed closely by NPK + OM and NPK. Dainello (2005) explained that the application of OM to vine crops favours the micro-climate for plant root growth. This in turn results in improved growth and quality yield. Control plot produced the shortest cucumber vine length.

For 21 and 35 DAP cucumber vine length was longest in NPK, OM, and NPK + OM plots, while the least cucumber vine length was recorded for control. At 42 DAP, NPK produced the highest cucumber vine length, but least cucumber vine length was obtained for control. Cucumber vine length in NPK, OM and NPK + OM plots were similar but highest in OM plots, while these were closely followed by the control plot.

At the third water level at 14 DAP cucumber vine length was highest in OM plots. This was followed closely by NPK + OM. But the least cucumber vine length was at control plot while additions of OM and NPK + OM during 21 DAPand 35 DAP produced similar but highest cucumber vine length respectively.Plant growth from both OM and fertilizer can be equally effective. The breakdown of organic materials to form inorganic compounds by microorganisms is identical to those in many commercial fertilizers. Plants are not able to determine a difference in the original source of the compounds they absorb. Extra growth often is a response to better root environments and action of soil organisms working on the organic matter. The water requirement of most species is high due to the rapid growth rate and the large leaf surface. Crop growth rate is affected by a range of factors including temperature, radiation levels, water and nutrient supply and the type and age of the plant. These factors affect the size and efficiency of leaf canopy and hence the ability of the crop to convert solar energy into useful products.Crop growth is a function of soil water and yield is a function of growth. (Majumdar,2006). When water is not limiting, crop growth and yield are a function of nutrient supply in soils provided other production functions are not limited and optimum.

During 35 and 42 DAP NPK + OM produced the highest vine length respectively while the least vine length was in control plots. A large number of experiments on manures and fertilizers conducted in several countries revealed that neither chemical fertilizers alone, nor organic sources used exclusively, can sustain the productivity of soils under highly intensive cropping systems (Sing and Yadav, 1992). Addition of OM produced the highest vine length of first, second and third water level respectively. Majumdar (2006) study observed that when rainfall in an area is the crop response to fertilizer application depends on irrigation water. Again, with increasing supply of water, crop yields go on increasing on application of fertilizers. The presence of adequate water in the soil increases the fertilizer use efficiency. The control plots consistently produced the least cucumber vine length.

5. Yield and Yield Components

Cucumber Fruits Yield Due to Date of Harvest (t ha^{-1}).

Cucumber fruit yield increased from the first up to the third harvest (56 DAP) and gradually reduced. (Fig. 1a, b and c).

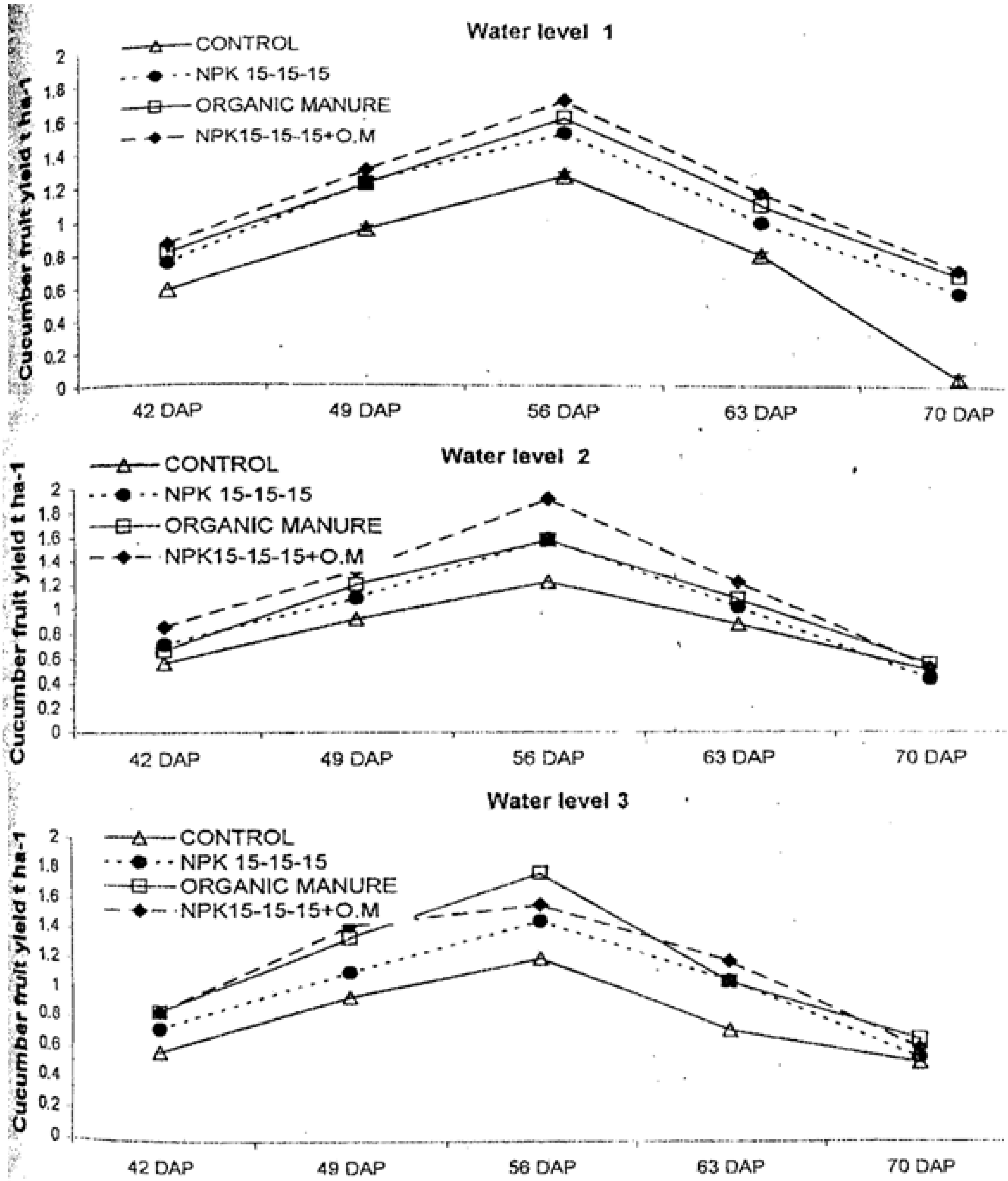


Fig 1. a:Effect of irrigation and soil amendments on Cucumber fruit yield at three water levels during year 1

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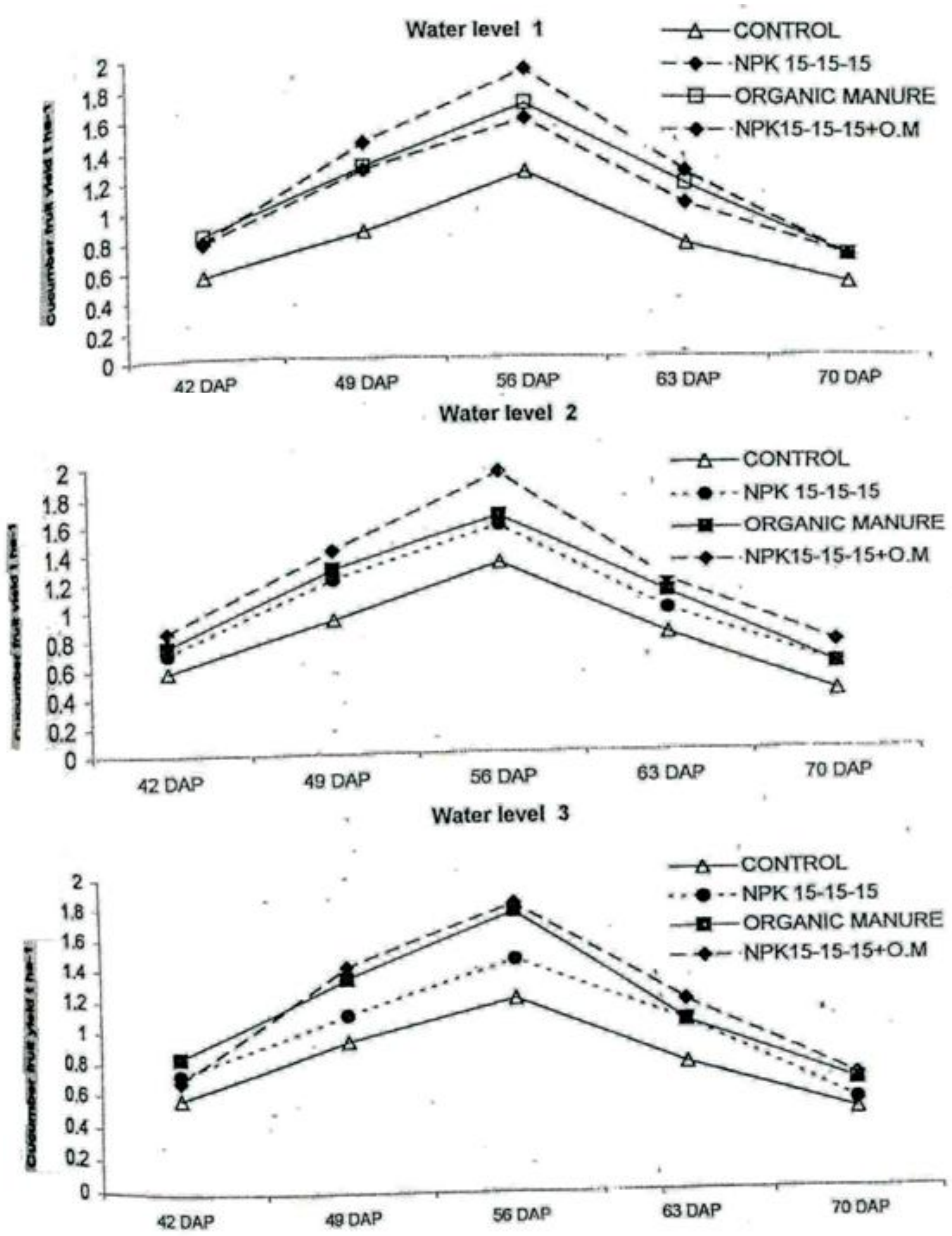


Fig 1.b:Effect of irrigation and soil amendments on Cucumber fruit yield at three water levels during year 2

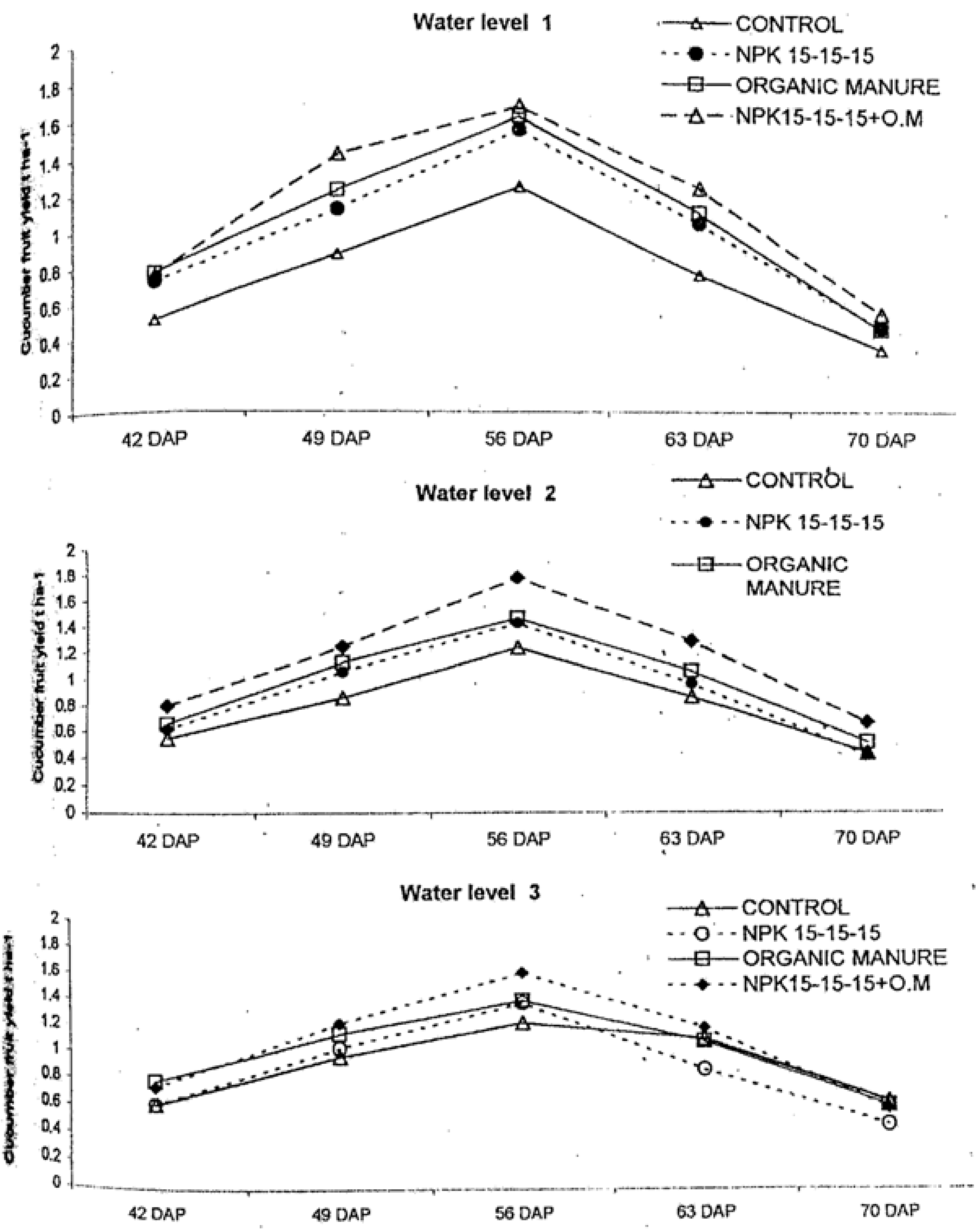


Fig 1.c:Effect of irrigation and soil amendments on Cucumber fruit yield at three water levels during year 3

Yields reduced from first, second and third cropping periods in that order. Cucumber fruits yield was highest at 56 DAP. This was closely followed by harvest at 49 DAP. While the lowest fruits yield was obtained during harvest at 42 DAP considering the different treatment effects. Treatment NPK + OM consistently recorded the highest fruit yield.This was to closely follow by OM plots, while the lowest fruit yield was obtained from control plots. This trend persisted for all three water levels, the first, the second and third cropping periods.

During the first cropping the first cropping period cucumber fruit yield was consistently higher at plots that had NPK + OM for secondand third water levels. This view was corroborated by Homer (1998) and Truggelman*et al*, (2000) that the best yield and quality results for vegetable production are obtained when a combination of organic and inorganic fertilizers are applied. Baldwin (2001) explained that this could be because of increased microbial population and activity which facilitates movements of nutrients from the nitrogen pool into available form for crop uptake. While George *et all*, (1999) and Boyham*et al*, (1999) implied this obvious better performance of OM to its ability to breakdown. It releases nutrients that crop can utilize and improve water holding capacity of the soil. However, Agboola and Oduyemi (1972) disagreed while stating that application of nitrogen fertilizer alone with OM did not result in any significant yield advantage. While plots that had OM obtained the highest cucumber fruit yield at the first water level, the control plots produced the lowest cucumber fruit yield consistently for all the water levels.

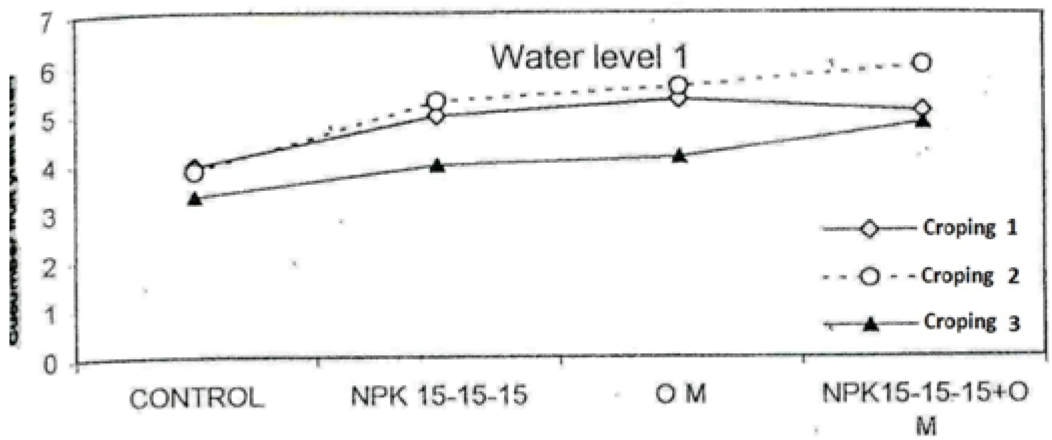
At the second cropping period, NPK + OM incorporated plots obtained the highest cucumber fruit yields for the first, second and third water levels respectively. Because crop vegetation and reproductive stages overlap and because plants need nutrients even up to fruit ripening, use of slow release N fertilizers and integrated use of fertilizers and organic sources of nutrients have proved very effective in increasing nutrient use effectively and crop productivity and reducing nutrient losses. These were generally closely followed by plots that received OM. Control plots had the lowest cucumber fruit yield for the first, second and third cropping period respectively.

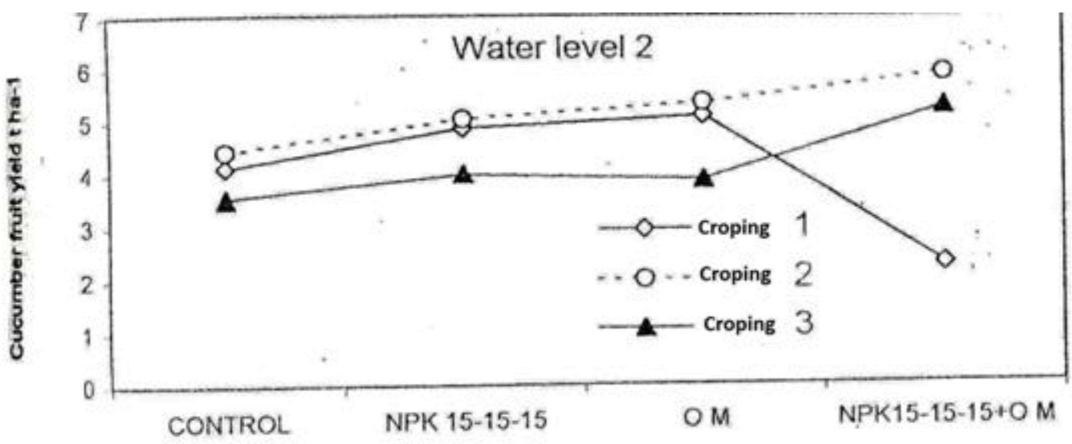
Considering the third cropping generally NPK + OM plots had the highest fruit yield for the first, second and third water levels respectively. However, for the third water levels, cucumber fruit yield recorded for OM plots was at par with those obtained for NPK + OM plots.

Cumulative Cucumber Fruit Yield (tha^{-1})

Fig. 2 shows cucumber fruit yield for the first, second and third cropping periods respectively. During the first cropping period cucumber fruit yield was consistently and significantly (<0.05) higher at plots that had NPK + OM for second and third water levels (5.59 and 5.74tha^{-1}). While plots that had OM obtained the highest cucumber fruit yield as the first water level (5.29tha^{-1}). The control plots produced the lowest cucumber fruit yield consistently for all the water levels 3.92, 4.1 and 4.11tha^{-1}).

At the second cropping, NPK + OM incorporated plots obtained the highest cucumber fruits yields (5.96, 5.88 and 5.99tha^{-1}) for the first, second and third water levels respectively. These were generally closely followed by plots that had OM. Control plots had the lowest cucumber fruit yield (3.81, 4.41 and 3.98tha^{-1}) for the first, second and third cropping period respectively.





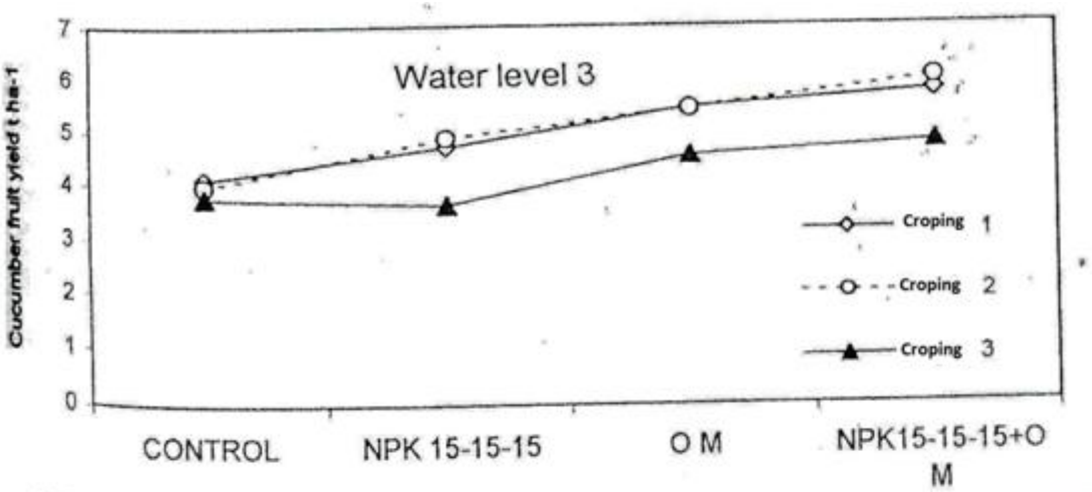


Fig.2:Effect of irrigation and soil amendments on cucumber fruit yield at three water levels

Considering the third cropping, generally NPK + OM plots had the highest cucumber fruits yield (4.73, 5.26 and 4.7tha^{-1}) for the first, second and third water levels respectively. However, for the third water levels cucumber fruit yield recorded for O.M (4.52 t ha^{-1}) was at par with those obtained for NPK + OM (4.77t ha^{-1}).

Cucumber Fruit length (cm)

The cucumber fruit length was recorded at 42, 49, 56, 63 and 70 days after planting and is tabulated in table 2a, b & c. It can be observed that all treatments had a positive effect on cucumber fruit length except at 48 and 70 DAP and at the third water level.

Table 2 a: Effect of irrigation and soil amendment applications on cucumber fruit length during first cropping (cm)

	42 DAP	49 DAP	56 DAP	63 DAP	70 DAP	Overall Mean
Irrigation rate 20,000 l ha^{-1} day^{-1}						
CONTROL	9.33^{*d}	14.92^{d}	18.65^{a}	18.00^{b}	17.00^{d}	17.50^{b}
NPK	10.12^{c}	15.00^{c}	18.40^{a}	17.33^{a}	17.85^{c}	15.74^{ab}
OM	11.33^{a}	19.67^{a}	18.50^{a}	13.50^{d}	19.01^{a}	16.40^{a}
NPK+OM	10.83^{b}	17.85^{b}	17.87^{a}	15.50^{c}	18.90^{b}	16.19^{a}
Overall Mean	10.40^{c}	16.33^{b}	18.19^{b}	15.83^{a}	18.32^{a}	
Irrigation rate 25,000 l ha^{-1} day^{-1}						
CONTROL	8.70^{d}	9.21^{d}	15.65^{b}	13.21^{d}	9.10^{d}	11.17
NPK	15.67^{a}	18.18^{b}	15.23^{c}	17.10^{b}	17.00^{b}	16.64
OM	10.50^{c}	19.33^{a}	17.18^{a}	17.33^{a}	15.70^{c}	16.00
NPK+OM	10.92^{c}	18.15^{c}	17.18^{a}	14.20^{c}	19.75^{a}	16.04
Overall Mean	19.93^{a}	16.22^{a}	16.31^{a}	15.46^{a}	15.39^{a}	
Irrigation rate 30,000 l ha^{-1} day^{-1}						
CONTROL	8.98^{c}	17.25^{d}	17.00^{d}	15.40^{d}	18.10^{b}	16.57
NPK	7.83^{d}	17.67^{b}	17.33^{c}	16.50^{c}	16.20^{c}	15.04
OM	10.63^{b}	17.43^{c}	18.00^{b}	18.50^{a}	18.20^{a}	16.43
NPK+OM	11.23^{a}	17.25^{d}	20.00^{a}	18.23^{b}	16.10^{a}	15.60
Overall Mean	9.67^{c}	17.05^{a}	17.61^{ab}	17.16^{b}	17.15	

* Denotes Duncan Multiple Range Test (DMRT)

Table 2 b: Effect of irrigation and soil amendment applications on cucumber fruit length during second croppin (cm)

	42 DAP	49 DAP	56 DAP	63 DAP	70 DAP	Overall Mean
Irrigation rate 20,000 l ha^{-1} day^{-1}						
CONTROL	7.15±*^{b}	7.20^{d}	20.15^{b}	15.20^{c}	15.10^{c}	12.96
NPK	6.50±^{bc}	15.2^{c}	18.00^{d}	15.00^{d}	14.90^{d}	13.92
OM	10.00^{a}	16.2^{b}	19.20^{c}	16.21^{b}	16.10^{b}	15.54
NPK+OM	5.30^{c}	17.20^{a}	21.10^{a}	17.80^{a}	17.10^{a}	15.76
Overall Mean	7.24^{d}	13.95^{c}	19.69^{a}	16.05^{b}	15.80^{b}	
Irrigation rate 25,000 l ha^{-1} day^{-1}						
CONTROL	6.70^{d}	7.60^{d}	21.00^{d}	20.40^{c}	19.60^{c}	15.06^{c}
NPK	7.83^{a}	14.51^{c}	24.00^{c}	21.30^{b}	20.40^{b}	11.59^{b}
OM	7.77^{b}	17.20^{b}	27.10^{b}	27.10^{a}	26.20^{a}	21.07^{a}
NPK+OM	7.40^{c}	19.20^{a}	28.60^{a}	18.40^{d}	17.60^{d}	18.24^{b}
Overall Mean	7.43^{d}	14.63^{c}	25.18^{a}	21.78^{b}	20.95^{b}	
Irrigation rate 30,000 l ha^{-1} day^{-1}						
CONTROL	8.40^{a}	10.00^{a}	16.70^{c}	16.20^{b}	5.60	12.68^{a}
NPK	8.50^{a}	17.20^{a}	18.00^{d}	11.00^{c}	5.37	12.01^{a}
OM	7.45^{a}		15.00^{a}	21.00^{d}	4.60	12.01^{a}
NPK+OM	7.57^{a}	18.80^{a}	18.20^{b}	12.90^{a}	6.53	12.40^{a}
Overall Mean	7.98^{c}	15.17^{a}	16.98^{ab}	16.53^{d}	5.53	

Table 2 c: Effect of irrigation and soil amendment applications on cucumber fruit length during third cropping (cm)

	42 DAP	49 DAP	56 DAP	63 DAP	70 DAP	Overall Mean
Irrigation rate 20,000 l ha^{-1} day^{-1}						
CONTROL	11.60*^{a}	15.65^{a}	8.35^{b}	6.34^{c}	14.00^{c}	11.19^{a}
NPK	5.8^{a}	15.30^{a}	13.6^{ab}	10.40^{a}	19.00^{a}	12.82^{a}
OM	11.00^{a}	13.73^{a}	15.10^{ab}	10.00^{a}	14.58^{b}	12.88^{a}
NPK+OM	8.40^{a}	14.10^{a}	17.90^{a}	7.90^{b}	6.20^{a}	10.90^{a}
Overall Mean	9.20^{b}	14.70^{a}	13.74^{a}	8.66^{a}	13.48^{a}	
Irrigation rate 25,000 l ha^{-1} day^{-1}						
CONTROL		**14.13^{a}**	**21.14^{a}**	**8.10^{d}**	8.33^{d}	**14.06^{a}**
NPK	15.33^{a}	12.50^{a}	18.33^{a}	10.10^{a}	9.53^{c}	14.12^{a}
OM	15.77^{a}	13.00^{a}	17.67^{a}	10.53^{c}	10.64^{b}	13.30^{a}
NPK+OM	16.45^{a}	17.14^{a}	15.83^{a}	11.21^{b}	**14.00^{a}**	14.25^{a}
Overall Mean	15.85^{b}	13.91^{c}	18.24^{a}	11.49^{a}	10.66^{d}	
Irrigation rate 30,000 l ha^{-1} day^{-1}						
CONTROL	9.23^{b}	14.10^{a}	18.63	15.50^{a}	15.20^{d}	15.34^{a}
NPK	10.25^{ab}	13.50^{a}	17.00	15.30^{a}	15.32^{c}	14.28^{a}
OM	11.93^{ab}	12.10^{a}	15.87	15.15^{a}	16.20^{b}	14.23^{a}
NPK+OM	13.25^{a}	19.90^{a}	18.50	15.40^{a}	17.80^{a}	16.17^{a}
Overall Mean	11.12^{a}	14.90^{a}	17.50	15.35^{ab}	16.11^{b}	

Slicing cucumbers are graded by fruit diameter, length, shape and colour. BCP (1996) reported that the most desirable fruit length for cucumber is 15 – 22cm with diameter of 4-13cm. Although Rosie and Michael (2001) recommended cucumber to be harvested before seeds become half their size, this he cautioned may vary with cultivar. But the rule of thumb; most cultivars will be 4 to 5cm in diameter and 13-20cm long. At 42 DAP and during the first cropping period, application of OM alone gave the greatest fruit length. This was closely followed by addition of NPK + OM. The shortest cucumber fruits were recorded in control plots. NPK + OM gave the greatest cucumber fruit length. But these values were not higher than values from NPK. Sizes of marketable fruit for slicing cucumber ranged from 15 – 25cm in length and 4 – 6.4cm in diameter. Cucumber should be fresh, crisp, of medium size, well-formed uniform and of deep green colour. Fruits should be picked before they reach full diameter and while the seeds are still soft and small. A light green or yellow skin colour is an indication that the fruit is over mature for marketing.

For the second water level, incorporation of NPK, OM and NPK + OM had statistically similar but greater fruit length respectively than the control. This was in line with the submission of Zuiketly*et al* (2002) who observed no significant difference in growth or yield with organic fertilizer only and organic fertilizer only and organic + inorganic fertilizer application, indicating that organic fertilizer as the sole nutrient source provided sufficient nutrients for early growth and yield of Meng Kudu under rubber.

While considering the third water level, the performance of cucumber fruit length was at its best in OM plots. At the second cropping, treatment only impacted significantly on cucumber fruit length at 49; 56; 64 and 70 DAP during the first water level.

Application of OM and NPK + OM had the highest fruit length at the first water level, while addition of OM recorded the significantly increased fruit length at the second water level.

During the third cropping period at the first water level and at 4-9 DAP control, NPK and NPK + OM recorded the longest fruits respectively. At 56 DAP incorporation of NPK + OM had the longest fruit, but this was similar with values recorded of NPK and OM. Similar results were obtained in a study by Virmala*et al*, (1998) while comparing various organic nutrients sources on yield of lettuce in Cameroon Highlands. He indicated that poultry manure as the sole source of nutrient gave yields equivalent to poultry manure + NPK. But at 63 DAP; NPK and OM application produced the greatest cucumber fruit length.

For the second cropping at 70DAP, control had the highest fruit length while in the third water level and 42 DAP, control produced the longest fruits. But this value was similar to those from NPK and OM. At 56 DAP control, NPK and NPK + OM had similar but highest fruit length. Control and NPK amended plots had the greatest fruit length respectively. This may be explained by Vimale*et al*, (1998) and Diane and Steve (2002). Whose report suggests that OM may not release enough of their principal nutrients, quickly enough to give the plant what it needs for best growth. Because to release nutrients most of them are efficient only when soil is moist and soil temperature is warm enough for the soil organism to be active. The associated low yield from OM could be attributed, in part, to the low nutrient control of the organic manure applied.

Cucumber Fruit Girth (CM)

The results of cucumber fruit girth is shown in Table 3a, b & c.

Table 3 a: Effect of irrigation and soil amendment applications on cucumber fruit girth during first cropping

	42 DAP	49 DAP	56 DAP	63 DAP	70 DAP	Overall Mean
Irrigation rate 20,000 l ha^{-1} day^{-1}						
CONTROL	12.75^{*c}	14.33^{b}	16.00^{v}	14.67^{b}	9.53^{d}	13.86^{a}
NPK	11.65^{d}	13.76^{c}	17.25^{a}	16.00^{a}	12.60^{b}	13.97^{a}
OM	13.43^{b}	17.23^{a}	15.95^{d}	11.27^{d}	14.90^{a}	14.56^{a}
NPK+OM	14.33^{a}	14.50^{b}	16.20^{b}	12.00^{c}	11.50^{c}	13.70^{a}
Overall Mean	13.04^{cd}	15.12^{b}	16.35^{a}	13.49^{c}	12.11^{c}	
Irrigation rate 25,000 l ha^{-1} day^{-1}						
CONTROL	9.60^{d}	10.71^{d}	13.50^{d}	13.20^{c}	13.60^{b}	12.12
NPK	13.95^{b}	15.93^{b}	13.63^{c}	14.00^{a}	14.00^{a}	14.30
OM	12.63^{c}	14.63^{c}	19.00^{a}	13.68^{b}	11.20^{d}	14.23
NPK+OM	14.27^{a}	16.15^{a}	16.69^{a}	9.5^{d}	30.00^{c}	13.90
Overall Mean	14.17^{c}	14.36^{b}	15.71^{a}	12.60^{c}	12.95^{v}	
Irrigation rate 30,000 l ha^{-1} day^{-1}						
CONTROL	10.66^{d}	13.65^{d}	15.13^{b}	12.60^{c}	12.30^{d}	13.55
NPK	11.30^{c}	14.00^{b}	14.13^{c}	13.00^{b}	20.21^{a}	14.53
OM	13.18^{a}	14.00^{c}	13.30^{d}	12.00^{d}	13.11^{c}	13.12
NPK+OM	14.28^{b}	16.37^{a}	15.38^{a}	16.0^{c}	16.11^{b}	14.95
Overall Mean	12.36^{c}	14.51^{ab}	14.49^{ab}	13.40^{bc}	15.43^{a}	

* Denotes Duncan Multiple Range Test (DMRT)

Table 3 b: Effect of irrigation and soil amendment applications on cucumber fruit girth during second cropping

	42 DAP	*49 DAP*	*56 DAP*	*63 DAP*	*70 DAP*	*Overall Mean*
Irrigation rate 20,000 l ha^{-1} day^{-1}						
CONTROL	9.83^{b}	12.26^{b}	20.60^{b}	13.00^{c}	12.20^{b}	14.45^{a}
NPK	7.83^{c}	16.00^{a}	24.10^{a}	12.00^{d}	9.10^{d}	13.83^{a}
OM	13.35^{d}	9.25*c*	14.20^{d}	13.10^{b}	12.00^{c}	12.57^{a}
NPK+OM	6.80^{a}	16.60^{a}	20.10^{c}	16.10^{a}	16.00^{a}	13.86^{a}
Overall Mean	9.00^{c}	13.70	19.78^{a}	13.58^{b}	12.35^{b}	
Irrigation rate 25,000 l ha^{-1} day^{-1}						
CONTROL	4.80^{d}					4.80^{b}
NPK	6.17^{b}	8.00^{b}	22.00^{b}	15.00^{b}	15.10^{b}	13.29^{a}
OM	6.70^{a}	11.0^{a}	26.10^{a}	12.00^{c}	12.00^{c}	13.62^{a}
NPK+OM	5.93^{c}	8.00^{b}	18.10^{c}	18.00^{a}	18.10^{a}	1367^{a}
Overall Mean	5.90^{d}	9.00^{c}	22.10^{a}	15.00^{b}	15.27^{b}	
Irrigation rate 30,000 l ha^{-1} day^{-1}						
CONTROL	6.05^{c}	12.18^{b}	24.00^{b}	20.00^{b}	19.10^{b}	16.29^{b}
NPK	7.30^{a}	16.00^{a}	10.00^{c}	8.00^{d}	8.00^{d}	9.86^{c}
OM	6.15^{b}	16.00^{a}	10.00^{c}	12.00^{c}	11.00^{c}	11.03^{c}
NPK+OM	6.03^{d}	16.60^{a}	28.10^{a}	21.10^{a}	20.00^{a}	18.37^{a}
Overall Mean	6.38^{c}	14.93^{b}	18.05^{a}	15.28^{b}	11.53^{b}	

Table 3 c: Effect of irrigation and soil amendment applications on cucumber fruit girth during third cropping

	42 DAP	*49 DAP*	*56 DAP*	*63 DAP*	*70 DAP*	*Overall Mean*
Irrigation rate 20,000 l ha^{-1} day^{-1}						
CONTROL	0.00*^{a}	7.36^{a}	7.00^{a}	1200^{c}	10.10^{d}	12.94^{ab}
NPK	6.53^{a}	7.53^{a}	19.10^{a}	13.67^{b}	13.10^{a}	14.48^{a}
OM	14.60^{a}	10.0^{a}	16.90^{a}	11.27^{d}	11.10^{c}	14.49^{a}
NPK+OM	7.50^{a}	12.0^{a}	14.00^{a}	16.00^{a}	12.10^{b}	11.50^{b}
Overall Mean	13.78^{a}	13.93^{a}	14.25^{a}	13.24^{a}	11.58^{a}	
Irrigation rate 25,000 l ha^{-1} day^{-1}						
CONTROL	7.00^{c}	16.65^{c}	14.35^{a}	14.20^{c}	14.00^{c}	15.16^{b}
NPK	18.00^{a}	21.00^{a}	15.10^{a}	14.20^{c}	14.10^{b}	16.53^{a}
OM	12.61^{bc}	14.70^{bc}	14.70^{a}	15.60^{b}	15.10^{b}	14.60^{b}
NPK+OM	15.85^{b}	17.30^{b}	17.00^{a}	17.02^{a}	16.20^{a}	16.93^{a}
Overall Mean	15.52^{b}	17.41^{a}	15.49^{b}	15.28	14.97^{b}	
Irrigation rate 30,000 l ha^{-1} day^{-1}						
CONTROL	16.70^{a}	16.57^{a}	18.58^{a}	18.12^{b}	18.00^{b}	17.65^{b}
NPK	18.00^{a}	17.41^{a}	16.65^{a}	16.21^{c}	16.57^{c}	16.68^{c}
OM	15.88^{a}	16.30^{a}	18.20^{a}	18.10^{b}	18.10^{b}	17.35^{b}
NPK+OM	16.80^{a}	18.63^{a}	20.70^{a}	20.10^{a}	20.10^{a}	19.29^{a}
Overall Mean	16.62^{c}	17.25^{b}	18.53^{a}	18.13	18.18^{a}	

At the first cropping under the first water level and at 42DAP application of NPK + OM gave the highest cucumber girth. At 49 and 70 DAP, OM proved superiority in cucumber fruit girth. But for 56, 63 NPK applications alone had the biggest cucumber fruit girth.

At the second water level and at 42 and 49 DAP, NPK + OM had the highest cucumber girth, respectively. But at 56 DAP, OM had the biggest cucumber fruit girth. While at 35 and 70 DAP, NPK had higher cucumber girth. Considering the third water level application, NPK + OM plots had the highest cucumber fruit girth at 42, 49, 56 and 63 DAP respectively. IRRI (1994) had confirmed that best results are obtained only with complementary use of mineral fertilizers and organic manures. Global awareness of the need to use renewable forms of energy had revived the use of organic manures.

Secondary reasons often given for the increased use of organic materials are the need to improve environmental conditions and public health and the need to reduce costs of fertilizing crops (IRRI, 1994). At 56 DAP, NPK + OM has the highest cucumber fruit girth, but at 70 DAP, NPK had the highest fruit girth.

The NPK, OM and NPK + OM treatments had the highest but similar cucumber fruit girth respectively. While for the third water level NPK had the biggest cucumber fruits. But this was similar to those form NPK treated plots. During the first cropping period, at the first water level and under 56 and 63 DAP; NPK applied plots had the highest cucumber fruit girth respectively. The influence of soil organic manure as a nutrient supplier and soil modifier has reported by various workers (Ranganathan*et al*, 1980; Agboola and Fagbenro, 1995).

At the second water level, incorporation of NPK + OM increased cucumber fruit girth for 42, 49 and 56 DAP respectively, but at 56 DAP, NPK + OM did not out yield plots that receive OM alone.

Considering the first cropping period; at first water levels and 42 DAP, NPK incorporation gave the highest cucumber fruit girth. Nitrogen in an organic fertilizer is slow in becoming available to plant use because the organic nitrogen must be reduced by micro-organisms to ammonium (NH_4) and nitrate ($N0_3$). Thus inorganic fertilizers are ‘fast’ while organic fertilizers tend to take more time to release (Morgan 2005).

A main advantage of organic fertilizer is that nitrogen becomes available to plant gradually over the course of the growing period. This slow release effect is important because nutrients become available on a continual basis and the likelihood of fertilizer burn is reduced or eliminated. But Janet (2007) cautioned however that a third to a half of the nitrogen in manure is in the ammonium or urea forms and can easily be lost as ammonia gas when left on the surface.

For 49 DAP; NPK, OM and NPK + OM had similar but highest cucumber fruit girth as compared with those of control.
While for 56, 63 and 70 DAP, NPK + OM increased cucumber fruit girth respectively. Considering the second water level, NPK produced the biggest cucumber fruits at 42 and 49 DAP respectively, while NPK + OM had the biggest cucumber fruits at 63 and 70 DAP respectively.

For the third water level and at 63 and 70 DAP application of NPK + OM increased cucumber fruit girth respectively. OM had the highest cucumber fruit girth at the first water level. But at the second water level NPK and NPK + OM had the biggest cucumber fruits respectively.

Applying organic fertilizers to the soil does not necessarily always benefit the crop. Under poorly drained conditions, applied OM may intensify the reduced condition of the soil to induce oxygen deficiency in the root area of the crop or cause toxic gas to form which as a harmful effect on the crop.

While at the third water level NPK + OM had the highest cucumber fruit girth. At the first cropping period, at the first water level and at 77 DAP, NPK, OM and NPK + OM gave similar but highest fruit yield respectively. This trend was repeated at the second water level and at 77 DAPS.

6. Conclusion and Recommendation

Farming practice in Isampou and infact in most of the Niger Delta environment in Nigeria is basically rain-fed. This study showed that water could be harnessed from a river during the dry season to irrigate the farmland and produce crops. For obvious reasons this study did not compare irrigation versus non-irrigation since it is not possible to carry out any farming activities in Isampou during the dry season without irrigation. For this reason, the non-irrigation control was not included among the treatment.

A comparison of irrigation rates of 20,000, 25,000 and 30,000 tha^{-1} however, did not show any significant effect consistently throughout this study. We therefore conclude that though irrigation is a must for any farming activity to be carried out at Isampou during the dry season, water level exceeding 20,000 lha^{-1} may not be necessary. It is therefore recommended that further studies be conducted with water levels less than 20,000 lha^{-1}.

The application of organic and inorganic fertilizers led to greater yields of cucumber when compared with the application of either poultry manure or NPK alone.

This research suggests that Isampou holds promise for cucumber cultivation in the Niger Delta zones of Nigeria.

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