ISSN NO. 2320-5407

Journal homepage:http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

Resource use efficiecncy of rainbow trout production under one village one product in Nuwakot –Rasuwa corridor , Nepal.

Surya Mani Dhungana[1], Prof. Jay Prakash Dutta[2] and Shiv Chandra Dhakal[1]

1 Assistant professor, Faculty of Agriculture, Agriculture and Forestry University,Rampur, Chitwan,Nepal.

2 Professor , Faculty of Agriculture, Agriculture and Forestry University, Rampur, Chitwan,Nepal.

Manuscript Info *Abstract*

Manuscript History:

Received: 14 January 2016
Final Accepted: 19 February 2016
Published Online: March 2016

Key words:
Rainbow trout, stage of production and decrease return to scales

Corresponding Author

Surya mani Dhungana (afusmd@yahoo.com)

A survey was carried out to assess the resource use efficiency of Rainbow Trout production under one village one program in Nuwakot -Rasuwa corridors, Nepal 2013. Two hundred of Rainbow Trout farmers were completely enumerate. No of economically active family members were found 3.56±0.18. The study revealed that in study area was 72% respondents have sufficient for food access to their household. The survey studies showed that 64 % respondent were worse livelihood situation before joining one village one program. Credit, seed /fingerling, access to food all around year, self-employment, training, production, increase household income and value adding technology were the major influencing factor of one village one program. It was found that 42 % of respondent increased household income and produce Rainbow Trout after joining the one village one program. The result showed that the cost of feeding accounted for the largest proportion (24.53%) of the total cost of Rainbow Trout production, followed by cost of labor (22.79%).The fingerlings cost and other input cost accounted for 12.7% and 7.87% of the total cost respectively. The rate of return on investment was 0.33 implies. The result shows that value of output of Rainbow Trout was best estimated using the linear function, which explained 96.5% of the total variation in the values of output of Rainbow Trout production. The total sum of elasticity of production of the significant variables, 0.932 was less than unity. This suggests that fish production in the study area had a decreasing return .This shows that production occurred among fish farmers in the study in stage 2, a rational stage of production.

Copy Right, IJAR, 2016,. All rights reserved.

Introduction:-

Aquaculture has emerged as potentially an important sector of Nepalese agriculture. The potential for increasing production through culture based activities is encouraging. Presently, it contributes about 0.89% to GDP, 2.68% in AGDP with Per capita fish production of about 1.7 kg and about 76200 people or around 3% of the total populations are estimated to be directly benefited from aquaculture and fisheries activities in the country (Country Profile, 2007). The Nepal Agriculture Perspective Plan (APP) has categorized Nepal fishery a small but important and promising sub sector of agriculture in the country (DoFD, 2006). Rainbow Trout (*Oncorhynchusmykiss*) is widely cultivated cold water salmonid throughout the temperate world (Bardach*et al*., 1972). In Nepal, its farming practices have recently been started to adopt (Rana, 2007 a). Rainbow Trout (*Oncorhynchusmykiss*) is one of the most suitable fish to cultivate in cold waters though Trout farming in Nepal is a new endeavour. (Bardach*et al*., 1972). Rainbow Trout culture in Trishuli is being practiced in water coming down from glaciers, whereas spring water is used in Godavari station. (Nepal *et al.,* 2002).Commercialization brings product into the market for business. However, understanding the ways how a product could be commercialized is highly interesting field of study. Recently, farming of trout (*Oncorhynchusmykiss*) has shown promising results (Rana, 2007a,) and prospects in hills and mountains of Nepal, having possibilities of multiplier impacts. The concept of "One Village One Product" is

originated from Japan and has been implemented to promote commercialization of local products in Thailand, Philippines and other countries. Recently, Government of Nepal has declared Rasuwa and Nuwakot districts as trout growing district, under "One Village One Product" (AEC,2008). The demand for fish product has been increasing over time significantly. Increasing fish productivity as well as total production in country is a challenging task and necessary in order to provide for increasing demand for fish as food without increasing import from neighboring countries.

Nepal has a comparative advantage compared to most countries in the region given the colder climate in the mountains and mid-hill regions. Rainbow Trout has a high potential in especially the mid-hill region, where other income sources are limited. Both domestic and regionally there is a high demand for this valuable fish and there is plenty of opportunities to tap into this market. However, there are a number of constraints and issues that need to be taken into account in development of trout culture. At present, production technology has been developed and verified in farmers' raceways. To date private sector involvement is limited. However, the private farmers are attracted towards trout farming in Nuwakot and Rasuwa districts.

In absence of sufficient information about resource allocation for production of rainbow trout, the farmers of this district are devoid of remunerative profit of their product. Population growth, external demand and increased consumption in hotels are the reasons for high demand of Rainbow Trout. It is, therefore, necessary to identify different production constraints to boost up Rainbow Trout production. Hence this research was carried out to analyses resource use efficiency and farmer perception and effectiveness of OVOP. It strongly believes that economic development programs linked with rural communities particularly focusing on the agriculture and potential employment generating economic activities have got to be the major program thrust areas for Nepal. However, its impact on these areas was not known and no effort had been made to evaluate the program and its activities hence creating an information gap that needed to be filed. In spite of the government's efforts to address the issue of food insecurity, the problem still remains unabated. This study, therefore, intended to assess the perception of the OVOP program on household level and resource use efficiencies of Rainbow Trout production.

Research methodologies:-

The research was conducted Nuwakot-Rasuwa corridors, central hill of Nepal, where government programme "one village one product" has been implemented for Rainbow trout. All Rainbow trout farmer under OVOP since inception were interviewed. Pretested semi-structured interview schedule was used for collection of primary information. The major variables included in interview schedule were households' socio-economic characteristics, farm characteristics and production, livelihood situation and farmers' perceptions. The field survey was conducted since June, 2013.

Economics of Rainbow Trout production and Resource use efficiency:-

For analyzing the cost of production, the variable cost items and fixed cost items wereconsidered. The variable cost included the farm expanse fingerling feed labor chemical and medicine, interest on variable cost etc. The fixed cost was calculated adding the depreciation cost, raceways rent etc.

Total cost = $\sum$ cost for the entire variable input + $\sum$ cost for all the fixed input.

Estimating cost was exclusively necessary for enterprising costing and subsequently determining the viability of the enterprise from the point of view of farm families. The Rainbow Trout farmers under OVOP had to incur costs for different inputs. Farmers purchased some inputs and some were home supplied. In order to examine resource use efficiency on Rainbow Trout production, regression analysis technique was used. The multiple regression models were employed to determine factors on the fish output level. The production response function model was expressed implicitly according to Mbanasor and Obioha (2003) thus the model is specified as follows Production functions for the farm as a whole was estimated.

The linear and Cobb-Douglas forms of production functions were fitted and former one were used because of higher coefficient of multiple determination (R^2) and, retaining more number of significant explanatory variables to calculate marginal value productivities as indicator of resource use efficiency in each category of farm. The forms of production functions used were:

(i) Linear : $Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5^{+} b_6X_6 + \mu$

(ii) Cob-Douglas: $Y = aX_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} X_6^{b_6} e^{\mu}$

Where, Y = total value product in (NRs)

X_1= value of fingerling costs (NRs) X_2= value of feeding costs (NRs)
X_3= value of labor incurred (NRs) X_4= value of other input cost (NRs)
X_5= depreciation value (NRs) X_6= size of raceway in M^2
μ= error terms

Estimation of marginal value products (MVP_s):-

The marginal value products (MVP_s) of the resources were estimated by multiplying the average value product (AVP) of a resource with its elasticity of production. The actual mechanics of estimating MVPs is described below:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5^{+} b_6X_6 + \mu \quad (1)$$

Partial derivative of Y with respect to X_1 is $\frac{\partial Y}{\partial X_1} = b_1$ … (2)

By definition, $\frac{\partial Y}{\partial X_1}$ = marginal value product of X_1 (MVP_{X1}) and

$\frac{Y}{X_1}$ = average value product of X_1 (AVP_{X1})

Thus, MVP_{X1} can be obtained by multiplying its elasticity of production (b_1) with its AVP at geometric mean level of both Y and X_1.

In general, for the i^{th}resource$AVP_{Xi} = \frac{\overline{Y}}{\overline{X}_i} MVP_{Xi} = b_iAVP_{Xi}$

Where, $\overline{Y}$ = Geometric mean value of Y $\overline{X}_i$ = geometric mean value of X_i

Indexing:-

Perceptions about Rainbow Trout under OVOP were ranked with the use of indexing scaling technique which provided the direction and extremity attitude of the respondent towards any proposition. Farmers' perception on different activities and effect of OVOP were ranked. The formula given below was used to find the index for intensity perception and effect of OVOP. The index of importance was computed by using the formula.

$$I_{inf} = \Sigma(s_i f_i / N)$$ Where, $I_{inf=}$ Index of influence s_i= scale value

$f_{i=}$ Frequency of influence given by respondents N= Number of respondents

Results and discussions:-

Socioeconomics characteristics of household:-

The average family size for OVOP farmers was 6.56. Economically active family member had 3.56 per household. The average family sizes observed form OVOP farmers were above the National average (CBS, 2011). Family size is more linked to family labor supply as almost all farming activities (Edriss and Simtowe, 2003) and household size can be positively related to technical efficiency of labor as smaller household sizes experience labor bottlenecks and thereby being inefficient (Wang *et al*., 1996).

Table 1. Socioeconomics description of household in study area (N=200)

Descriptive statistics	Family Size	Economically active members
Mean±Std. Error	6.56±0.34	3.56±0.18
Std. Deviation	2.43	1.3
Level of education	Frequency	Percent
Illiterate	24	12.00
Literate	60	30.00
SLC	60	30.00
Above SLC	56	28.00
Occupational status		
Agriculture	92	46.00
Business	60	30.00
Services	40	20.00
Labor	8	4.00

Source: Field survey, 2013

Surveyed population was classified into 4 categories based on educational attainment as in table. The education status of survey household is presented in table. Education status of study area (88 %) is remarkable higher than national average 54.10 % (CBS, 2011). Rainbow Trout farmer under OVOP mainly concentrated road side might be cause of higher literacy. The only 12 % respondents were found illiterate where only 28 % were passed SLC, 58 % respondent can read and write only. According to Mangisoni (1989), Education compliments extension advice in that educated people can understand agricultural instructions quite well and be able to apply technical skills imparted to them better than uneducated ones. From table it could be consider that majority of respondent sustained their livelihood through agriculture as primary occupation. In totality, agriculture was the primary occupation of 46 % of respondent.

Land Hold Distribution Pattern and food sufficiency:-

The land holding pattern of the study area is presented in table along with land categories.

Table 2. Land distribution pattern and food sufficiency in study area (N=200)

Land category(Ropani)	Frequency	Percent
<16	112	56
16-22	64	32
>22	24	12
Situation of food sufficiency	Frequency	Percentage
<6 month	20	10
6-9 month	36	18
9-12 month	100	50
>12 month	44	22

Source: Field survey, 2013

The surveyed revealed that the average land holding size of respondent was found to be 16.34±0.756 ropani having 5.344 S.D were found among the OVOP farmers in the study area. Food sufficiency is an important determinant for the food security of household. Food sufficiency means the sufficiency of cereal like paddy, maize, fingerling, wheat, potato and buckwheat produced in own farm. The study revealed that food sufficiency situation in study area was 72 percentage respondent have sufficient for food access to their household. Only 28 percentage of respondent have suffered from food shortage from their own farm.

Household Livelihood before Join the OVOP:-

The respondent who had participated under OVOP as Rainbow Trout farmers were asked livelihood condition before joining the OVOP. The survey revealed that 64 percent of respondent found to be worse livelihood situation before joining OVOP. 36 percent of respondent found to be same livelihood condition before joining OVOP.

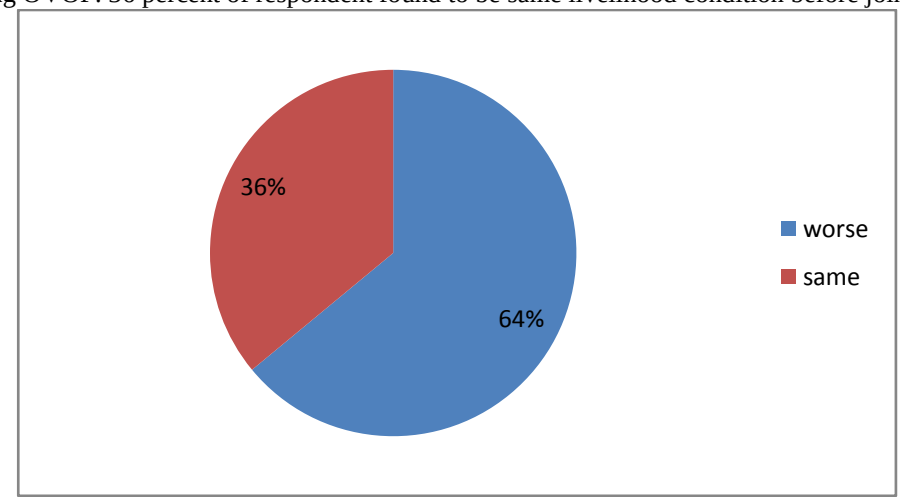

Figure 1. Livelihood Situation before Joining OVOP in study area (N= 200)

Perception of Rainbow Trout farmer towards OVOP:-

So far the household decision to join OVOP is concerned, credit, seed /fingerling were major influencing factor that found in position first and second decided to join OVOP. The other factor influencing to decide joining OVOP was

employment generation, training marketing, access to extension and value adding technology. The index values and rank of factors is shown in table.

Table 3. Motivation factor to Joining OVOP in study area (N=200)

Motivation factor	Index value	Rank
Credit	0.397	I
Seed /Fingerling	0.400	II
Employment Generation	0.422	III
Training	0.577	IV
Marketing	0.688	V
Access to Extension	0.768	VI
Value Adding Technology	0.805	VII

Source: Field Survey 2013

Factor of OVOP on household livelihood condition:-

Access to food all around year was the major effect persuaded by farmers being OVOP member in the study area.

Table 4. Factor of OVOP on household livelihood condition in study area (N=200)

Perception	Index	Ranks
Increase house hold income	0.687	V
Access to food all around year	0.393	I
Employment	0.45	II
Production	0.63	IV
Training	0.597	III
Value adding	0.743	VI

Source: Field survey, 2013

In study area, respondent told that if they were not member of OVOP they couldn't access food throughout year from their own farm as well they couldn't purchase food for their household demand. Unemployment is problematic of our country, the study revealed that farmer being member of OVOP they were able to generate self-employment. Training was important factor that influence joining OVOP. Production, increase household income and value adding technology were effect of OVOP on household livelihood.

Farmer perception on household income contribution by OVOP:-

The study was revealed that significance contribution household income being member of OVOP in study area. It was found that 42 per cent of respondent had increased household income being member and produce Rainbow Trout under OVOP were highly significant and 39 %, 19 % of respondent were found their household income moderately and less significance contribute being member of OVOP. Thus OVOP programme was effective for livelihood and food security at the study area.

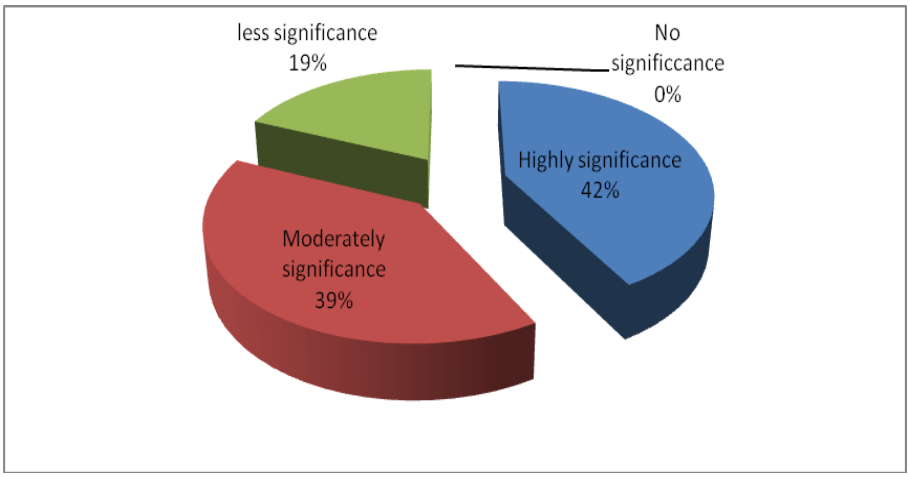

Figure 2. Farmer Perception Being OVOP Member in study area (N=200)

Economics of Rainbow Trout under OVOP:-

The study examines the profitability of Rainbow Trout production under OVOP in the study area. To determine the profit level, attempts were made to estimate the cost and return from Rainbow Trout production under OVOP. The input used, cost, yield or output data generated from the farmers were used to undertake the cost and return analysis for assessing the profitability of Rainbow Trout production under OVOP in the study area. The cost and return analysis is presented in the table no. The result reveals that the cost of feeding accounted for the largest proportion (24.53%) of the total cost of Rainbow Trout production. This is followed by cost of labor (22.79%).The fingerlings cost and other input cost accounted for 12.7% and 7.87% of the total cost respectively

Table 5. Calculate profitability of Rainbow Trout production in study area

Item annually	Minimum	Maximum	Mean	% of total cost
Fingerling cost	6300.00	202000.00	46693.00	12.70
Feeding cost	50400.00	134000.00	90168.00	24.53
Labor cost	6500.00	353000.00	83786.00	22.79
Other cost	7000.00	77000.00	28940.00	7.87
Total variable cost	70200.00	766000.00	249587.00	67.89
Fixed cost	24000.00	315000.00	118030.00	32.11
Total cost	94200.00	1081000.00	367617.00	
Revenue	196000.00	5000000.00	1104900.00	
Profit	101800.00	3919000.00	737283.00	
Gross margin	125800.00	4234000.00	855313.00	
ROI	0.48	0.22	0.33	
ROIC	1.08	3.63	2.01	

Source: Field survey, 2013

This clearly shows that large amount of money is spent by Rainbow Trout farmers in the study area for the purchase of feeds and labor. Rainbow Trout production is highly labour extensive and required concentrate ratio rather other fish .The fixed cost of production consists of cost of fixed assets such as land rent, aerators, assembling cost of pond and pond hiring which accounted for 32.11% of total production cost. It is because of those farmers who produce Rainbow Trout have their own land and government support as OVOP a public private partnership program.

Equally evident from the result an average total cost of NRs 367617.00 was incurred per annum by the respondents while gross revenue of NRs 1104900.00 was realized. The rate of return on investment of 0.33 implies that for every one NRs invested in Rainbow Trout production by farmers, a return of NRs 1.33 were obtained. The implication of study, there is a considerable level of profitability in Rainbow Trout farming in the study's findings area. This result is consistent with the finding of Ashaolu et al. 2005 from their studies on profitability on fish farming. The rate of return per capital invested (RORCI) is the ratio of profit to total cost of production .It indicates what is earned by the

business by capital outlay (Awotide and Adejobi, 2007). The result revealed that the RORCI of 200% is greater than the prevailing bank lending rate, 15% implying that Rainbow Trout in the study area is profitable.

Model estimation and resource use efficiency:-

The model estimation of Rainbow Trout production under OVOP is presented in table. The result shows that value of output of Rainbow Trout was best estimated using the linear function, which explained 96.5% of the total variation in the values of output of Rainbow Trout production. The lead equation (Linear form) shows that values of Fingerling cost invested (X1), feed cost (X_2) depreciation value(X_5) and area of the lake fished (X6) were significant while value of variable inputs, labor and value of other inputs were not. All the significant variables (fingerling costs, feed costs, depreciation value size of pond in M^2) and some variables that are not significant (and value of other inputs) had positive relationship with the value of outputs.

Table 6. MPP of Rainbow Trout productionin study area

Variables	Linear production function	Cobb-Douglas
Constant	447560.75(177862.56)**	11.43(3.57)**
Fingerling costs	12.13 (4.48)*	.059(.27)
Feeding costs	-5.13(1.86)*	-.239(.23)
Labor cost	-.944(.96)	-.01(.07)
Other input cost	4.95(4.99)	.42(.16)**
Depreciation value	-77.57(30.08)**	-.48(.20)**
Area of raceway in M^2	10476.46(2948.75)*	1.00(.33)*
R^2	.97*	.93*
F-ratio	199.94	94.77

* and **Significant at 1% and 5% Figures in parenthesis are S.E.

This implies that as their quantities used increased, the revenue accruing to the Rainbow Trout production would increase. It shows that the revenue of Rainbow Trout farmers would depend on the improve technology adopted, numbers and size of raceways were identified and utilized, considering the constraints imposed by nature.

Marginal productivities of inputs:-

The results of the estimated production functions were further used to compute the marginal productivities of the inputs in Table. The computed marginal value products (MPP) in the case are the marginal physical products (MPPs) since the outputs were measured in monetary terms (Mbanasor and Obioha, 2003). This implies that one unit increase in any of the inputs holding other constant, will change the monetary returns by value corresponding to the marginal value product of that input used were more productive than other resources. The relative allocated efficiency of the rainbow trout producer was based on the non-classical requirement that each factor be paid equal to its marginal value product (MVP).

Table 7. Marginal value products and units acquisition cost of inputs in study area

Input used	MVP	MVP/MFC	Unit acquisition
fingerling costs	12.13	10.54	1.15
feeding costs	-5.13	-4.46	1.15
labour cost	-0.94	-0.82	1.15
other input cost	4.95	4.30	1.15
depreciation value	-77.57	-67.45	1.15
Area of raceway in M^2	10476.46	209.5	50

Source: Field survey, 2013

Based on this, the ratio of marginal factor cost to marginal factor cost (unit acquisition cost) were 10.54 , -4.46 , -0.82 ,4.3 -67.45 and 20.95 for fingerling cost , feed cost , labor cost ,other variable input depreciation value and area of raceway respectively. Previous studies show that maximum or absolute allocated efficiency for a particular

resource is confirmed if efficiency ratio is equal to one. But if efficiency ratio is greater than one, it means that less than the profit maximizing level of the input is in use (Mbanasor and Obioha, 2003).

But from the result obtained, it is evident that the values of feed labor and depreciation of fixed asset were less than one indicating that more than the profits maximizing level of all the resources were employed by the Rainbow Trout farmers'. The result shows the need for the Rainbow Trout farmers to reduce the use of these resources employed in order to improve efficiency. However, the results indicate that the value of fingerling other variable input and size of raceways were greater than one indicating that less than their profit maximizing level of the resources were employed by the Rainbow Trout farmers under OVOP. This suggests that these resources were inefficiently allocated and were underutilized below their economic optimum levels.

Elasticity of production and return to scale:-

The sum of elasticity of production of the significant variables (0.932) was less than unity. This suggests that fish production in the study area had a decreasing return. The implication is that each additional unit of the inputs will results in a small increase in the value of fish output than the preceding unit. This shows that production occurred among fish farmers in the study in stage 2, a rational stage of production. This finding is consistent with that of Olagunju*et al*. (2007) in their study on economic viability of cat fish production in Oyo state, Nigeria.

Table 8. Elasticity of production and return to scale of fish farmers in study area

Input used	**Values**
fingerling costs*	0.049682
feeding costs*	-0.00149
Labour cost	-0.00027
depreciation value**	0.026423
Other input cost	-2.03183

Source: Field survey, 2013. * Significant at 1% , **Significant at 5%

Conclusions:-

Aquaculture has emerged as potentially an important sector of Nepalese agriculture. The potential for increasing production through culture based activities is encouraging. Commercialization brings product into the market for business. However, understanding the ways how a product could be commercialized is highly interesting field of study. Credit, seed /fingerling were major influencing factor decided to join OVOP. Access to food all around year was the major impact persuaded by farmers being OVOP member the study revealed that farmer being member of OVOP they were able to generate self-employment. Training was important factor that influence joining OVOP. Production, increase household income and value adding technology were effect of OVOP on household livelihood. The elasticity of production of the significant variables, 0.932 was less than unity. This suggests that fish production in the study area had a decreasing return .This shows that production occurred among fish farmers in the study in stage 2, a rational stage of production.

Literatures cited:-

1. AEC (2008): Working Procedures of One Village One Product program-2063 approved by the Government of Nepal
2. Ashaolu, O.F., Akinyemi, A. A. and Nzekwe, L.S. O. (2005): Economic viability of homestead fish production in Abeokuta metropolis of Ogun State, Nigeria. Asset Series A, 6(2): 209-220.
3. Awotide, D. O. and Adejobi, A. O. (2007): Technical Efficiency and Cost of Production among Plantain Farmers in Oyo State Nigeria, Moor Journal of Agricultural Science, 7(2): 107-113
4. Bardach, J., Ryther, J. H and McLarney, W. O (1972): Aquaculture: The farming and husbandry of freshwater and marine organisms, Wiley Inter-Science, John Wiley & Sons, Inc; pp 868.
5. CBS (2011): Population census. GON, National Planning Commission Secretariat, Central Bureau of Statistics, in collaboration with UNFPA Nepal, Kathmandu
6. Country Profile (2007): Fisheries Sub Sector, Ministry Of Agriculture and Cooperative, Department Of Fisheries Development Central. Fisheries Building. Balaju; Kathmandu, Nepal.
7. DoFD (2006): Annual report 2005-2006. Directorate of Fisheries Development (DoFD), Central Fisheries Building, Balaju, Kathmandu, Nepal.

8. Edriss, A.K. and Simtowe. F. (2003). The dynamics of groundnut production, efficiency, profitability and adoption of technology in Sub-Saharan Africa: The Malawi Case. International publishers and press, Las Vegas, USA.
9. Mangisoni, J.H. (1989). A survey of the socio-economic constraints to smallholder dairy production in the Lilongwe milk shed area in Malawi: Implications for dairy production policy. Bunda College of Agriculture, University of Malawi
10. Mbanasor, J.A. and. Obioha, L.O. (2003). "Resource productivity under fadamascropping system in Umuahia North Local Government area of Abia State Nigeria". Tropical and subtropical agriculture. 2: 81– 86.
11. Nepal, A. P., Basnet, S. R., Lamsal, G. P. , Joshi P. L. and Mulmi, R. M. (2002): Economics of Rainbow Trout farming systems in Nepal. In: T. Petr and D. B. Swar (eds.) Cold Water Fisheries in the Trans-Himalayan Countries. FAO Fisheries Technical Paper No. 431 Rome, FAO. P. 376
12. Olagunju, F.I., Adesinyan I.O and Ezekiel, A. A. (2007) Economic Viability of Cat Production in Oyo State. Journal of Human Ecology, 21(2): 121-124.
13. Rana C.(2007a). Rainbow trout: an agricultural breakthrough. The Boss magazine, 15 Jan-14 Feb 2007: 97-99. www.readtheboss.com
14. Wang. J., Cramer, G.L. and Wails, E.J. (1996): Production *efficiency of Chinese agriculture: evidence rural household survey data*. Journal of Agricultural Economics, 15:17- 8.