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Assessment of Farmer's Technologies on Integrated Fish Farming and Non - Integrated Fish Farming in Ogun State, Nigeria

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Abstract - The study assessed farmers' technologies on integrated and non integrated fish farming in Ogun State Nigeria. Multi stage Random sampling techniques was used to select 133 non - integrated fish farmers (NIFF) and 216 integrated fish farmers (IFF) (n = 349) from the study area. Data were analysed using chi-square, T-test and Pearson Product moment correlation. Results showed that 92.5% of NIFF were male compared to IFF (90.7%). Also, 96.8% of IFF and 79.7% of NIFF were married. The mean ages of sampled farmers were 44 years (NIFF) and 46 years (IFF) while the mean fish farming experiences were 4 years (NIFF) and 5 years (IFF). More so, 99.1% of IFF identified pond site selection as one of the key technologies used in integrated fish farming compared to 95.5% recorded for NIFF.

Keywords : Assessment, Technologies and Integration.

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ASSESSMENT OF FARMERS TECHNOLOGIES ON INTEGRATED FISH FARMING AND NON INTEGRATED FISH FARMING IN OGUN STATE, NIGERIA

Strictly as per the compliance and regulations of:

Assessment of Farmer's Technologies on Integrated Fish Farming and Non – Integrated Fish Farming in Ogun State, Nigeria

Abiona, B. G. [α], Fakoya, E.O. [σ], Apantaku, S.O. [ρ], Alegbeleye, W. O. [Ѡ], Ajayi, M. T. [¥], Obasa, S.O. [§], & Arowolo, k. [χ]

Abstract - The study assessed farmers' technologies on integrated and non integrated fish farming in Ogun State Nigeria. Multi stage Random sampling techniques was used to select **133** non - integrated fish farmers **(NIFF)** and **216** integrated fish farmers **(IFF)** **(n = 349)** from the study area. Data were analysed using chi-square, T-test and Pearson Product moment correlation. Results showed that **92.5%** of **NIFF** were male compared to **IFF (90.7%).** Also, **96.8%** of **IFF** and **79.7%** of **NIFF** were married. The mean ages of sampled farmers were **44** years **(NIFF)** and **46** years **(IFF)** while the mean fish farming experiences were **4** years **(NIFF)** and **5** years **(IFF).** More so, **99.1%** of **IFF** identified pond site selection as one of the key technologies used in integrated fish farming compared to **95.5%** recorded for **NIFF.** The chi-square analyses showed that knowledge of fish farming had significant association with respondents sex **(χ^2 = 9.44, df = 2, p < 0.05),** marital status **(χ^2 = 23.2, df = 4, p < 0.05),** occupation **(χ^2 = 25.5, df = 8, p < 0.05),** interaction with friend and relatives **(χ^2= 14.0, df = 2, p < 0.05),** radio/television **(χ^2 = 21.7, df = 2, p < 0.05)** and internet usage **(χ^2 = 6.40, df = 2, p < 0.05).** Bivariate correlation analyses showed significant relationship between farmers knowledge and age **(r = 0.20, p < 0.05),** fish farming experience **(r = 0.17, p < 0.05),** Significant differences exist between integrated and non - integrated fish farming, sources of information **(t = 40.1, χ = 48.09, p < 0.05)** and knowledge of fish farming **(t = 21.5, χ = 43.01, p < 0.05).**

Keywords : Assessment, Technologies and Integration.

I. Introduction

In Nigeria, Integrated fish farming has been reported in many states of the federation in which 50% of fish farmers integrate, poultry, piggery or livestock with fish production, while integrated fish cum crop production is on the rise also in several states (AIFP, 2005). According to Asala (1994) the essence of integrated system is productivity of fish as to meet the challenges of food shortage and reducing the unemployment rate in Nigeria. Socio-economic conditions should be considered when developing integrated fish- farming systems. The development of a diversified economy depends on the harmonious interactions between socio-economic conditions, agricultural productions and regional environmental conditions (Huazhu and Boatang, 1989). In any part of the country, the type and level of integration depends on the prevalent environmental conditions, social norms, cultural values and religious factors (Ayinla, 2003). For example in the northern part of the country, fish cum pig integration is not advisable because of religions factors. The agricultural enterprise to be combined and their level of intensity determine the type of integration fish culture can be extensive, semi-intensive or intensive. The semi-intensive earthen pond fish culture is the most suitable integrated aquaculture system because of the natural ecosystem that can conveniently accommodate both crop and livestock production (Ayinla, 2003). Apart from market forces, demands for agricultural products should be put into consideration before establishing any integrated farming enterprise in any area (Pullin and Shehadeh, 1980). As such, this study seeks to assess various technologies in integrated and non integrated fish farming in Ogun State, Nigeria.

II. Objectives of the Study

1. Identify various technologies available in integrated and non – integrated fish farming in Study area.
2. Describes the socio economic factors of the respondents in the study area
3. Ascertain farmers sources of information in the study area
4. Assess farmers' knowledge of fish farming technologies in the study area.

Hypotheses tested :

HO_1 : There is no significant relationship between socio economic characteristics of the respondents and their knowledge of fish farming.

HO_2 : There is no significant difference between integrated and non - integrated fish farming as regards constraints, sources of information and knowledge of fish farming.

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III. Methodology

This study was carried out in Ogun State (Figure 2). The state came into being in February, 1976. Ogun Sate is bounded in the West by Republic of Benin, in the South by Lagos state and Atlantic Ocean, in the North by both Oyo and Osun states, and in the East by Ondo state (Ogun State of Nigeria, 1998).

It lies within latitudes 7^{o01} N and 7^{o18}N and longitudes 2^{o45}E and 5^{o55}E (Oyesiku, 1992). The state is situated within the tropics covering 16,409.29 square kilometers with a population of about 4,054,272(National Population Commission 2006).

Multistage and simple random sampling (SRS) technique was used in this study. The first stage involved selection of all Ogun State Agricultural Development Programme (ADP) operational zones (Abeokuta, Ilaro, Ijebu-ode and Ikenne). Fifty percent (50%) of the blocks was selected which is equivalent to two and three blocks respectively from each of the zone. Furthermore, sixty percent (60%) of the cells in each of the selected blocks were also selected which amounted to 13, 9, 9 and 8 making a total of 39 extension cells. Thereafter, 56% of registered fish farmers were selected from the chosen cells. Thus 349 respondents were interviewed for the study.

The data for the study were obtained with the aid of a well structured interview guide. The interview was structured into sections to generated information about socio economic characteristics of the respondents and areas where their knowledge was assessed. Farmers knowledge was assessed using the following scale: Very well (3), Fairly well (2), Have idea(1) and not at all(0). Sources of information was measured using Yes(1) and No(2). Descriptive and inferential statistics were used for data analysis. T-test was also used to compare the means among the categories of farmers.

IV. Results and Discussion

Table 1 shows the mean age of the respondents between the two categories of fish farming (Non - integrated fish farming and integrated fish farming) to be 44, and 46 years, indicating that majority of the respondents were within economically active age category (FAO, 1997; Yunusa, 1999). In support of this result, Fakoya and Daramola (2005) observed that respondents within this age bracket are more innovative, motivated and adaptable individuals who can with wisdom cope with farming challenges. Respondents in the age bracket 40 – 50 years are more involved in integrated fish farming (38.0 percent) while non - integrated fish farming recorded (NIFF) 36.1 percent. The percentage range between the two categories under study is a pointer to the fact that much commitment either in terms of finances or experience is needed to cope with farm operations especially with integrated fish farming (IFF) with multiple enterprises which recorded the highest value (38.0 percent). The age bracket 30-40 years is another important age category with strength for mobility to tackle some of the task on the farm. In this age bracket, integrated fish farmers (IFF) dominated with 27.8 percent compared to non - integrated fish farmers (NIFF) (19.5 percent). It could be recalled that, the above age category are youth who have the capacity to explore and withstand farm stress. However, this may be one of the reasons why those who are into integrated fish farming dominated this age category. Financial requirements of the farm operations in all categories may also be the reason for lower values recorded for other age groups (< 30, 30-40, 50-60 and >60 years) as compared to age 40-50 group.

Table 1: Distribution of respondents by their socio economic characteristics

Variables	Non integrated fish farming n=133		Integrated fish farming n = 216		Total response n = 349	
Age(years)	Freq	%	Freq	%	Freq	%
Below 30 years	15	11.3	4	1.9	19	5.4
30 - <40	26	19.5	60	27.8	86	24.6
40 - <50	48	36.1	82	38.0	130	37.2
50 - <60	32	24.1	52	24.1	84	24.1
60 and above	12	9.0	18	8.3	30	8.6
Mean age	44		46			
Sex						
Male	123	92.5	196	90.7	319	91.4
Female	10	7.5	20	9.2	30	8.6
Educational status						
No formal education	4	3.0	12	5.6	16	4.6
Primary education	15	11.3	28	13.0	43	12.3
Secondary education	51	38.3	103	47.7	154	44.1
Tertiary education	63	47.4	73	33.8	136	39.0
Marital status						
Single	16	12.0	4	1.9	20	5.7
Married	106	79.7	209	96.8	315	90.3

Others	11	8.3	3	1.4	14	4.0
Occupation						
Artsianship and craft	15	11.3	9	4.2	24	6.9
Farming	62	46.6	126	58.3	188	53.9
Paid employment	29	26.4	57	21.8	86	24.6
Trading	12	9.0	20	9.3	32	9.2
Others	15	11.3	4	1.9	19	5.4
Mode of involvement					190	54.4
Full time	62	46.6	128	59.3		
Part time	71	53.4	88	40.7	159	45.6
Fish farming experience(years)						
1 -5	103	77.4	130	60.2	233	66.8
6 – 10	20	15.0	62	28.7	82	23.5
Above 10	10	7.5	24	11.1	34	9.7

Source: Field survey, 2009 .

Ability to use the technologies involved in integrated and non - integrated fish farming

Ability of the respondents to use the technology involved in integrated and non – integrated fish farming is one of the very important indicators in assessing farmer's knowledge in fish farming. Based on this, ability of the respondents to select fertile land for pond construction was investigated. It was recorded that 66.2 percent of integrated fish farmers can handle this particular technology very well on their farms compared to non - integrated fish farmers. Considering other technologies (ranging from lime application to artificial production of fingerling), larger percentages were recorded for integrated fish farmers on the ability to handle almost all the technologies in their respective farms compared to non - integrated fish farmers.

Farmers knowledge was also examined based on the technology of maggot production from livestock waste, it was found that 40.7 percent of the integrated fish farmers can use this technology very well compared to 9.8 percent of non - integrated fish farmers, while 71.4 percent of non - integrated fish farmers cannot use this technology compared to 76.9 percent accounted for integrated fish farmers.

So also, 19.9 percent of integrated fish farmers had the ability to harvest insect to feed their fishes compared to 4.5 percent of non - integrated fish farmers. On the contrary, 88.7 percent of non - integrated fish farmers cannot use this technology which was higher compared to their counterpart. The technology that involved the use of pond water for crop irrigation was sampled. It was gathered that 65.3 percent of integrated fish farmers can use this technology very well compared to non - integrated fish farmers with 24.1 percent.

Furthermore, 74.5 percent of integrated fish farmers had the ability to use the technology that involved production of fish meal from fish waste as compared to non - integrated fish farmers with 25.6 percent. It was also gathered that 29.3 percent of non integrated fish farmers had fair idea of how to use this technology compared to their counterpart.

The study further sampled the opinion of the respondents to handle fish feed production and pelleting as another technology. It was shown that most of the respondents have the ability to use this technology very well. Values recorded were 62.5 and 46.6 percent for integrated and non - integrated fish farmers. It is worthy to note that both categories of farmers cannot handle post-harvest preservation and storage together with adding value to fish after harvesting. More so, the level of farmers' knowledge fall into medium level (41.2) while 31.2 percent of the respondents fall into high knowledge level of ability to use different technologies on their farms and finally 28.6 percent of the respondents falls to the low level of knowledge.(table 2b)

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Table 2 : Distribution of respondents by ability to handle /use integrated fish farming technologies n = 349.

Variables	Non integrated				Integrated				Total response			
Technologies	NT	HI	FW	VW	NT	HI	FW	VW	NT	HI	FW	VW
Pond site selection	14(10.5)	17(12.8)	34(25.6)	68(51.1)	15(6.9)	30(13.9)	28(13.0)	143(66.2	29(8.3)	47(13.5)	62(17.8	211(60.5
Pond construction	4(3.0)	8(6.0)	34(25.6)	87(65.4	18(8.3)	4(1.9)	45(20.8)	149(69.0)	22(6.3)	12(3.4)	79(22.6)	236(67.6)
Application of lime	-	2(1.5)	15(11.3)	116(872)	8(3.7)	2(0.9)	13(6.0)	193(89.4	8(2.3)	4(1.1)	28(8.0)	309(88.5)
Fertilizer application	1(0.8)	1(0.8)	11(8.3)	120(90.2)	-	-	6(2.8	210(97.2)	1(0.3)	1(0.3)	17(4.9)	33(94.6)
Fish pond netting to control predators	7(5.3)	4(3.0)	13(9.8)	111(83.5)	-	6(2.8)	4(1.9)	206(95.4)	7(2.0)	10(2.9)	15(4.3)	317(90.8)
Fish feed formulation	5(3.8)	17(12.8)	40(30.1)	71(53.4)	4(1.9)	9(4.2)	81(37.5)	122(56.5)	9(2.6)	26(7.4)	121(34.9)	193(55.2)
Test and control of pond water acidity	2(1.5)	4(3.0)	13(9.8)	114(85.7)	-	8(3.7)	4(1.9)	204(94.4)	2(0.6)	12(3.4)	17(4.9)	330(94.6)
Test and control of pond water fertility	1(0.8)	5(3.8)	12(9.0)	115(86.5)	-	8(3.7)	3(1.4)	205(94.4)	2(0.6)	12(3.4)	17(4.9)	318(91.1)
Test and control of oxygen in pond water	7(5.3)	4(3.0)	13(9.8)	111(83.5)	-	6(2.8)	4(1.9)	206(95.4)	7(2.0)	10(2.9)	15(4.3)	317(90.8)
Artificial production of fingerling	86(64.7)	18(13.5)	4(3.0)	25(18.8)	98(45.4)	17(7.9)	11(5.1)	90(41.7)	184(52.7)	35(10.0)	15(4.3)	115(33.0)
Production of maggot from livestock waste	95(71.4)	18(13.5)	7(5.3)	13(9.8)	68(31.5)	40(18.5)	20(9.3	88(40.7)	163(46.7)	58(16.6)	27(7.7)	101(28.9)
Harvesting of insect to feed fish	118(88.7)	8(6.0)	1(0.8)	6(4.5)	166(76.9)	7(3.2)	-	43(19.9)	284(81.4)	15(4.3)	1(0.3)	49(14.0)
Uses of pond silt for cultivation	7(5.3)	4(3.0)	13(9.8)	111(83.5)	-	6(2.8)	4(1.9)	206(95.4)	7(2.0)	10(2.9)	15(4.3)	317(90.8)
Uses of pond water to irrigate crop	70(52.6)	19(14.3)	12(9.0)	32(24.1)	38(17.6)	2(0.9)	35(16.2)	141(65.3)	108(30.9)	21(6.0)	47(13.5)	173(49.6)
Production of fish meal from fish waste	42(31.6)	18(13.5)	39(29.3)	34(25.6)	15(6.9)	5(2.3)	35(16.2)	161(74.4)	57(16.3)	23(6.6)	74(21.2)	195(55.9)
Processing of poultry dropping into manure	19(14.3)	5(3.8)	13(9.8)	96(72.2)	9(4.2)	2(0.9)	4(1.9)	201(93.1)	28(8.0)	7(2.0)	17(4.9)	297(85.1)
Fish feed production and pelleting	11(8.3)	26(19.5)	34(25.6)	62(46.6)	12(5.6)	26(12.0)	43(19.9)	135(62.5)	23(6.6)	52(14.9)	77(22.1)	197(56.4)
Post harvest preservation and storage	105(78.9)	16(12.0)	1(0.8)	11(8.3)	192(88.9)	11(5.1)	2(0.9)	11(5.1)	297(85.1)	27(7.7)	3(0.9)	22(6.3)
Adding value to harvested fish by processing	103(77.4)	18(13.5)	4(3.0)	8(6.0)	150(69.40	22(10.2)	21(9.7)	23(10.6)	253(72.5)	40(11.5)	25(7.2)	31(8.9)

Table 2 b : Level of farmers knowledge in fish farming .

Level of knowledge	Frequency	Percentage
High knowledge (46 – 57)	108	31.2
Moderate knowledge(33 – 45)	143	41.2
Low knowledge (19 – 32)	99	28.6

Source: Field survey, 2009 .

Farmers' sources of information

Access to information is one of the most valuable resources in agricultural development. Agricultural extension services therefore need to be armed with adequate and essential information in other to make good impact on the target groups (Fabusoro, 2000). In other word, farmers' sources of information have been reported to be influential in their decision to accept or reject a technology (Atala, 1980).

This study identified various sources of information available to respondents in the study area. Table 3 illustrates that; the most popular sources of information available to respondents was interaction with friends and relatives, it was very obvious that all categories of farmers rely on this source. As indicated from this study, 96.3 percent of integrated fish farmers, and 90.2 percent of non - integrated fish farmers used this source. This finding corroborates the assertion of Nwabude (1995), who said that farmers mainly source for information from fellow farmers and neighbours. It was also recorded that 9.8 percent of non - integrated fish farmers did not rely on this source which had higher percentage compared to other farmers. This was closely followed by extension agent as information source. It is worthy of note that integrated fish farmers identified with this source better (91.2 percent) compared to non - integrated fish farmers (72.2 percent).

Another source which featured significantly is radio and television programme, it could be recalled from Table 12 that integrated fish farmers (84.3 percent) had the highest percentages followed by non - integrated fish farmers which accounted for 60.2 percent. This finding is in agreement with the report of Ajayi (2003) who pointed it out that the use of radio was the most popular among farmers in South West Nigeria. Higher percentage recorded for integrated fish farmers may be as a result of search for facts which can greatly assist them in their practices since they combine more than one activity in their farming operations.

Short courses, seminar and workshop were also reported as one of the sources that has added values to the practice of integrated and non – integrated fish farming in the study area. It was reported that most of the respondents rely on this source. There was an appreciable response among the two categories of farmers in this respect. Better still, integrated fish farmers (75.9 percent) featured well in this option compared to non - integrated fish farmers (65.4 percent) The interest of farmers in their various operations may be responsible for this result.

Furthermore, other sources reported were formal training, apprentices/work experience on other farms, newspaper, magazines and fliers and finally internet. It was found that integrated fish farmers had higher response compared to non - integrated fish farmers.

Table 3 : Respondents sources of information used on integrated fish farming n = 349.

Variables	Non integrated fish farming		Integrated fish farming		Total response	
Sources of information	Freq	%	Freq	%	Freq	%
Formal training in school						
Yes	25	18.8	35	16.2	60	17.2
No	108	81.2	181	83.8	289	82.8
Short courses, seminar and workshop						
Yes						
No	87	65.4	164	75.9	251	71.9
	46	34.6	52	24.1	98	28.1
Extension agent						
Yes	96	72.2	197	91.2	293	84.0
No	37	27.8	19	8.8	56	16.0
Interaction with friends and relatives						
Yes						
No	120	90.2	208	96.3	328	94.0
	13	9.8	8	3.7	21	6.0
Apprenticeship/work experience on other farms						
Yes	23	17.3	21	9.7	44	12.6
No	110	82.7	195	90.3	305	87.4

Radio/Tv programme						
Yes	80	60.2	182	84.3	262	75.1
No	53	39.8	34	15.7	87	24.9
Internet						
Yes	16	12.0	28	13.0	44	12.6
No	117	88.0	188	87.0	305	87.4
Newspaper, magazine and fliers						
Yes	23	17.3	38	17.6	61	17.5
No	110	82.7	178	82.4	288	82.5

Source: Field survey, 2009.

Test of hypothesis

To test for the relationship between the variables in hypothesis one, Pearson Product Moment Correlation (PPMC) and Chi-square (χ^2) analyses were used. PPMC was used where the variables were measured at the interval level, while for chi-square variables were measured at nominal level. The correlation coefficient obtained from the statistical analysis in Table 16 shows that, there was a significant relationship between knowledge of the farmers (integrated fish and non integrated fish farming) and age ($r = 0.20, p < 0.02$) and fish farming experience ($r = 0.17, p < 0.00$). This result is in agreement with the report of Adeniji (2005) who reported a similar significant relationship between age and knowledge among farmers. The implication of this result is that, the prominent age category of the respondents between the two different types of farming categories may be responsible for the trend of this result. In other words, as the age of the respondents increases, their knowledge in fish farming also increase which further shows their interest in fish farming. Furthermore, there were significant relationship between knowledge and cosmopoliteness, fish production capacity, livestock population capacity and area of crop land cultivated ($r = -0.16, p<0.01$), ($r = 0.21, p < 0.00$), ($r = 0.36, p < 0.00$) and ($r = 0.55, p = < 0.00$) .

The result of chi-square analysis shows that, there were significant relationship between knowledge of fish farming and marital status ($\chi^2 = 23.2, p < 0.05$), occupation ($\chi^2 = 25.5, p < 0.05$), mode of involvement ($\chi^2 = 17.1, p < 0.05$) land acquisition ($\chi^2 = 26.4, p < 0.05$) and extent of group participation ($\chi^2 = 12.5, p < 0.05$), while no significant relationship was recorded between educational level ($\chi^2 =10.79, p > 0.05$), religion ($\chi^2 = 1.20, p > 0.05$), nativity($\chi^2 = 2.51, p > 0.05$) and knowledge of fish farming.

From the data collected, there were more male farmers in integrated fish farming (91.4 percent) than their fellow female counterpart; this observation may be due to the energy and physical exertions required for farming activities. However, the significance value recorded is an indication that sex is a barrier to this type of farming. The significant relationship observed between farmer's educational status and their knowledge of integrated fish farming is a clear attestation to the fact that education is important to the success of any innovation. This finding is supported by assertion of Islam and Dewan (1987), that education is an important factors in changing attitude, adoption of new technologies and ability of the respondents to handle different technologies.

Similarly, the significance of mode of involvement may be due to time demanded for fish farming, especially more for those in integrated category. So also, for cosmopoliteness, the significance implies that, farmers tend to pursue one or two things outside their native communities that can be of help in their farming enterprise.

Table 4 : Chi –square analysis of respondents socio economic characteristics and their knowledge of integrated fish farming.

Variables	χ^2	Df	CC	Decision
Sex	9.44	2	0.00	S
Educational status	10.79	6	0.09	NS
Marital status	23.2	4	0.00	S
Occupation	25.5	8	0.01	S
Mode of involvement	17.1	2	0.00	S
Religion	1.20	2	0.54	NS
Nativity	2.51	2	0.28	Ns
Extent of group participation	12.5	4	0.01	S

Source: Field survey, 2009.

Note: S = Significant at 0.05 level.

NS = Not Significant at 0.05 level.

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Table 5 : Correlation analysis of the respondents socio economic characteriscs and their knowledge of integrated fish farming.

Variable	R	P	D
Age	0.20	0.00	S
Fish farming experience	0.17	0.00	S
Level of cosmopoliteness	0.16	0.01	S
Livestock population	0.21	0.00	S
Fish production capacity	0.36	0.00	S
Area of crop land cultivated	0.55	0.00	S

Source: Field survey, 2009.

Note: S = Significant at 0.05 level.

NS = Not Significant at 0.05 level.

Chi square result of respondents sources of information and their knowledge of integrated fish farming

Table 6 shows the chi square analysis between the respondent's sources of information and knowledge in fish farming (IFF & NIFF). Significant association was found between some information sources (extension agent, Radio/television programme, interaction with friends and relatives and internet) and knowledge in fish farming (χ^2=14.8, p < 0.05, χ^2 = 21.7, P < 0.05, χ^2 = 14.0, P < 0.05,) and (χ^2 = 6.40, p< 0.05)). This observation is expected since farmers attached their ties with friends and neighbour as a source of information and also have greater influence on respondent's knowledge of fish farming. Finding of Ajayi (2005) supported the significant of radio and television as the most popular media among farmers in south west, Nigeria.

Table 6 : Chi square analysis of respondents sources of information and knowledge of in fish farming

Variables	χ^2	Df	CC	Decision
Formal training in school	3.25	2	0.19	NS
Short courses, seminar and workshop	8.43	2	0.15	NS
Extension agent	14.8	2	0.00	S
Interaction with friends and relative	14.0	2	0.00	S
Apprentice/work experience	0.24	2	0.88	NS
Radio/Tv programme	21.7	2	0.00	S
Newspaper, magazine and fliers	0.33	2	0.84	NS
Internet	6.40	2	0.04	S

Source : Feild survey, 2009.

Note : S = Significant at 0.05 level.

NS = Not Significant at 0.05 level.

Difference in constraints, sources of information and knowledge level scores between two categories of fish farmers (IFF & NIFF).

Table 7 present results of t-test of significant difference between mean level of constraints, sources of information and knowledge level score by the two categories of fish farmers (IFF &NIFF) in Ogun State. The results shows that significant difference exists in the level of constraints faced by the farmers (t = 1.018, P < 0.05), sources of information (t = 0.48, p < 0.05) and knowledge (t = 3.58, p < 0.05). An average integrated fish farmers was revealed as facing significantly higher level of constraints (constraints = 14.09) than non - integrated fish farmers (constraints = 13.02). Also with reference to knowledge, integrated fish farmers (t = 43.01) are more knowledgeable than non - integrated fish farmer in most of the technologies identified by sampled respondents. The notable reason for this observation may be as a result of enterprise mix in which integrated fish farmers are involved in, since each unit has its own distinct constraints. Combination of several of these units may tend to increase the number of constraints faced compared to non-integrated fish farming.

Table 7 : Result of t-test of significant difference between mean level of constraints, sources of information and knowledge for non - integrated and integrated fish farming.

Variables	Farm types	N	Means	Std error of means	t- values	Decision
Sources of information	NIFF	133	32.00	0.48	0.00	S
	IFF	216	48.09	0.56		
Knowledge scores	NIFF	133	40.08	3.58	0.00	S
	IFF	216	43.01	9.87		

Source: Computed from survey data 2009.

S = Significant at 0.01 level.

V. Conclusion and Recommendations

The study has shown that harvesting of insect to feed fish, post harvest preservation and storage and adding values to harvested fish by processing have not been given proper attention. The study has also confirmed that farmers relied solely on information gotten from friends and relatives. Based on the findings of the study the following recommendations are suggested.

1. There is need to ensure that respondents are exposed to most of the technologies in fish farming through various training at local, state and at national level so as to enhance their knowledge of fish farming.
2. Effort should be made in assisting the farmers on how to preserve fish after harvesting through provision of cold room at strategic places where farmers can have access to it.
3. The technologies should be more gender sensitive in favour of women so that they will be able to handle the so call technologies in fish farming.

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Poverty Transitions in Rural South West Nigeria

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Abstract - Poverty dynamics enables a better appreciation of the extent of poverty over time by distinguishing between households exiting and entering into poverty, those never poor and the persistently poor. However, it has not received much attention in the poverty literature in Nigeria, largely due to the lack of nationally representative panel data that track the poverty status of households over time. The dynamics of poverty in rural SouthWest Nigeria (SWN) was therefore investigated using regional panel data. Results showed that 49.5 percent of the households were non-poor while 28.2 percent were poor in both periods respectively. On the other hand, 22.3 percent of the households moved in and out of poverty between the two periods indicating a higher level of chronic poverty in rural South Western Nigeria. However, of the transient poor, while 6.8 percent exited poverty, a larger proportion (15.5 percent) moved into poverty. Results also revealed an overlap between the determinants of chronic and transient poverty as vulnerability aggravated both chronic and transient poverty in the region by increasing the odds of remaining and moving into poverty of poor and non poor households respectively. However, there were a few factors such as primary education of household head, membership of local group or association, access to remittance and credit associated with chronic but not transient poverty and vice versa. The study suggests adoption of mixed policies to poverty reduction and taking into account the factors that prevent the poor from slipping into poverty while giving due attention to the factors that help them overcome poverty in the targeting of the various anti-poverty programmes of government.

Keywords : *poverty transitions, rural households, southwest Nigeria.*

GJSFR-D Classification: *FOR Code: 920502, 160804*

POVERTY TRANSITIONS IN RURALSOUTH WEST NIGERIA

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I. Introduction

In Nigeria, as in most other developing countries, the poverty situation is a daunting challenge especially in the rural areas. For instance, 54.4 percent of the population was below the poverty line in 2004 out of which 36.6 percent of the total population were living in extreme poverty (NBS, 2005). Findings of a 2006 Core Welfare Indicator Questionnaire (CWIQ) survey conducted by the National Bureau of Statistics also revealed that 67 per cent or two-thirds of Nigeria's rural population were poor compared to 57.9 per cent in urban areas. However, for informing policies and in the design of various poverty reduction strategies and programmes, cross-sectional household survey data are still being employed. In spite of these various policies, strategies and programmes (such as Green Revolution, National Fadama Development Project I, II and III, National Poverty Eradication Programme (NAPEP), National Economic Empowerment Development Strategy (NEEDS), Seven Point Agenda, Vision 20-2020 among others) aimed at improving the conditions of the poor, the number of poor people continues to increase. This could be owing to the fact that in using static poverty measures based on cross-sectional data, generally expressed by indicators such as the headcount ratio and the poverty gap, identifying the poor is based on how far consumption, expenditure or income lies below the poverty line. However, poverty measured at a particular point in time usually does not take into account the future prospects of household welfare which depends not only on its present income or consumption, but also on the risks or shocks it faces (Zhang and Wan, 2008). In other words, poverty is viewed as a static rather than a dynamic phenomenon. Hence, targeting currently poor households do not take into account households whose welfare decline sharply in the event of shocks.

The dynamic nature of poverty, adds an important aspect to the analysis of poverty as some households experience poverty for long periods of time, while others only experience it on a temporary basis due to negative shocks that result into a sudden loss of welfare. This indicates that today's poor may not be tomorrow's poor and has led to the increasing recognition in the past few years that there are considerable flows into and out of the poverty pool (Baulch and Hoddinott, 2000). For instance, Baulch and McCulloch (1998) observed that a high percentage of households in Pakistan moved into poverty due to temporary shocks (such as illness or loss of employment) that were reversed just one or two years later. Also, many of the people who escaped poverty only succeeded in doing so for one or two years before a reverse in their circumstances forced them back below the poverty line. This brings to the fore the importance of the analysis of poverty transitions in the prescription of potent poverty policies as well as in the design and targeting of anti-poverty programmes.

The analysis of changes of a household's welfare over time distinguish between the chronically poor and the temporarily poor and why some households remain poor over extended periods of time (Atasoy et al., 2008). Also, evidence from research on poverty dynamics has shown that the factors influencing chronic poverty may differ from those of transient poverty. Thus, the characteristics and needs of the transiently and chronically poor households are likely to differ implying that in targeting these households, alternative policies may be required (Jalan and Ravallion, 2000). Although, in the design of policies,

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chronic poverty usually causes more concern among policymakers and scholars than transitory poverty, it is nevertheless important to understand movements in and out of poverty over time and factors associated with transitions, since they have relevance for poverty persistence (Gamba and Mghenyi, 2004). Recent research has also established that for assessing the well-being of poor households and for devising effective strategies of poverty reduction in developing countries, the need for measures that take into account the dynamic nature of poverty phenomena is imperative (Hardewag et al., 2007). In line with the recent trend, this paper examines the dynamics of poverty in rural Southwest Nigeria with a view to assisting in isolating effective strategies for poverty reduction.

There have been few empirical studies on the dynamics of poverty in Nigeria (e.g. Alayande and Alayande, 2004; Oni and Yusuf, 2006; Oyekale and Oyekale, 2007 and Oluwatayo, 2007). These studies, apart from using cross sectional data which involves the exclusive reliance on the strong assumption of the ability of cross-sectional variability to capture temporal variability, did not investigate poverty transitions and the factors associated with movements into and out of poverty. The problem of distinguishing between chronic and transitory poverty, and investigating the factors that determine if a household will remain poor or move out of poverty with time has not received much attention in the poverty literature in Nigeria, largely due to the lack of nationally representative panel data that track the poverty status of households over time. The attendant cost of collecting such data at the national level and the need to demonstrate the usefulness of panel data justifies the choice of South Western Nigeria. It is also clear that an understanding of the factors that determine poverty transitions has important implications for the design of cost effective poverty reduction strategies (Kirimi and Sindi, 2006) particularly for rural communities in Nigeria where poverty rates are disproportionately high. Therefore, this study, apart from contributing to scarce literature on poverty transitions will also examine the factors associated with poverty transitions to allow for effective targeting of vulnerable groups in Nigeria.

II. Review of Empirical Studies on Poverty Dynamics

Empirical works on poverty dynamics date back to Bane and Ellwood (1983) which used panel data of income dynamics (PSID) for United States (US). Various methods that have been used in the study of poverty dynamics were reviewed. They posited that poverty dynamics can only be properly understood if it is defined in terms of poverty spells because the degree to which the poor fall into and out of poverty due to changes in income and family structure can be estimated. Results showed that while less than 40 percent of the poverty spells began due to decreases in the income of the household head about three-fifths of the spells ended due to increases in the household head's earnings. Also, majority of the poor were found to experience longer spells of poverty.

Findings from the reviewed literature on poverty transition in the United Kingdom showed that people who have experienced poverty in the past are at more risk of entering poverty than those who have not been in poverty, and that the longer someone stays poor the less likely they are to escape poverty for instance, Jenkins et al. (2001) found that about 30 per cent of those leaving poverty became poor again within a year. For those in poverty, the chances of escaping decrease over time. They suggest even less mobility: while over half of poverty entrants left after a year and a third after two years, the exit rate declined sharply so that, of those poor for seven years, only 19 per cent had left poverty the following year.

Jalan and Ravallion (1998) differentiated the poor into the chronically and transiently poor using China panel data and the 'component' approach. In this approach, those with "time-mean consumption" below poverty line over a given time period were classified as the chronically poor while the total expected poor were those with the inter-temporal consumption below poverty line. The difference between total expected poverty and chronic poverty was then measured as transient poverty. They also investigated the determinants of chronic and transient poverty using the censored conditional quintile regression method. Results of their analysis showed that while physical assets were important determinants of transient poverty, chronic poverty was highly influenced by demographic characteristics of the household. Generally they found that the determinants of chronic and transient poverty differ although there were some factors that were associated with both types of poverty. They suggested consumption variability mechanisms such as seasonal public works, credit schemes, buffer stocks and insurance options as effective poverty reduction tools.

In the same vein, McCulloch and Baulch (1999) using a five-wave panel data for Pakistan distinguished the chronically, transitorily and never poor households. They examined the characteristics influencing these categories of household employing both an ordered and a multinomial logit model. The results showed that between 21 per cent and 29 per cent of households had incomes below the poverty line In each year of the survey, but 46 per cent to 51 per cent of poor households' moved out of poverty from one year to the next while only 3 per cent of households were poor in all five years of the panel. Furthermore, the correlates of entries and exits from poverty were found to be different from those of poverty status. The policy implications of their findings give the indication that if anti-poverty policies are targeted using the characteristics of the currently poor, it will miss a significant proportion of households who slip into poverty when faced with shocks. They recommend that if governments care primarily about reducing the poverty headcount, they should focus their efforts on increasing exits from and decreasing entries into poverty.

Bigsten and Shimeles (2003) and Swanepoel (2005) analyzed the dynamics of poverty using spells and component approach for ERHS 1994-1997. Results revealed that while most households in the rural areas were transiently poor, factors such as age of the head of the household, dependency ratio within the household greatly affected the odds of moving into poverty. Similarly, the review work by Baulch and Hoddinott (2000) on ten developing countries revealed that poverty in developing countries is more of transient than being chronic.

Using panel data from Egypt for 1997-1999, Haddad and Ahmed (2002) investigated poverty transitions using both the transition matrix and the components approach. Findings showed that poverty was largely chronic while those who moved into poverty were over twice those who exited poverty. They investigated the determinants of chronic and transient poverty and found out that there were factors such as average years of schooling of household members that inversely affected both types of poverty but had a stronger effect on chronic poverty. They concluded that poverty alleviation policies should focus on improving the asset accumulation process since majority of the households were found to be chronically poor. Similarly, employing a three year panel data set of rural households in the Tigray region of northern Ethiopia, Nega et al.(2008) examined the dynamics of poverty and the impact of two intervention measures – the food for work (FFW) and the food security package (FSP) programs – upon poverty by disaggregating total poverty into its transient and chronic components. Findings from their study revealed that poverty in the region is predominantly chronic. Results of matching estimators indicate that the FSP program has a significant negative effect on total and chronic poverty, but not on transient poverty and that households involved in the program have on average lower levels of total and chronic poverty than households not involved in the program. The FFW on the other hand does not significantly influence any of the three forms of poverty. Tertile regressions, however, reveal that the FFW benefits households in the richest and the middle tertiles.

Okidi and Mckay (2003) and Lawson et al. (2006) in the 1990s examined the dynamics of poverty and factors influencing the dynamics in Uganda employing different econometric approaches Lawson et al (2006) investigated the correlates of the never poor, those moving in and moving out of poverty. They found lack of education and assets important factors influencing chronic poverty.

Oleksiy Ivaschenko and Cem Mete (2008) in their study showed that the factors which make households move out of poverty are different from the factors which make them fall back into poverty. The study used panel data analysis for Tajikistan and showed that, in such a transitory economy, the mobility of households from and into poverty is quite high.

From the above literature, it is evident that the class of decomposable poverty measures of FGT was used in measuring poverty and the decomposition of poverty was done using either the spells or the component approach. To investigate the factors influencing total, chronic and transient poverty, different econometric models such as multinomial logistic, probit, mutinomial probit, tobit and quantile regression were used by different authors. In this study, the much simpler "spells approach" was adopted in decomposing poverty into its chronic and transient components (McKay and Lawson, 2003) and the factors associated with total, chronic and transient poverty were examined using the probit and multinomial logistic regression method respectively. In addition, in the case of Africa, there are few studies of poverty dynamics despite the rampant poverty in the region. This may be due to the demanding nature of the data in analyzing the dynamics of poverty. Only few countries (Cote d'Ivoire, Ethiopia, Egypt, South Africa, Uganda, Kenya, Ghana and Zimbabwe) to the best of my knowledge have household-level panel data. Therefore, this study will be quite an immeasurable contribution to the body of knowledge on poverty dynamics in Nigeria and Africa as a whole.

III. Materials and Methods

The geographical location of South West Nigeria covers about 114, 271 kilometer square that is, approximately 12 percent of Nigeria's total land mass (see Adepoju et al., 2011). The total population is 27,581,992 and predominantly agrarian. The vegetation is typically rainforest; however climatic changes over the years have turned some parts of the rain forest to derived savannah. The cultivation systems mostly practiced are mixed farming and mixed cropping. Depending on the prevailing vegetation, soil and weather conditions, notable food crops cultivated include cassava, maize, yam, cowpea while cash crops include cocoa, kolanut, coffee and oil palm (NPC, 2006). Non-farm activities of the households include trading, carpentry, bricklaying as well as government employment.

Primary data employed in this study were collected from a two-wave panel survey undertaken at 5-months interval to allow measurement of seasonal variation in behaviour and outcome and to balance both the cross-sectional and time series requirements of panel data. The two periods correspond to the lean and harvesting seasons of 2009. Data were collected (from the same households in the two rounds) on demographic characteristics, education, employment, housing and housing conditions, social capital, income, consumption expenditure as well as the economic infrastructure available to the community.

The frame for the study was the demarcated Enumeration Area (EA) maps produced by National Population Commission for the 2006 Housing and Population Census (see Adepoju et al., 2011 for details).

a) Specification of the Models

i. *The Poverty Threshold*

There is now recognition in literature that poverty is complex in nature and that consumption-based poverty measures are usually more stable than those of income (Lipton and Ravallion, 1995). This is because consumption tends to fluctuate less than income (which can even go to zero in certain months due to seasonality), making it a better indicator of living standards. Unlike income, consumption also reflects the ability of a household to borrow or mobilize other resources in time of economic stress (Grosh et al., 2008). Therefore, in line with most poverty studies (Dercon and Krishnan, 2000; Goh et al., 2001; Haddad and Ahmed, 2003; Gaiha et al., 2007), per capita household consumption expenditure was used as a proxy for per capita household income. A relative poverty line was constructed based on the Mean Per Capita Household Expenditure (MPCHHE) of the sampled respondents. Poverty categories were then established using the relative poverty lines for each of the periods following Baulch and McCulloch (1998); Gamba and Mghenyi (2004) and Gaiha et al., (2007). Those who spent less than two-thirds of their MPCHHE were classified as poor (moderately) while (non-poor) are those who spend two-thirds or more of their MPCHHE (NBS, 2005).

The poverty measure that was used in this analysis is the class of decomposable poverty measures by Foster, Greer and Thorbecke (FGT). They are widely used because they are consistent and additively decomposable (Foster et al., 1984).

The FGT index is given by

$$P_\alpha = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^\alpha \qquad (1)$$

Where;

Z is the poverty line defined as 2/3 MPCHHE, yi is the value of poverty indicator/welfare index per capita in this case per capita expenditure in increasing order for all households; q is the number of poor people in the population of size n, and ∝ is the poverty aversion parameter that takes values of zero, one or two.

In operationalising the concepts of chronic and transient poverty, household poverty status in the different years of the panel was employed. A common approach is the decomposition of total poverty, defined as an inter-temporal average poverty measure, into its chronic and transient components (Jalan and Ravallion ,1998). This approach however, relies on the computation of inter-temporal mean of consumption which cannot be properly captured using only two waves of panel data (McKay and Lawson, 2003). Hence, in this study, the "spells approach" in which a household that is poor in only one period is classified as transient poor, while a household that is poor in both periods is considered to be chronically poor is adopted. To examine the movements of households in and out of poverty and to understand the relationship between poverty entry and exits, poverty transition matrix and the simple-first order Markov model were employed.

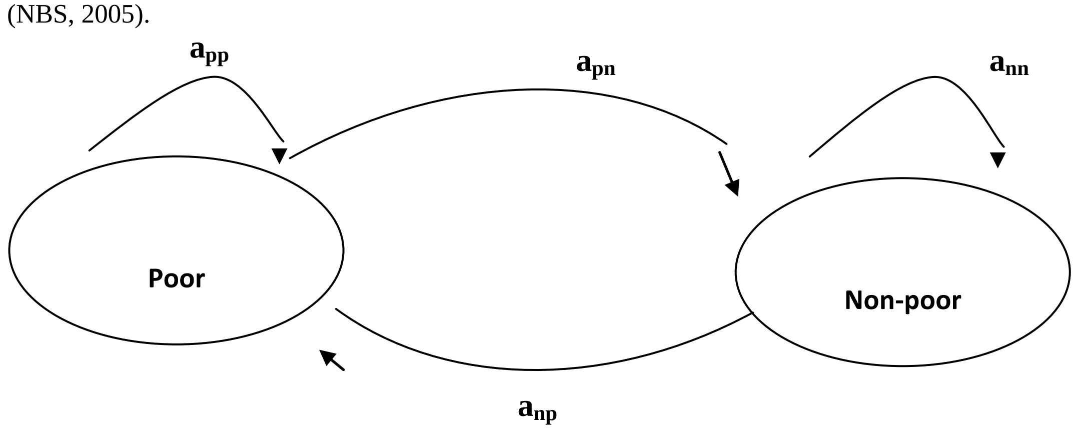

Figure1 : Markov Model of Poverty Transitions.

Source : Adapted from Baulch and McCulloch (1998)

Where p denotes poor and n denotes non-poor, thus

app = probability of staying poor

ann = probability of staying non-poor

apn = probability of exiting poverty

anp = probability of entering poverty

ii. *Multinomial Logit Model*

The multinomial logit model (following Gaiha et al., 2007; Bigsten et al., 2003; Bhatta and Sharma, 2006; Haddad and Ahmed, 2003; Baulch and Hoddinott, 2000) was used to analyze the shift of poverty status between the two periods (Harvesting and Lean periods). The relative probability of $Y_i = j$ in relation to the base category $Y = 0$ is given by the Relative Risk Ratio (RRR) or odds ratio.

$$\Pr(Y_i = j) = \frac{e^{(X_{ij}\lambda \ + \tau V\hat{E}P_{ijt-1})}}{\sum_{k=0}^{3} e^{(X_{ij}\lambda + \tau V\hat{E}P_{ijt-1})}}, \quad j = 0,1,2,3 \tag{2}$$

The parameter estimates measure the impact of a unit increase in the relevant explanatory variable on the log odds ratio of the particular state in relation to the base line category [1].

The MNL model is explicitly expressed as

$$Y_1 = \propto_1 + B_{11}X_1 + B_{21}X_2 + \dots\dots\dots\dots B_nX_n + \epsilon_i \quad \text{--------------------------(3)}$$

$$Y_2 = \propto_2 + B_{12}X_1 + B_{22}X_2 + \dots\dots\dots\dots B_nX_n + \epsilon_i \quad \text{--------------------------(4)}$$

$$Y_3 = \propto_3 + B_{13}X_1 + B_{23}X_2 + \dots\dots\dots\dots B_nX_n + \epsilon_i \quad \text{----------------------(5)}$$

$$Y_o = \propto_o + B_{10}X_1 + B_{20}X_2 + \dots\dots\dots\dots B_nX_n + \epsilon_i \quad \text{----------------------(6)}$$

Where Yi represents 4 unordered categories of poverty transition:

Y_1 = those who were poor in both periods (i.e. chronically poor)

Y_2 = those who were poor in the first period, but non-poor in the second period (i.e. transitory poor)

Y_3 = those who were non-poor in the first period, but poor in the second period (i.e. transitory poor)

Y_0 = those who were non-poor in both periods (i.e. always non-poor) (which is the reference case where it was assumed that $\lambda_0 = \tau_0 = 0$ Hence, the results for the base will not appear).

X_1 - - X_n represent vector of the explanatory variables where n = 1 …22

B_1 - - B_{22} represent the parameter coefficients.

ϵ_i = represents the independently distributed error terms.

$\propto_0 - \propto_3$ shows the intercept or constant terms.

To measure the promotional and protective effects, following Greene (2000), equation (2) was normalized by setting.

$$\Pr(Y_i = j) = \frac{e^{(x_i\lambda_j)}}{1 + \sum_{k=1}^{3} e^{(x_i\lambda_k + \tau_k V\hat{E}P_i)}}, \quad j = 1,2,3 \tag{7}$$

$$\Pr(Y_i = 0) = \frac{1}{1 + \sum_{k=1}^{3} e^{(x_i\lambda_k + \tau_k V\hat{E}P_i)}}, \quad j = 0 \tag{8}$$

Probabilities for four different choices were then obtained from equations (7) and (8). Upon normalization, the 'protective effect' (i.e. the effect of preventing the non-poor from falling into poverty), and the 'promotional effect' (i.e. the effect associated with helping the poor escape poverty in a dynamic framework) were then identified (see Gaiha et al., 2007 for details).

Chi-square (X^2) distributions and log – likelihood function was used to test the goodness of fit of the overall model.

IV. Results and Discussion

a) *Poverty Transition and Decomposition (Spells Approach)*

The mean per capita household expenditure for the study area in the harvesting and lean periods was ₦4970.36 and ₦ 6140.43 respectively from where poverty lines of ₦ 3313.57 and ₦ 4093.21 equivalent to two-thirds of the mean per capita household expenditure (MPCHHE) were obtained. This gave poverty incidence of 35 percent and 43.6 percent for the harvesting and lean periods respectively. The poverty transition matrix in table 1 shows that 49.5 percent of the households were non-poor in both periods implying that a significant proportion of the respondents were non-poor in the 2 periods (65.0 percent and 56.4 percent respectively). This corroborates the findings of NBS (2005) in which Osun and Oyo states had relatively lower poverty incidence (32.35 percent and 24.08 percent respectively) when compared with other states in the South West zone. On the other hand, the percentage of households that were poor in both periods was 28.2 percent indicating that, approximately 78% of the households did not change their poverty status between the two periods. Table 2 shows the percentage of households in each poverty category based on the spells approach of poverty decomposition.

Table 1 : Poor/Non-Poor Transition Matrix

		2nd period		
		Non poor	Poor	Total
1st Period	Non Poor	288 (49.5)*	90 (15.5)	378 (65.0)
	Poor	40 (6.8)	164 (28.2)	204 (35.0)
	Total	328 (56.4)	254 (43.6)	582 (100)

Source : Field Survey, 2009

* *Top number is cell frequency and number in parenthesis is cell percentage*

The chronic and transient poverty rates were 28.2% and 22.3% respectively indicating a higher level of chronic poverty in rural South Western Nigeria, although a significant percentage (around one fifth) of the households in the region suffered from transient poverty. However, of the transient poor, while 6.8 percent exited poverty, a larger proportion (15.5%) moved into poverty (table 2). This result is in line with other African estimates reported by Baulch and Hoddinot (2000). In sum, poverty is largely chronic in rural South Western Nigeria. Hence, poverty alleviation policies in Nigeria should focus on how to pull out the long run poor from their poverty trap, while giving due attention to the transient poor.

Table 2 : Poverty Decomposition (Spells Approach)

Poverty Status	Nos. of Households	Percentage
Always poor (chronic)	164	28.2
Sometimes poor (transient)	130	22.3
Never poor	288	49.5
Total	582	100.0

Source: Field Survey, 2009 .

b) Factors Influencing Poverty Transitions

This section presents the multinomial regression results for the correlates of poverty transitions (chronic and transient poverty) in the study area. Similar sets of explanatory variables were used in each case. The determinants of chronic and transient poverty were interpreted in terms of the odds ratio of all other response categories relative to the base category. The base category in this case is the never poor households (i.e. the non- poor state). The results also presents the relative risk ratios (RRR) associated with the different explanatory variables. The multinomial logit model (table 3) passes the minimum requirement for robustness where the likelihood ratio of 511.76 based on chi-square test for overall model is significant at 1 percent. The model also explains well given the pseudo R^2 of 0.376.

i. *Determinants of Chronic Poverty*

Table 3 shows that VEP, sex of household head, household size, years of experience in primary occupation, distance to public health facility, membership of social group or association, access to remittances, dependency burden, primary occupation of the household head, access to potable water , construction material of outside wall (Mud), primary education of household head, secondary education of household head, tertiary education of household head and access to credit are the major factors influencing chronic poverty in the study area. While vulnerability, household size, dependency burden, primary occupation of household head, construction material of outside wall, and distance to public health increased the likelihood of being chronically poor, gender of household head, years of experience in primary occupation, membership of local group, access to remittances, potable water, credit and educational attainment of the household head reduced the likelihood of chronic poverty in the study area .The human capital variables (primary, secondary and tertiary education of household head) showed a significant negative relationship with chronic poverty. Specifically, while an additional year of primary and secondary education of household head impacted negatively on the odds of being chronically poor by 0.020 and 0.411 respectively, the RRR associated with tertiary education was observed to be 0.459 implying that tertiary education of the household head decreased the odds of being chronically poor more. Such results corresponds strongly with a priori expectations that education is very likely to have a fundamental influence on a households poverty status and highlights the strong role of human capital development in raising the long term welfare of households (McCulloch and Baulch , 1999; Gaiha et al., 2007; Muyanga et al., 2007). Therefore, the factors perpetuating poverty in the study area are: larger household size, higher dependency burden, no educational attainment, primary occupation (farming), and poor housing conditions.

Table 3 : Multinomial Logit Regression Result for the Determinants of Chronic and Transient Poverty.

	Chronic Poverty			Exiting Poverty			Moving into Poverty		
Variable	**RRR**	**Coeff.**	**z-value**	**RRR**	**Coeff.**	**z-value**	**RRR**	**Coeff.**	**z-value**
VEP	10.05	2.308	2.77***	1.621	0.483	0.48	1.802	1.820	2.22**
Sex	0.036	-3.299	- 4.52***	0.305	-1.187	-1.31	0.229	-1.471	-2.33**
Age	1.008	0.008	0.12	0.949	-0.051	-0.73	0.989	-0.010	-0.18
Age squared	1.000	0.000	0.04	1.000	0.000	0.93	0.999	-5.77E-06	-0.01
Household size	2.479	0.908	5.66***	0.017	-0.702	-3.59***	1.800	0.588	3.86***
Dep.burd.	221.371	5.399	3.52***	0.047	-4.193	-2.82***	6.026	3.968	2.15**
Household type	0.929	-0.073	- 0.16	1.264	0.234	0.41	1.225	0.203	0.46
Primary Educ.	0.020	-0.777	-1.81*	0.826	-0.190	-0.36	0.637	-0.456	-1.09
Sec. Educ.	0.411	-2.501	-3.09***	1.029	1.625	2.27**	0.659	-0.415	-0.84
Tertiary Educ.	0.459	-3.867	-3.53***	3.196	3.526	2.80***	0.910	-2.273	-2.95***
Pry Occup.	3.620	1.286	2.03**	0.889	-1.506	-2.06**	1.197	0.180	0.31
Yexp.Occup.	0.919	-0.084	-2.83***	0.929	-0.735	-1.97**	0.954	-0.046	-1.66*
Land size	1.146	0.136	0.97	0.998	-0.001	-0.01	0.700	-0.007	-1.90*
Mem. Assoc.	0.442	-0.815	-2.14**	0.522	-0.649	-1.40	0.724	-0.322	-0.86
Access to credit	0.417	-0.873	-2.23**	1.670	0.399	0.79	1.041	0.040	0.12
Access remitt.	0.640	-1.730	-2.64***	0.679	-0.387	-0.47	2.285	0.826	1.42
Dist.pub.Health	1.865	0.144	2.07**	0.826	-0.190	-1.76*	1.037	0.036	0.59
Mud	1.453	0.790	1.96**	0.874	-0.134	-0.26	0.617	-0.482	-1.26
Room ratio	0.483	-0.726	-1.14	0.284	-1.255	-1.38	0.751	-0.285	-0.62
Sanexcre	1.008	0.008	0.02	1.181	0.167	0.32	1.133	0.125	0.31
Pwater.	0.497	-0.699	-2.01**	2.799	1.071	2.56***	0.950	-0.050	-0.16
Electricity	0.941	-0.060	-0.15	2.204	0.790	1.50	0.782	-0.245	-0.62

*Source : Computed from 2009 Panel Data *** Significant at 1% , ** at 5%, * at 10% Log likelihood -425.46 Observations 582 Pseudo R. Squared 0.3756 LR Chi2 (66) = 511.76 Prob > Chi2 = 0.0000*
Dependent variable: poverty status (0=non-poor,1=chronic poor,2=poor-nonpoor,3=nonpoor-poor),with base category poverty status=0.

ii. *Determinants of Exiting Poverty (Transient Poverty) in the Study Area*

Table 3 also reveals the major factors influencing the odds of exiting poverty in the study. These are; household size, years of experience in farming, distance to public health facility, dependency burden, primary occupation (farming), access to potable water, primary and secondary education of the household head. While household size, distance to public health facility, dependency burden, primary occupation of household head decreased the odds of exiting poverty, years of experience in primary occupation, access to potable water, secondary and tertiary education impacted positively on the odds of exiting poverty in the study area. The coefficient of vulnerability was positive but not significant for poverty exit (Lawson, 2004; Gaiha et al., 2007). However, the effect of household size and as expected, dependency burden on the likelihood of exiting poverty was negative with a RRR of 0.017 and 0.047 respectively. This indicates that an additional member of household as well as an additional dependant to the household decreased the odds of exiting poverty in the study area. This result as earlier stated might not be unconnected with the fact that increased household size decreases per capita expenditure while dependants do not contribute to household income thereby aggravating poverty in the household. This result corroborates the findings of Haddad and Ahmed (2002). Similarly, the negative effect of the variable of primary occupation on the odds of exiting poverty implies that being engaged in farming as primary source of income decreases the probability of exiting poverty. However, contrary to a priori expectations, a year increase in experience in primary occupation of household head decreased the odds of exiting poverty by 0.929. This could be attributed to the fact that as the years of experience in primary occupation increase, the age of the household heads also increase. This will consequently lead to a reduction in productivity, income and ultimately increased poverty. Distance to public health facility also had a negative impact on exiting poverty by decreasing the odds ratio that the households will exit poverty by 0.826.

On the other hand, the RRR of 1.02 for secondary education and 3.19 for tertiary education implies that while both secondary and tertiary education of the household head had strong positive influence on the likelihood of exiting poverty in the study area, the latter increased the odds of exiting poverty more. Again this corresponds to findings that education is very likely to be a strong causal influence on household poverty status (Lawson, 2004; Baulch and Mcculloch , 1999). Although not significant, the negative effect of the head having primary education on the probability of household escaping poverty may seem counter intuitive, but this is probably picking up the effect that households whose head had completed primary school were less likely to be poor to start with (Lawson ,2004; Bhatta and Sharma, 2006). This is consistent with findings of Woolard and Klasen (2005), Bigsten et al. (2003) and Lawson (2004). Similarly, access to potable water increased the odds of exiting poverty, implying that access to infrastructure such as potable water is an effective tool for poverty reduction. In summary, the poor would overcome poverty in the next period through smaller household size, access to healthcare facility, lower dependency burden, access to potable water, and education (at the secondary and tertiary levels).

iii. *Determinants of Moving into Poverty (Transient Poverty) in the study area*

Movement into poverty is a function of VEP, gender of household head, household size, land size, dependency burden, and tertiary education. While VEP, household size and dependency burden impacted positively on the movement into poverty, tertiary education, land size, years of experience in primary occupation and gender of household head had a negative impact on movement into poverty.

As shown in table 3, vulnerability impacted positively on the movement into poverty by 1.82 implying that those vulnerable and non-poor are likely to fall into poverty. This result corroborates the findings of Gaiha et al. (2007). The positive coefficient of household size and dependency burden also indicates that increases in household size and dependants in the household are strongly associated with moving into poverty (Gaiha and Imai, 2003; Haddad and Ahmed, 2003). Specifically, an additional member or dependant to the household increased the likelihood of slipping into poverty by 1.80 and 6.03 respectively. On the other hand, rural residents with higher number of years of experience in primary occupation and larger sized land were found to be less likely to fall into poverty. Similarly, male headed households decreased the odds of slipping into poverty by 0.229. Also, among all the human capital assets, only tertiary education of the head had a strong negative influence on the likelihood of a household moving into poverty. That is, tertiary education decreased the odds of slipping into poverty. This result is consistent with findings of Lawson et al. (2005) and implies that higher levels of education is crucial for sustained poverty reduction as it increases opportunity of gainful employment, access to skills which enhances productivity and consequently improves household income and welfare. Tertiary education is therefore a priority factor for moving out of poverty in the study area. Hence, the factors that prevent the non poor from slipping into poverty in the study area include: smaller household size, lower dependency burden, higher education and larger land.

c) *Promotional and Protective Effects*

The difference between coefficients of VEP for poor – non poor category (2) and poor – poor category (1) reflects the promotional effect (Gaiha et al., 2007) . The greater coefficient of VEP for category 1 as shown in table 3 implies that those vulnerable and poor are more likely to remain in poverty. In this wise, the promotional effect is lower. This result is consistent with findings of Gaiha et al. (2007) and corroborates previous findings in this study that those vulnerable and poor are more likely to remain in poverty. On the other hand, the positive coefficient for VEP in the non-poor–poor (category 3) relative to the base category implies that the probability of those vulnerable and non- poor slipping into poverty, relative to being non-poor is higher (protective effect is lower). This result again corroborates previous findings in this study that those vulnerable and non-poor are likely to fall into poverty. These result highlights the need for the Nigerian government to give due attention to the factors that help the poor overcome poverty and those that prevent them from slipping into poverty for targeting of anti-poverty interventions.

V. Conclusion

Despite the various efforts of government to reduce the incidence of poverty through different poverty alleviation programmes and strategies and the quest to be one of the 20 largest economies by the year 2020, Nigeria, continues to be one of the poorest countries in the world. This high level of poverty characterising the country therefore, requires an urgent need to gain a better understanding of the persistence and dynamics of poverty at the household level in Nigeria.

In this study, poverty dynamics was studied using regional panel data and it brings to the fore that the poor are not a homogenous group but consists of households who move into and out of poverty (transient poor) as well as households that are trapped in poverty (chronic poor). Hence, to achieve the right policies that will address both types of poverty, the extent to which poverty is transient versus chronic should be an important consideration when designing policies aimed at reducing poverty (Jalan and Ravallion, 2001). Furthermore, the fact that there are more chronically poor households in the region although there is a significant proportion of transiently poor households is an indication that the government should focus on providing sustainable social protection strategies (for instance general price subsidies, cash and conditional cash transfers) to empower the households and adopt policies (such as adequate access to microfinance) that assist households in increasing their assets. In the case of the transient poor, policies are needed to help households smooth their consumption over time such as measures to encourage insurance schemes and safety nets (Haddad and Ahmed 2003).

In addition, since there is an overlap between the determinants of chronic and transient poverty, although there were a few factors associated with chronic but not transient poverty and vice versa, the targeting criteria of the various anti-poverty programmes must take into account the factors that prevent the poor from slipping into poverty while giving due attention to the factors that help them overcome poverty.

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Fluoride Status of Sudha Dam Water Near Bhoker Maharashtra, India

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Abstract - Fluoride is one of the critical chemical parameter, which influences the quality of dam water. Fluoride in water was determined by SPADNS method by using a UV-visible spectrophotometer at 570 nm. Excess intake of fluoride through drinking water causes fluorosis on human beings in many states of India, including Maharashatra. The concentration of F was estimated from three sampling sites named as up stream, mid stream and down stream i.e. S_1, S_2 and S_3 .The entire study was carried out during January to December 2010. The observed values showed the variations during the research study were ranged between 0.25-1.2 mg/L. The concentration of F was found within the permissible limit i.e.1.5 mg/L.

Keywords : *Fluoride, Dam water, Chemical parameter, SPANDS.*

GJSFR-D Classification: *FOR Code: 050101, 060204*

FLUORIDE STATUS OF SUDHA DAM WATER NEAR BHOKER MAHARASHATRA, INDIA

Strictly as per the compliance and regulations of:

Fluoride Status of Sudha Dam Water Near Bhoker Maharashtra, India

Sayyed Juned. A [α] & Bhosle Arjun. B [σ]

Abstract - Fluoride is one of the critical chemical parameter, which influences the quality of dam water. Fluoride in water was determined by SPADNS method by using a UV-visible spectrophotometer at **570 nm.** Excess intake of fluoride through drinking water causes fluorosis on human beings in many states of India, including Maharashatra. The concentration of **F** was estimated from three sampling sites named as up stream, mid stream and down stream i.e. S_1, S_2 and S_3. The entire study was carried out during January to December 2010. The observed values showed the variations during the research study were ranged between **0.25-1.2 mg/L**. The concentration of **F** was found within the permissible limit **i.e.1.5 mg/L.**

Keywords : Fluoride, Dam water, Chemical parameter, SPANDS.

I. Introduction

Water is essential natural resource for sustaining life and environment which we have always thought to be available in abundance and free gift of nature. However, chemical composition of surface or subsurface, geothermal or non - thermal, is one of the prime factors on which the suitability of the water for domestic, industrial or agriculture purpose depends.

The quality of surface water and its vulnerability to pollution is a highly topical issue. Pollution can potentially occur as a result of precipitation, lithological alteration and soil erosion, but other causes may include anthropogenic sources connected to urban development, industry and agriculture (Simeonov et al. 2003 and Singh et al. 2005).

Fluoride is one of the chemical elements necessary for human life. Fluoride exists naturally in water sources and is derived from fluorine, the thirteenth most common element in the Earth's crust. Fluorine is the most electro negative of all elements and is physiologically more active than any other ion. Fluorine in drinking water is totally in an ionic form and hence it rapidly and passively passes through the intestinal mucosa and interferes with metabolic activities of the living system.

Fluorine is particularly available in rocks, soils, water and biological chains in living organisms. It has higher electro negativity and reactivity. Fluoride occurs naturally in water due to weathering of rocks that contain fluoride rich minerals such as hornblende, biotite, apatite and fluorite (Breiter et. al, 2006 and Zhu, 2007). Fluoride can also leach into water from anthropogenic sources such as phosphate fertilizers and electronic waste materials (Arnesen, 1998).

Abundance of fluoride in water depends on several factors. Fluoride is readily available in water with lower Ca and higher Na. Anthropogenic inputs such as fertilization and farming activities can elevate the concentrations of fluoride in water (Totsche et.al 2004 and Gilpin, 1998). On the other hand, as a major component in acidic soils, iron hydroxides serve as an important sink for fluoride in soil resulting into the enhancement of fluoride concentration in water under acidic conditions (Zhu et.al 2006). Fluorine is not highly redox sensitive and therefore it occurs naturally as fluoride in a wide range of pH and under positive oxidation reduction potential (ORP). However it can be available as HF under strongly acidic conditions (Takeno, 2005).

II. Study Area

The Sudha Dam is construed on the Sita river at Ranapur, 4 km from the Bhoker. Bhoker is the hilly area and Tehsil place in Nanded district of Maharashatra. The dam is situated $19^0 15'$ latitude and $73^0 43'$ longitude. The catchment area of the dam is 106 sq.kms. The area covered by this project is about 175.385 hectares. This project is highly benefited by several villages along with Bhoker town.

The two maps showed the undertaken work is to Fig.1a show the location of sampling show in Nanded city which is located in Maharashatra and second one is Fig. 1b map show the location of sampling station show in Bhoker Taluka of Nanded district And also showing in the water sampling station S_1, S_2 and S_3.

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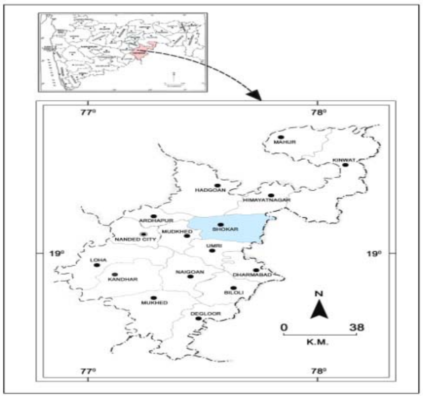
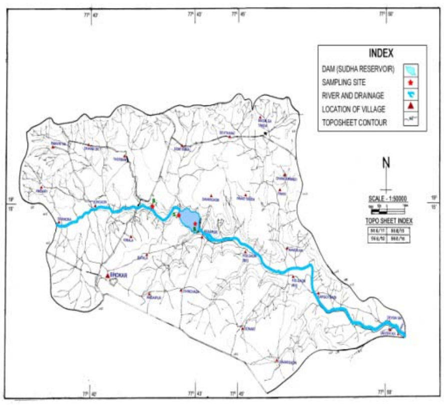


Map 1a : Location of Water Sampling Sites of Sudha dam.



Map 1b : Location of Water Sampling Station of Sudha dam.

The Sudha dam water is basically used for the purpose as drinking, domestic, irrigation and agriculture application and very rarely for small scale industries, factories etc. The water supplies to entire Bhoker city and near by several villages. More than 75,000 people get benefited from this dam.

III. Material and Methods

a) Water sample

The water samples were collected from Sudha dam, the sampling and the study was undertaken during January to December 2010. Water samples were placed in stoppered polythene containers, which were previously rinsed with portion of distilled water and water samples. The water samples were filtered immediately using filter paper properly labeled and maintained well. The chemical analysis was carried out by using the standard methods on spectrophotometer.

b) Experimental

All solutions were prepared with deionized water. Stock solution of the fluoride containing 1000 mg F- was used for preparation of the standards for the calibration curve. Fluoride concentration was determined by spectrophotometrically using SPANDS method. The procedure depends upon the principle that, under acidic condition fluoride reacts with zirconium reagent SPANDS solution and 'lake' (colour of SPAND reagent) gets bleached due to formation of ZrF_6. Since. Bleaching is a function of fluoride ions it is directly proportional to the concentration of fluoride. Zero absorbance was measured spectrophotometrically at 570 nm. Sudha dam water fluoride concentrations were calculated with the help of standard fluoride calibration curve. The temperature and pH was measured by using mercury micro thermometer and pH paper was on the water sampling sites. Further pH was measured by pH meter was calibrated for 4.0 and 9.2 buffer solution. (APHA 1992).

VI. Result and Discussion

The pH can be affected by chemicals in the water. It is an important indicator of water that is changing chemically (Ahipathy and Puttaiah, 2006). The variation in pH was from 7.2 to 7.6 at S_1, S_2 and S_3 during the sampling period. The temperatures were ranged from 20^0C -26^0C at S_1, S_2 and 21^0C - 26^0C at S_3. All values of pH and temperature were within the permissible limit.

Table1: Variation of Fluoride (mg/L) content of Sudha Dam water during January to December 2010.

Months	pH			Temperature			Fluoride		
	S_1	S_2	S_3	S_1	S_2	S_3	S_1	S_2	S_3
January	7.5	7.4	7.5	23	23	22	0.44	1.1	0.82
February	7.2	7.3	7.3	22	22	21	0.49	0.565	0.64
March	7.5	7.4	7.5	24	24	23	0.57	0.835	1.07

April	7.4	7.3	7.3	26	26	26	0.73	0.39	0.56
May	7.3	7.2	7.2	24	25	24	1.2	0.93	1.05
June	7.4	7.3	7.3	26	26	26	0.59	0.65	0.71
July	7.4	7.3	7.3	23	24	23	0.25	0.28	0.31
August	7.5	7.5	7.4	26	25	25	0.47	0.5	0.53
September	7.6	7.6	7.6	24	25	24	0.51	0.69	0.87
October	7.4	7.5	7.4	23	22	22	0.85	0.98	1.11
November	7.3	7.5	7.3	21	22	21	0.55	0.635	0.72
December	7.5	7.5	7.5	20	20	22	0.69	0.77	0.85

S_1, S_2, S_3 : *Sampling sites of sudha dam water.*

Fluoride analyses of the water during the study period are presented in Table 1. The concentration of fluoride was within the permissible limit. It ranged between 0.25- 1.2 mg/L at S_1, 0.28- 1.1 mg/L at S_2 and 0.31- 1.11 mg/L at S_3. The highest fluoride concentrations observed in the month of January, May and October were 1.1, 1.2, and 1.11 mg/L and the lowest concentration in the month of July 0.25 mg/L at S_1, 0.28 mg/L at S_2 and 0.31 mg/L at S_3.

Gautam et al (2011) found fluoride concentration between 0.6 to 0.9 mg/L and 0.07 to 0.9 mg/L from Kagina river of Gulburga district in post and pre-monsoon seasons respectively. Also they observed fluoride ranged from 0.3 to 0.6 mg/L and 0.1 to 0.9 mg/L from Krishna river of Bagalkot district, Karnataka in post and pre-monsoon seasons respectively.

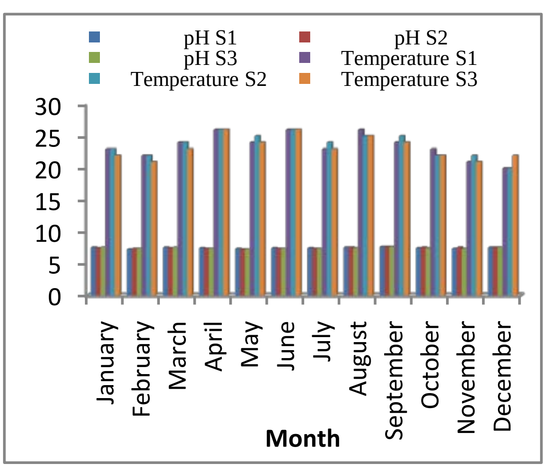


Fig. 2a : Values of pH & temperature level observed during Jan. to Dec. 2010.

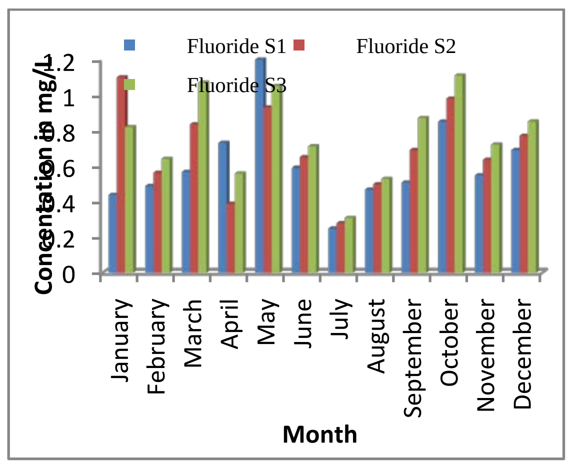


Fig. 2b : Values of Fluoride level observed during Jan. to Dec. 2010.

Rao et al (2001) obtained fluoride content ranged from 0.102 to 0.894 mg/L, 0.254 to 0.83 mg/L and 0.115 to 1.61 mg/L from western, eastern zones and BED village drinking respectively water ponds of Kolleru lake region during the period of three years. (Rao et al, 2001).

Akoto and Adiyiah (2007) Fluoride varied from 0.32 to 1.03 mg/L. Minimum (0.32 mg/L) and maximum (1.03 mg/L) concentration of F- was observed from Pruso and Fiaso villages respectively

AKM Fazlul Hoque et al (2003) studied Fluoride concentrations in 304 water samples from different sources ranges from 0.02 mg/L to 2.32 mg/L with a mean of 0.43 ± 0.40 mg/L.

Gikunju et. al (2002) observed fluoride levels in the river water samples showed only small zonal variations. The highest level was 0.85 ppm in Laikipia District and the lowest was 0.08 ppm in Murang'a District.

V. Conclusion

This study provides an overview of the fluoride content in dam water and show that is within the permissible limit of fluoride. The favorable factor which contributes to rise of fluoride in Sudha dam water is presence of fluoride rich rock system. The result of current study as well as other available data from water quality should be taken in to account when developing strategies for safe drinking water supplies.

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Oil Palm Waste-Sewage Sludge Compost as a Peat Substitute in a Soilless Potting Medium for Chrysanthemum

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Abstract - Co-composting oil palm wastes, particularly the empty fruit bunch (EFB), frond and trunk with sewage sludge could be potentially converted into value added product. The objective of this study was to determine the best formulation using oil palm wastes and sewage sludge in producing a composted material to be used as a potting media in horticulture. Shredded oil palm wastes (EFB, frond and trunk) were mixed with sewage sludge in 3 different ratios (1:0, 3:1 and 4:1 ratio) using a polystyrene box and adjusted to 60% moisture content. At week 12, oil palm trunk with sewage sludge at 4:1 ratio was found to be the most optimum compost as potting media for ornamental plants because of its texture suitable for potting media, not stringent or stiff, had high nutrient contents (2.05 % N, 0.640 % P, 1.39 % K, 0.705 % Ca, 0.229% Mg), pH 6.2 and low C/N ratio, 19. Oil palm trunk + sewage sludge compost (OPTSC) was used as as a complete or partial substitute to peat and possible enhancing effect with Agroblend and Grofas chemical fertilizer in the production of potted chrysanthemum. The design used was a randomized complete block design (RCBD) with 9 treatments, replicated 5 times giving a total of 45 pots.

Keywords : *oil palm waste, sewage sludge, soilless media, chrysanthemum.*

GJSFR-D Classification: *FOR Code: 900403*

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Strictly as per the compliance and regulations of:

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Abstract - Co-composting oil palm wastes, particularly the empty fruit bunch **(EFB),** frond and trunk with sewage sludge could be potentially converted into value added product. The objective of this study was to determine the best formulation using oil palm wastes and sewage sludge in producing a composted material to be used as a potting media in horticulture. Shredded oil palm wastes (**EFB**, frond and trunk) were mixed with sewage sludge in 3 different ratios **(1:0, 3:1** and **4:1** ratio) using a polystyrene box and adjusted to 60% moisture content. At week 12, oil palm trunk with sewage sludge at **4:1** ratio was found to be the most optimum compost as potting media for ornamental plants because of its texture suitable for potting media, not stringent or stiff, had high nutrient contents **(2.05 % N, 0.640 % P, 1.39 % K, 0.705 % Ca, 0.229% Mg), pH 6.2** and low **C/N** ratio, **19.** Oil palm trunk + sewage sludge compost **(OPTSC)** was used as as a complete or partial substitute to peat and possible enhancing effect with Agroblend and Grofas chemical fertilizer in the production of potted chrysanthemum. The design used was a randomized complete block design **(RCBD)** with 9 treatments, replicated 5 times giving a total of 45 pots. Three types of potting media were compared; peat + vermiculite **(3:1 w/w)** as standard medium, **OPTSC** and **OPTSC** + peat. In this study, potted chrysanthemum exhibited better vegetative growth (increase in lateral shoots, top dry weight and total leaf area) and flowering qualities (early buds and blooms production, higher number and bigger diameter of flowers) in **OPTSC** and **OPTSC** + peat potting media, than the standard medium. However both **OPTSC** and **OPTSC** + peat media performed similarly. Application of both Agroblend and Grofas, or Agroblend alone, produced similar growth performance with an increase in nutrient uptake and growth of the potted chrysanthemum. Therefore, it is concluded that **OPTSC** could be used as a soilless potting medium with Agroblend alone, for potted chrysanthemum, as a complete or partial substitute for peat with reduced fertilizer cost.

Keywords: oil palm waste, sewage sludge, soilless media, chrysanthemum.

I. Introduction

Traditionally choices of potting media that are available in the market are limited mainly to peat and red clay soils. Recent research has sought to identify alternatives to peat and focusing on reusable and recycling materials not derived from non-renewable sources such as peat bogs (Hadar et al., 1985; Raviv et al., 1986; Verdock, 1988). Many studies have reported that organic wastes composts, such as from sewage sludge (Piamonti et al., 1997; Perez-Murcia et al., 2006), municipal solid waste (Ostos et al., 2008), animal manure (Atiyeh et al., 2001; Eklind et al., 2001), green waste (Grigatti et al., 2007; Ribeiro et al., 2007) and agro-industrial waste (Baran et al., 2001; Garcia-Gomez et al., 2002; Papafotiou et al., 2004; Bustamante et al., 2008) can be used with very good results as growth media instead of peat. Malaysia a major exporter of oil palm with a planted area of more than 3.9 million hectares in year 2005, created more than 51 million tonnes of oil palm wastes particularly the empty fruit bunch **(EFB),** frond and trunk **(MPOB, 2006).** These renewable organic wastes have great potential to be used as raw materials in composting into fertilizer, organic soil additive and crop substrate due to their high nutrient composition, particularly K, which are essential for plant growth (Wingkis, 1999 and Mohammed, 2000). Chan et al. (1980) reported that moisture retained in EFB mulch provided good environment for root development and increased nutrient release and plant nutrient uptake. Oil palm wastes, particularly the EFB, fronds and trunks compost were reported to have many characteristics that are equal or superior to peat as growing media (Lin and Ratnalingam 1980). Another organic waste that needs to be disposed off is the sewage sludge. Malaysia produces 5 million cubic meters of domestic sludge. By the year 2022, the amount will be increased to 7 million cubic meters per year (Indah Water 1997). Sewage sludge contain significant amounts of macro and micronutrients such as N, and is suitable for composting and as potting media for horticulture plants, (Akhtar and Malik 2000; Lazzari et al.,2000; Barrena et al. 2005), due to its high organic matter content (50% to 70%) of the total solids content (Smith 1992 and Ingelmo 1998; Rosenani et al. 2008; Zubillaga 2001 and Perez et. al. 2006). Due to high moisture content, sewage sludges need to be mixed with dry materials (such as sawdust,vegetal remains, straw), which act as bulking agents, absorbing the moisture and providing the composting mass with an appropriate degree of sponginess and aeration (Sanchez Monedero et al. 2001; Iranzo et al. 2004; Tremier et al. 2005). Therefore, there is a potential for

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composting oil palm wastes with sludge to produce composts, physically similar to peat. The resulting compost should be fine textured, odourless, rich in macro- and micronutrients and with acceptable levels of heavy metals. It may partially or fully substitute peat in the normally used potting media for ornamental plants. This paper reports the results of a study with the following objectives: a) to determine the optimum formulation of oil palm wastes (EFB, frond or trunk) and sewage sludge to produce compost that is suitable for use in potting media, (b) to investigate the effectiveness of the selected oil palm waste-sewage sludge compost as a partial or complete substitution of peat in potting medium for crysanthemum.

II. Materials and Methods

This study involved a co-composting experiment to determine the most appropriate formulation of oil palm waste and sewage sludge that will produce good compost for use in soilless potting media for ornamentals. Sewage sludge is a good N-source and is an easily available resource Co-Composting of oil palm wastes-sewage sludge The experiment was conducted in a glasshouse (28-31oC) and laid-out in a randomized complete block design using a white polystyrene box measuring 0.6 m in length, 0.5 m in width and 0.4 m in height. The treatments for this experiment consisted of EFB, frond and trunk, and each was mixed with sewage sludge in 3 different ratios (v:v), i.e. 1:0 (control), 4:1 and 3:1 with 5 replicates. Several whole EFB's, trunk chips and fronds were collected from an oil palm plantation, Durian Estate, Golden Hope Sdn Bhd, Selangor. They were first manually chopped into small pieces and then shredded with a mechanical shredder into smaller pieces of 6-10 cm to hasten composting process. Dewatered sewage sludge was collected from Indah Water Konsortium (IWK) wastewater treatment plant. The chemical compositions of the oil palm wastes and sewage sludge used in this experiment were as given in Table 1. Composting method was done according to Kala et al. (2009). At the end of 12 weeks of composting, samples were analysed for chemical properties (pH, total N, total C and macronutrients and heavy metals concentration).

III. Compost Characteristics After 12 Weeks

Results on composting of oil palm wastes (EFB, frond and trunk) with sewage sludge are published in Kala et. al. (2009). In this study, it was observed that the compost did not reach thermophilic stage (> 45^{o}C). This could probably be due to the dissipating of heat due to small volume. After 12 weeks, composts with added sludge had darker colour compared to the controls. The trunk+sludge composts had finer particle size similar to peat (< 20 mm)compared to the EFB and frond + sludge composts which were still fibrous with long strands (> 40 mm) and did not look matured. Final compost of oil palm wastes + sludge had total N content ranging from 1.18 to 2.05 % which was more than the recommended level by CEC (1986) for compost (0.6 % N). Phosphorus concentration was highest in the frond composts, F3:1 (1.025 %) followed by trunk compost, T3:1 (0.885 %). Generally, K concentration in this study was more than the recommended level by CEC (1986) in compost (0.3 % K). The percentage of K was highest in the EFB compost E3:1 (4.03 %). This could be due to the initial higher K in EFB than the frond and trunk. Calcium concentration was higher in composts with sewage sludge than the controls. This could be due to higher Ca content of sludge compared to the oil palm wastes. The Ca content was significantly higher ($p<0.05$) in the trunk + sludge composts, T3:1 and T4:1 (0.705 and 0.635%, respectively) followed by the frond + sludge compost, F3:1 and F4:1 (0.523 and 0.477%, respectively). However, the Ca and Mg content in this study was less than 2.0 and 0.3% respectively, which is the recommended level by CEC (1986). The trunk composts, T3:1 and T4:1 had Mg concentration of 0.237 and 0.229 %, respectively. The frond compost, F3:1 and F4:1 had 0.207 and 0.182 % Mg concentration, respectively. The composts, F1:0, F4:1 and T1:0 had lower Mg content than the other composts. Generally, addition of sludge to oil palm wastes had significantly increased the heavy metal contents of the oil palm wastes + sludge composts compared to the control due to the higher heavy metal contents in sewage sludge. Compost mixtures with 3:1 ratio had higher Pb, Zn and Cd concentrations than 4:1 ratio but were within the recommended level by CEC (1986), for compost.

IV. Use of Compost in Potting Media for Chrysanthemum

Oil palm trunk with sewage sludge compost (OPTSC) at 4:1 ratio was found to be the most optimum as potting media for ornamental plants because of its texture suitable for potting media, not stringent or stiff, had high nutrient contents (2.05 % N, 0.640 % P, 1.39 % K, 0.705 % Ca, 0.229% Mg), pH 6.2 and low C/N ratio, 19. Therefore three types of potting media were compared; peat + vermiculite (standard medium), OPTSC (as a complete substitute to peat) and OPTSC + peat (as a partial substitute for peat) (Table 2). These experiments were carried out under rain shelter at Universiti Putra Malaysia, Serdang, Selangor. The design used for this study was a randomized complete block design (RCBD) with 9 treatments, replicated 5 times giving a total of 45 pots. Treatments also included different rates of foliar and slow release fertilizers, to investigate if fertilizers could be reduced with the use of OPTSC. Data obtained in this study were subjected to analysis of variance (ANOVA). Where a significant F value ($p<0.05$) was obtained, Duncan's multiple range test was carried out to test for differences between the treatments means. The chemical characteristics of the three types of potting media are given in Table 3. Three rooted chrysanthemum cuttings were planted into a pot of 15.2 cm diameter. The plants were exposed to artificial long days for the first four weeks using 5 florescent Truelight® bulbs placed approximately 1 m above the pots. Long days were used to maintain vegetative growth by switching on the lights from 2300 hour to 0200 hour every night, controlled by a timer. To allow more side shoots, the terminal buds were pinched two weeks after commencement of the long days. A growth retardant, B-nine at the rate of 2500 mg/L was sprayed on the 37th day. Short day treatment was imposed four weeks after planting by covering with black polyethylene plastic. The treatment was from 1830 hour to 0830 hour every day until the flower buds start to show colour. The plants were watered twice daily using a sprinkler system. Foliar fertilizer, Grofas® was prepared in solution and sprayed weekly from day one. A slow release fertilizer, AgroBlend® (16:8:9:36+ MgO) was applied on the first and 8th week after planting. Insecticide and fungicide were sprayed weekly. The insecticide used was Ambush® (15-20 mL/4.5 L) and the fungicide used was Benlate® (1.5-3.0g/4.5 L). Weeds in the pots and the surrounding were controlled by hand weeding. Plant growth parameters measured during growth are as below. Plant height was measured weekly from the start until there was no change in plant height at the end of experiment (120 days after planting). It was measured from the soil surface to the shoot tip. The diameter of plant top was measured divided by the height of tallest stem for each plant and was recorded weekly as diameter : height ratio. Number of days to first visible bud was counted from the start of the short day treatment to the visible bud stage. Number of days to first bloom was taken as the days from the start of short day to the first opening of the outer most floret of the first flower in each pot. Number of bloomed flowers per pot was counted before harvest. Flower diameter was recorded as the average diameter of ten biggest flowers at harvest. All leaves that were fully opened were plucked to measure leaf areas using an automatic leaf area meter LI-COR Model LI-3100 and recorded as total leaf areas. Chrysanthemum plants were taken out from the media at the end of the experiment. The root was separated from the plant and washed to remove soil. The fresh weights of the plant (leaf, flowers and stem) and the root were recorded. These samples were oven-dried at 60 to 65°C for 48 hours to determine the dry matter weight (DMW). Leaf samples from first to fourth leave of the plant, when the flower bud first bloomed (Jones et al., 1991), were taken for foliar analysis. The leave samples were oven-dried at 60 to 65 °C until no changes were seen in the dry matter weight before grinding. Total N was determined by Kjeldahl digestion of 0.1 g sample with concentrated H_2SO_4 (Bremner and Mulvaney, 1982) and the solution was analyzed for N by an auto analyzer. Phosphorus, K, Ca and Mg contents were determined by dry ashing method. Briefly, 0.25 g of plant tissue was weighed and placed into a muffle furnace and temperature in the furnace was set at 500oC for 5 hours. The ash was moistened with distilled water and 2 ml of concentrated HCl was added and were heated on a hot plate at 100°C for an hour. Then, 10 ml of 20 % of HNO^3 was added and the sample was digested at 100oC in a water bath for an hour. The solution was then filtered and analyzed for P, K, Ca and Mg cations. Calcium and Mg were analyzed in the presence of Lanthanum chloride (1000 ppm). From the digest P content was read by the auto-analyzer while K, Ca and Mg by atomic absorption spectrophotometer (AAS).

V. Results and Discussion

Chemical characteristics of potting media Addition of peat to OPTSC (3:1 w/w) in the growth media did not lead to substantial changes in its chemical characteristics, the only important effect being a slight lowering of the pH (Table 4). According to Bunt (1988) the optimal pH range of media and mixes for growing ornamental plants in container is 5.2 to 6.3. Total C content was over 28% in peat, 32% in OPTSC and 41% in OPTSC + peat; by contrast, total N in both OPTSC and OPTSC + peat more than doubled that of peat, though never exceeding 3%. The C/N ratio is widely used as an indicator of the maturity and stability of organic matter. In this experiment C/N ratio were 18.96, 23.25 and 34.36 in OPTSC, OPTSC + peat and peat potting media, respectively. Davidson et al (1994) reported that composts with a C/N ratio of less than 20 are ideal for nursery plant production. Ratios above 30 may be toxic, causing plant death (Zucconi et al.,1981). Peat growth medium had significantly highest Mg and Ca, but lowest K concentration when compared to OPTSC and OPTSC + peat media. The heavy-metal content in three potting media were within the recommended levels of CEC (1986) in compost.

VI. Vegetative and Flowering Growth Performance of Chrysanthemum Plant

Effects of potting media i.e, standard peat, OPTSC and OPTSC + peat with different combinations of fertilizers on plant growth and flowering of potted chrysanthemum are shown in Table 5. Plants in this experiment ranged from 23.5 to 28.3 cm which tended to lodge and had to be supported. According to Crater, (1992) an ideal height for potted chrysanthemum is approximately 2 to $2^{½}$ times the height of the pot. However the standard peat medium had a plant height of 27.2 cm with weak and slender stems. Therefore it is suggested that the plants should be pinched twice to reduce plant height and increase lateral shoots. According to Crater (1992), several cultivar of potted chrysanthemum is too sensitive to heat therefore plant height could not be controlled. Selecting heat tolerant varieties would be more feasible. However plants in OPTSC and OPTSC + peat potting media treated with Grofas only (foliar fertilizer) had retarded growth (23.5 and 23.8cm, respectively) and did not have many lateral shoots. This could be due to inadequate supply of macronutrient from foliar fertilizer for the vegetative growth. Plants grown in the standard peat medium took the longest time for the appearance of first visible bud (34 days) compared to other treatments which ranged from 22 to 25 days. According to Machin (1978), insufficient nutrient or unbalanced nutrient can delay buds and flower formation by a week or ten days. In this study however, peat growth medium had significantly highest Mg and Ca, but lowest K concentration when compared to OPTSC and OPTSC + peat media. Chrysanthemum plants in OPTSC and OPTSC + peat potting media were the earliest to produce first blooms (46.0 days) compared to the standard peat medium which took 66 days. These composts media also produced higher number of bloomed flowers (30 to 63) compared to the standard peat medium which produced smaller and the least number of bloomed flowers (14) despite applications of both fertilizers. Actually, the standard peat medium produced many buds but only a few bloomed at the time of harvest. According to Crater (1992) potted chrysanthemum which is suitable for sale should have qualities such as free from diseases and insects, bushy with dark green foliage, with a full, white, actively growing root system and a minimum of 20 to 25 flowers of good size. Salinger (1987) reported that high absorption of nitrogen and potassium occurs during early vegetative growth in chrysanthemum. Higher nutrient contents (N, K and micronutrients) in OPTSC, which slowly mineralized and released nutrients in the long term, could be the reason for their higher yields. Moreover these potting media also exhibited higher top dry weight and total leaf area compared to peat medium. Peat is in a stable form; therefore it does not mineralize and provide additional nutrients to plants like the compost. However the performance (vegetative and flowering) of potted chrysanthemum in OPTSC and OPTSC + peat potting media, were significantly influenced by the application of chemical fertilizers, Agroblend (slow release fertilizer) and Grofas (foliar fertilizer). The effect of Agroblend and both Agroblend and Grofas, on plant performance were similar and better compared to half the recommended concentration of these fertilizers in OPTSC and OPTSC + peat media. However the application of Grofas only, had negative effects on the potted chrysanthemum; stunted growth, late blooms, decreased number of flowers, flower diameters, top dry weight and leaf areas. These observations were similar to potted chrysanthemum grown on standard peat media.

VII. Foliar Nutrient Contents

There were significant differences ($p<0.05$) in foliar total nitrogen concentration between the treatments (Table 6). Foliars in OPTSC and OPTSC + peat medium with the application of Agroblend only had the highest nitrogen concentration compared to others. However, foliars in the standard peat medium, OPTSC and OPTSC + peat with application of Grofas only had lower than the recommended nitrogen concentration which is 4.0 to 6.0 % (Tandon, 1993). This explains the yellowing followed by necrosis of the leaves. The recommended foliar phosphorus concentration in chrysanthemum plants was 0.25 to 1.0 %. Chrysanthemum foliars in all the treatments studied had phosphorus within the recommended concentration. According to Eysinga et al. (1980), when potassium is below the recommended concentration (< 4.0 %) in chrysanthemum plant foliar/tissue, necrosis of older leaves occurs and longer time will be taken for the appearance of first visible bud and flowering. These symptoms in foliar were found in treatments which may be due to inadequate K supplied by foliar fertilizer (Grofas) only. There were significant differences ($p<0.05$) in foliar calcium concentration of chrysanthemum plant between the treatments. The recommended foliar calcium concentration is 1.0 to 2.0 %. However in all the treatments except the standard peat medium, OPTSC and OPTSC + peat medium with application of Grofas fertilizer alone, had Ca concentrations ranging from 1.08 to 1.20 % which is within the recommended level. According to Eysinga et al. (1980), lower concentration of Ca in chrysanthemum plants (< 1.0 %) will result in reduced flower diameter, petals not properly formed and the colour changing from yellow to brown. There were significant differences ($p<0.05$) in foliar magnesium concentration of chrysanthemum between the treatments. However foliars in the standard peat medium, OPTSC and OPTSC + peat media with the application of Grofas only, had lower Mg concentrations ranging from 0.212 to 0.244 %. The recommended Mg concentration in foliar is 0.25 to 1.0 %. According to Salisbury and Cleon (1991), lower concentration of magnesium causes yellowing of older leaves. These symptoms were observed in the treatments with application of Grofas (foliar fertilizer) only, where supply of Mg could be insufficient. There were significant differences ($p<0.05$) in foliar iron (Fe), manganese (Mn) and zinc (Zn) concentrations in the chrysanthemum plant between the treatments (Table 7). All the treatments in the OPTSC potting medium had lower foliar Fe concentration in chrysanthemum plants compared to the other treatments. This results is contrast to the Fe concentration in the original OPTSC potting media, (6310 mg.kg-1), which is lower than peat

(2398 mg.kg-1). According to Tandon (1993), chrysanthemum plants show toxicity symptoms when iron concentration is more than 250 mg.kg-1. However, no toxicity symptoms such as stunted growth or severe leaf chlorosis were seen in this experiment. Foliars in all the treatments had manganese concentration within the recommended concentration of manganese in chrysanthemum plants by Tandon (1993). However no toxicity symptoms, (clorosis of younger leaves) were found in chrysanthemum foliar where concentration of manganese was more than 250 mg.kg-1. The foliar zinc concentration in this study ranged from 306 to 442.8 mg.kg-1, more than the recommended zinc concentration (20 to 250 mg.kg-1) for chrysanthemum plants, except for the standard peat media (60 mg.kg-1).

VIII. Conclusions

The trunk + sludge compost (4:1) was selected to be the most ideal for use as a potting media for chrysanthemum. The trunk composts had finer particle size similar to peat. However the final composts of EFB and frond + sludge were still fibrous with long strands and did not look matured. The EFB and frond composts may need to be composted more than 12 weeks to achieve finer particle size. Total N and Ca contents were highest in the trunk + sludge compost at week 12. The P and K contents were also fairly high. The pH, C/N, macronutrients and micronutrients were within the recommended levels of (CEC, 1986) in compost. Potted chrysanthemum gave better vegetative growth (increase in top dry weight and total leaf area) and flowering qualities (early to produce buds and blooms, higher number of flowers and bigger flower diameters) in oil palm trunk compost (OPTSC) and OPTSC + peat potting media, than the standard peat medium. However both OPTSC and OPTSC + peat media performed similarly. A proper fertilization program is essential in the production of potted chrysanthemums. In general the application of both slow release fertilizer (Agroblend) and foliar fertilizer (Grofas), and Agroblend alone, produced similar growth performance of the potted chrysanthemum plants. Addition of fertilizers had also influenced the nutrient uptake and growth of the potted chrysanthemums. Application of Grofas alone did not produce good vegetative growth and flowering qualities of potted chrysanthemum. This seemed to indicate that the combined effect of Agroblend and Grofas seemed to give beneficial effect of Agroblend alone and not the latter. Thus, it is recommended that use of 100 % of oil palm trunk + sewage sludge compost with Agroblend alone, could be used in the production of potted chrysanthemum with reduced fertilizer cost. Therefore, it is concluded that oil palm trunk + sewage sludge compost could be used as a soilless potting medium for chrysanthemum, as a complete or partial substitute for peat. This would convert oil palm waste into a value-added product and provide an alternative disposal method for sewage sludge in Malaysia.

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Table 1 : Chemical characteristics of the raw materials used for the composting experiment (n=3).

Parameter	EFB	Frond	Trunk	Sludge
pH	7.30 a	6.70 a	6.80 a	5.24 b
C %	50.87 a	52.28 a	52.18 a	37.41 b
N %	1.10 b	0.75 c	0.77 c	2.82 a
C/N	46.25 b	69.71 a	67.77 a	13.26 c
Ca %	0.17 b	0.17 b	0.15 b	0.83 a
Mg %	0.13 a	0.12 a	0.13 a	0.09 b
K %	2.06 a	1.63 b	1.46 c	0.08 d
P %	0.11 b	0.08 b	0.05 c	0.63 a
Pb (mg.kg^{-1})	7.67 b	7.37 b	5.33 b	68.00 a
Cd (mg.kg^{-1})	1.30 b	1.33 b	0.56 c	3.50 a
Mn (mg.kg^{-1})	42 b	47 b	39 b	257 a
Zn (mg.kg^{-1})	37 b	38 b	94 b	1322 a
Fe (mg.kg^{-1})	1076 b	1090 b	51 b	19000 a
Cu (mg.kg^{-1})	8 b	9 b	13 b	178 a

Means with different letters within the row indicate significant differences ($p<0.05$) using Duncan's Multiple Range Test.

EFB - *Empty fruit bunch.*

Table 2 : Treatments comparing three types of potting media i.e, standard peat, OPTSC and OPTSC + peat with different combinations of fertilizers.

Treatments	Ingredients
P+V+Ag+Af	Peat:vermiculite (2:1) +15 g Agroblend* +15 ml Grofas^
OPTSC+Ag+Af	OPTSC + 15 g Agroblend +15 ml Grofas
OPTSC+ Ag	OPTSC + 15 g Agroblend
OPTSC + Af	OPTSC + 15 ml Grofas
OPTSC+½Ag+½Af	OPTSC + 7.5 g Agroblend + 7.5 ml Grofas
OPTSC+peat+Ag+Af	OPTSC + peat +15 g Agroblend +15 ml Grofas
OPTSC+peat+Ag	OPTSC + peat + 15 g Agroblend
OPTSC+peat+Af	OPTSC + peat + 15 ml Grofas
OPTSC+peat+½Ag+½Af	OPTSC + peat + 7.5 g Agroblend + 7.5 ml Grofas

Agroblend* (Ag) - slow release fertilizer.
Grofas ^ (Af) - foliar fertilizer.
OPTSC -{oil palm trunk + sludge (4:1) w/w}.
OPTSC + peat (3:1 w/w).

Table 3 : Chemical characteristics of the oil palm wastes (E=EFB, F=frond and T=trunk) and sewage sludge at different ratios (1:0, 3:1 and 4:1) after 12 weeks of composting (n=5).

Parameter	$E_{1:0}$	$E_{3:1}$	$E_{4:1}$	$F_{1:0}$	$F_{3:1}$	$F_{4:1}$	$T_{1:0}$	$T_{3:1}$	$T_{4:1}$
pH	6.9 a	6.7 a	6.9 a	6.1 b	5.8 c	6.0 bc	6.3 b	6.1 b	6.2 b
Vol. red.	19.7 b	44.9 a	47.0 a	12.6 c	18.2 b	18.8 b	10.6 d	15.6 b	14.8 bc
N %	1.48 e	1.78 c	1.93 b	1.22 f	1.63 d	1.45 e	1.18 f	2.04 a	2.05 a
C/N	32.6 b	21.83 cd	22.16 cd	41.5 a	29.67 b	24.6 c	41.24a	19.0 d	18.98 d
Ca %	0.320 g	0.440 e	0.420 e	0.350 f	0.520 c	0.489 d	0.287 h	0.645 b	0.702 a
Mg %	0.260 c	0.40 a	0.330 b	0.180 f	0.220 e	0.180 f	0.160 f	0.250 d	0.230 d
K %	2.11 bc	4.03 a	2.36 b	1.89 cd	2 21 bc	2.05 bc	1.32 f	1.66 de	1.39 ef
P %	0.428 e	0.585 d	0.469 e	0.444 e	1.025 a	0.808 c	0.330 f	0.885 b	0.64 d
Pb (mg.kg^{-1})	9.35 h	62 a	34.73 b	9.97 h	29.0 d	26.35 f	15.33 g	33.19 c	26.35 e
Cd (mg.kg^{-1})	1.53 e	3.9 a	3.43 b	2.0 d	3.32 b	2.97 c	0.96 f	2.78 c	1.63 e
Mn (mg.kg^{-1})	46.1 c	108 a	99.43 ab	52.8 c	98.46 ab	84.85 b	46.88 c	87.97 b	92.64 b
Zn (mg.kg^{-1})	112 g	881 a	723 c	66 h	675 d	495 e	188 f	829 b	671 d
Fe (mg.kg^{-1})	3163 cd	7335 a	5322 ab	1201 d	5239 ab	4692 bc	1205 d	6794 ab	6310 ab
Cu (mg.kg^{-1})	17.88 d	68.31 b	67.63 b	9.5 f	53.33 b	52.33 b	14.67 e	78.6 a	68.83 b

Vol. red - volume reduction.

Means with different letters within the row indicate significant differences ($p<0.05$) using Duncan's multiple range test.

Table 4 : Chemical characteristics of potting media involved in this study (n=3). Different letters indicate significant differences ($p<0.05$) using Duncan's multiple range test.

	Peat	OPTSC	OPTSC+ Peat (3:1w/w)
pH	5.83 a	6.20 a	5.90 a
C (%)	28.86 b	32.78 b	41.39 a
N (%)	0.84 c	2.04 a	1.78 b
C/N	34.36 a	18.96 c	23.25 b
P (%)	0.67 a	0.65 a	0.75 a
K (%)	0.07 c	1.40 a	0.71 b
Mg (%)	0.85 a	0.24 b	0.46 b
Ca (%)	1.53 a	0.70 c	0.96 b
Fe (mg kg^{-1})	2389 c	6310 a	3922 b
Mn (mg kg^{-1})	31 b	93 a	88 a
Zn (mg kg^{-1})	20 c	671 a	240 b
Pb (mg kg^{-1})	13 c	27 b	37 a
Cd (mg kg^{-1})	0.15 c	1.63 a	0.95 b
Cu (mg kg^{-1})	8.09 a	6.90 b	6.80 b

Table 5 : Effects of potting media i.e, standard peat, OPTSC and OPTSC + peat with different combinations of fertilizers on plant growth and flowering of potted chrysanthemum. Different letters in columns indicate significant differences ($p<0.05$) between treatment means in Duncan's multiple range test.

Treatment	Plant Height (cm)	D:H	First Visible bud (days)	First bloom (days)	Bloomed flowers/pot	Flower Diameter (cm)	Total Leaf Area (cm^2)	Top Dry Matter Weight g/pot	Root Dry Matter Weight g/pot
P+V+Ag+Af	27.2 ab	0.709 d	34.4 a	66.0 a	14 f	5 f	399 c	8.5 c	2.24 b
OPTSC+Ag+Af	26.4 b	1.070 a	23.4 bcd	47.8 bc	55 cd	5.8 bc	815 ab	17.2 ab	2.74
OPTSC+ Ag	27.2 ab	0.880 bc	23.0 cd	46.2 d	63 a	5.6 cd	857 ab	18.0 a	2.77
OPTSC + Af	23.5 c	0.780 d	23.0 bcd	48.4 bc	30 e	5.4 def	387 c	8.4 c	2.78
OPTSC+½Ag+½Af	26.2 b	0.904 bc	22.6 cd	47.9 bc	53 d	6.0 ab	678 b	14.7 b	2.82
OPTSC+peat+Ag+Af	28.3 a	0.958 ab	23.8 bc	47.6 bc	61 ab	6.2 a	922 a	19.23 a	2.80
OPTSC+peat+Ag	28.2 a	0.828 bcd	22.2 d	46.2 d	57 bcd	5.5 cde	665 b	15.2 b	2.82
OPTSC+peat+Af	23.8 c	0.690 d	25.0 b	48.6 b	30 e	5.2 ef	378 c	7.1 c	2.74
OPTSC+peat+½ Ag+½Af	26.4 b	0.796 cd	23.8 bc	47.4 c	59 abc	5.8 bc	755 ab	14.8 b	2.76

Table 6 : Effects of potting media i.e, standard peat, OPTSC and OPTSC + peat with different combinations of fertilizers on foliar nutrient concentration (%) in chrysanthemum plant. Different letters in column indicate significant differences ($p<0.05$) in between treatment means in Duncan's multiple range test.

Treatment	Total N	Total P	Total K	Total Ca	Total Mg
	----------	----------	%	----------	----------
P+V+Ag+Af	3.34 e	0.240 d	4.93 a	0.987 bc	0.212 f
OPTSC+Ag+Af	4.61 a	0.355 a	4.95 a	1.20 a	0.366 a
OPTSC+ Ag	4.25 cd	0.300 bc	4.43 b	1.15 ab	0.273 de
OPTSC + Af	3.28 e	0.247 ab	3.27 e	0.971 c	0.231 ef
OPTSC+½Ag+½Af	3.98 d	0.315 ab	4.11 c	1.08 abc	0.296 cd
OPTSC+peat+Ag+Af	4.49 ab	0.330 ab	4.49 b	1.19 a	0.348 ab
OPTSC+peat+Ag	4.34 bc	0.295 bc	4.34 bc	1.13 abc	0.330 abc
OPTSC+peat+Af	3.49 e	0.257 cd	3.59 d	0.985 cb	0.244 ef
OPTSC+peat+½ Ag+½Af	4.1 cd	0.295 bc	4.11 c	1.07 abc	0.314 bcd

Table 7 : Effects of potting media i.e, standard peat, OPTSC and OPTSC + peat with different combinations of fertilizers on foliar micronutrient concentration (%) in chrysanthemum plant. Different letters in column indicate significant differences ($p<0.05$) in between treatment means in Duncan's multiple range test.

Treatment	Fe	Mn	Zn
	----------	$mg.kg^{-1}$	----------
P+V+Ag+Af	455 a	68 f	60 e
OPTSC+Ag+Af	317 c	387 a	442 a
OPTSC+ Ag	301 c	243 c	388 ab
OPTSC + Af	307 c	128 e	342 bc
OPTSC+½Ag+½Af	382 c	277 b	428 a
OPTSC+peat+Ag+Af	471 a	171 d	313 c
OPTSC+peat+Ag	434 a	170 d	396 ab
OPTSC+peat+Af	341 bc	79 f	207 d
OPTSC+peat+½ Ag+½Af	427 ab	129 e	306 c

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2. Ethical Guidelines,

3. Submission of Manuscripts,

4. Manuscript's Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

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Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.
- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.

- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

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Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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