APPLING ENVIRONMENTAL MANAGEMENT ACCOUNTING FOR SUSTAINABLE AGRICULTURE WITH SPECIAL REFERENCE TO SUGAR CANE AND POMEGRANATE FARMING

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Abstract

This paper focus on application of Environmental Management Accounting (EMA) for sustainable agriculture.The emphasis of this research paper is onPhysical EMA (PEMA) of sugarcane and pomegranate farming.Scope of paper is restricted Five Environmental Performance Indicators (EPI) relevant to sugarcane and pomegranate farming are Fertilizer, water, Planting Density, Life cycle of crop, yield of crop etc.

Introduction

Introduction to Environmental Management Accounting (EMA)

An accounting tool that can help the farmer in his Sustainable Agriculture endeavor is "Environmental Management Accounting" (EMA). Environmental Management Accounting (EMA) is a relatively a new concept of accounting for the use of resources and generation of emissions and wastes in economic activities that can help organizations to take informed decisions on management of their activities. Being an emerging discipline, there are many definitions of Environmental Accounting (e.g. ACCA, USEPA, UN); for the purpose of this research we will follow the definition provided by the UN Working Group on Environmental Management Accounting, viz.,

"EMA is broadly defined to be the identification, collection, analysis and use of two types of information for internal decision making:

- *physical information on the use, flows and destinies of energy, water and*

materials (including wastes) and

- *monetary information on environment-related costs, earnings and savings.*

("International Guidance Document – Environmental Management Accounting", International Federation of Accountants, August 2005)

This research aims to study the application of EMA to Sustainable Agriculture.

Significance of the study

RATIONALE AND SIGNIFICANCE OF RESEARCH

Increased food production means the use of more and more resources like water, fertilizers and land etc., unless disruptive technologies are introduced to meet this demand. For example, if we take the case of sugar cane, to produce about 350 million tonnes of sugar cane, which is required to meet the present demands of sugar in India, we need about 85 billion tonnes of water. The amount of water required to grow sugar cane that can meet the demand for sugar in 2030 will be about 130 billion tonnes . Water being a finite resource, where are we going to get this extra water, when already predictions are that the future wars will be fought for water ! At least a few Indian farmers have introduced new technologies where the water requirement is less than 50 % per tonne of sugar cane (e.g. A.K. Srivastava et al, Current Science, VOL. 101, NO. 6, 25 September 2011)

We are all familiar with the Management Mantra that "What gets measured gets managed". The same is true with Management of Agriculture. The farmer, the manager in-charge, has to identify appropriate indicators for measurement so that he could manage his farming activity profitably. In recent times, with more and more emphasis on Sustainable Agriculture, and faced with the scarcity of natural resources required for agriculture, he will be better off if he considers not only economic indicators but also environmental indicators for taking managerial decisions.

As a farmer, the researcher is aware that environmental indicators do not appear in the radar of the farmer when deciding the selection of crops. He does not consider water consumption, GHG emissions, energy use, loss of top soil etc., while deciding on the crop. In the long and short run all these parameters affect the profitability of the farmer. As of now quite a few of the inputs to his farming like water, electricity and fertilizers etc., are given at subsidized prices by the government. Hence economic indicators based solely on the consumption of these resources appear to be defective with respect to decision making; cost of input is apparently the only major concern apart from the market price of the produce.

That indicators related to these environmental parameters are important is borne out by the fact that UN and Countries include them in their study on Agriculture and for predicting the future. But it has not so far dawned on the individual farmer that these indicators do help him to make informed decisions.

In this research the researcher seeks to study the chosen environmental indicators along with the conventional economic indicators to understand how the former indicators can help the farmer to make informed decisions.

Since the subject of Research is still in its infancy even in advanced countries (e.g. see "Environmental Accounts for Agriculture" (2008); "Integrated Economic and Environmental Accounting for Agriculture" (2005)), and no micro-level study to measure environmental performance indicators has been attempted in India, the researcher has chosen the Drought prone area of Solapur, Pune,Sangli,Satara and Ahmednagar District of western Maharashtra for this study. He proposes to study the environmental indicators with respect to water use, energy use,fertilizers and land use, waste generation, GHG emissions etc., for a few crops such as sugar cane and pomegranate in various small and medium holding farms at least for two cropping cycles or as appropriate for this research. He proposes to collect relevant economic indicators for these crops and explore the possibility of using the environmental indicators to assist the farmer in making informed decisions on

selecting the crop and farming methods such as (a) What to grow ? (b) Where to grow ? (c) How much area to grow ?and (d) when to grow etc..

Aim of the Study

The main aim of this study is to assess the relevance, impact, sustainability and effectiveness of EMA as a tool for Sustainable Agriculture with special reference to Sugar cane and Pomegranate farming lands in the Drought prone area of Solapur, Pune,Sangli,Satara and Ahmednagar District of western Maharashtra.This study also has aim to decide pathway for the further main research work.

In this study researcher has aim to evaluate EMA application, based on feedback and information collected from Farmers.

Literature Review

Purpose of Literature Review

The purpose of any literature review is to get background of study / topic, to search for information and includes identification and articulation of relationships between the literature and field of research. The researcher wishes to study current situation of the usage and Management of EMA in Sugarcane and Pomegranate farming. It also provides information and knowledge of prior works done in this area.

Scope of the Study

EMA in Drought prone area of Maharashtra

This research will be conducted among the farmers with small and medium holdings of agricultural lands in the Drought prone area of Solapur, Pune, Satara and Ahmednagar District of western Maharashtra. Farmers who grow Sugarcane and pomegranates of crops will be included in this study.

District	No. of sugar factory
Solapur	37
Ahmednagar	22
Sangali	18
Pune	17
Satara	15

TOTAL	109

As per information receive from Vsi, Pune.

In each sugar factory average Sugarcane farmer member are 20000. So total farmer population is 20000x109= 2180000. But out of which only 10% i.e. 218000 farmer cultivate sugarcane along with pomegranates.

Sampling technique

The sample for the study and further research is selected from the above mentioned details. For the selection of Farmer for the study following criteria is considered,

The Stratified Random Sampling method is used for the selection of sample. Researcher has decided to take 1/10000 of total farmer which is from above mentioned 218000.

So the sample size for the research would be 1/10000 X 218000 = 21.8

Formulae for selection of sample;

Sample selection for study

Representative sample Pomegranate and sugarcane farm from western drought prone area of Maharashtra selected for research. Following criteria is considered for the selection of sample s for the study

a) Farmer who keep record of input and output (as per EMA).
b) Farmer who grow both Sugarcane and Pomegranate.
c) Small and medium holdings farmer are selected.
d) Acceptance for participate in the research work by farmer.
e) The Stratified Random Sampling method is used for the selection of sample.

Research Methodology

Data Collection and survey Method

This research is exploratory in nature, as no such published study is available in literature, related to Indian farmers. It is to use both "positivistic" and "phenomenological" methods for carrying out this research.

A combination of Case Studies and interviews/surveys will be used to collect the necessary primary data for this study. This will cover at least 30 independent farmers with different sizes of farm land ranging from 0.40 hectors to 20 hectors holding in western Maharashtra. It is also proposed that a part of this study falls under "Action Research" where the researcher himself will be involved in the activity being studied (i.e. agriculture).

Data will be collected for at least two cycles of cropping; where the crop has a long life, like, for example, pomegranate, at least one year data will be collected.

Secondary data will be collected from the District Agriculture Office,Department of Agriculture, Government of India, Ministry of Environment and Forests, Government of India, Planning Commission, Government of India, Indian Council of Agricultural Research, UN, and various relevant publications and internet sources.

The existing knowledge on EMA will be applied to Agricultural activities in the area selected for this research (as defined in the Scope). Even though the emphasis of this research is on sugarcane and pomegranate, it is to study as many crops as possible to get an overall idea of the application of EMA to Sustainable Agriculture.

The collected data will be analyzed using relevant statistical methods and conclusion drawn based on the result of analysis.

Tools used for Data Collection

To study implementation of EMA in Sugarcane and Pomegranate farming detailed questionnaires were designed for theEnvironmental Performance Indicators (EPI) like fertilizer, water, planting density, LCA and yield by keeping in mind objectives of the study. To prepare questionnaire reviewed literature and other secondary sources helped a lot. Researcher obtained guidance for designing of questionnaire from research guide and experts in statistics.

Questionnaire were comprising following sections (EPI)

Fertilizer	Water	Planting Density	LCA	Yield
1.Types of Fertilizer 2.Quantity of Fertilizer 3.Impact of Fertilizer on yield 4.Conservation of Fertilizer 5. Timely distribution of fertilizer	1.Types of Reservoir 2.Quantity of water 3.Impact of water on yield 4. Techniques for Conservation of Water 5. Type of distribution (Flood or Drip)	1. Cropping Pattern 2.Quantity of final product(Count of fruits or stem) 3.Impact of Planting density on inputs like water and Fertilizer 4.Conservation of Soil 5. Impact of Planting density on cost reduction	1.Impact of LCA on water resources 2.Impact of LCA on Yield 3.Impact of LCA on Fertilizer 4. Conservation of unnecessary activities. 5. Efficient use of weather for improving yield	1.Awareness about EMA and its impact on yield 2. Impact of all EPI on productivity. 3.Impact of informed decision on yield 4.Relationship between SA and Productivity

Keeping objective of the study in mind different Interview questionnaires was designed for the farmers.

Statistical tools for the analysis

The data was entered in Excel sheets; it was coded and then used for analysis using Statistical Package for Social Sciences (SPSS) software (Version 16.0). The relevant T test for equality of two means were calculated and placed below relevant tables.

The results of data analysis checked against the objectives & hypothesis formulated. The overall findings & suggestions were drawn with respect to result of data analysis.

Data Analysis

2. For Sugarcane Farming

Sugarcane Farmer No	Fertilizer					Water In Lakh Liter	Planting Densities In Feet's	Lca Months	Yield Tons		Remark
	N	P	K	Micro	Org						
1	450	750	350	25	250	3	4	12	15	44	No
2	320	275	175	25	100	3	4	13	16	90	Yes
3	150	150			12000	3.5	4	12		60	No
4	300	150	150		270	2.5	9	16	20	50	Yes
5	200	450	300	25	9000	2.7	5.1/2	16	20	90	Yes
6	250	420	320	25	2250	3	4	12	15	60	Yes
7	175	280	300			3	4 ½	14	12	55	No
8	100	400	250	25		3.5	6	15	16	80	Yes
9	150	350	300		200	3	51/2	15	14	70	Yes

10	300	350	300			3	5	16	15	75	Yes
11	200	350	350			2.7	4	12	13	46	Yes
12	250	400	300	25	1000	3	4	13	14	70	Yes
13	350	280	280			3	4	14	10	45	Yes
14	250	260	250			2.8	4	13	10	50	Yes
15	275	500	300	25	200	3	6	14	12	70	Yes
16	320	225	350			3.25	41/2	13	13	60	Yes
17	175	200	250			3	4	12	10	40	No
18	100	100	50			2.75	4	12	10	35	No
19	180	250	175	25		2.5	4	12	10	35	No
20	520	420	250			3	4	12	12	40	Yes

t test for Sugarcane farming

t test for equality of two means-

We have performed t test for comparison of mean yield of sugarcane farmers who follows the EMA and does not follow EMA.

Our null hypothesis is that there is no difference between the mean yield of sugarcane farmers which follow EMA and does does not follow EMA. Our alternative hypothesis is that there is difference between the mean score of farmers which follow EMA and does not follow EMA.

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
yield	y	14	64.0000	16.45974	4.39905
	n	6	44.8333	10.49603	4.28499

Sr. No.	Test	Df	T statistic	p-value
1	For equal variance	18	2.611	0.018
2	For unequal variance	14.779	3.121	0.007

Conclusion-

Here the p value is less than 0.05 so reject null hypothesis.

That is, there is difference between the mean score of farmers which follow EMA and does not follow EMA.

3. For Pomegranate Farming

Pomegranate Farmer No	Fertilizer					Water In Lakh Litter	Planting Densities (M)	Lca Months	Yield Tons		Remark
	N	P	K	Micro	Org						
1	90	400	250	130	2100	2.9	4.5x3.0	Feb	125	9	Yes
2	450	750	350	50	250	2.3	4.5x3.0	Aug	80	8	Yes
3	100	450	300	50	4000	2	4.5x3.0	June	75	6	Yes
4		200	200	25	1200	2.1	4.5x3.0	June	50	3	No
5	100	250	300	10	2000	2.5	4.5x3.0	Aug	65	5	Yes
6	100	470	300	25	3000	2.6	4.5x3.0	Feb	100	7	Yes
7	100	200	250	10	2000	2	4.5x3.0	June	60	3	Yes
8			200			2	4.5x3.0	June	30	1.6	No
9	100	250	250	20	2000	2.4	4.5x3.0	Aug	60	4.5	Yes
10	50	200	200	25	3000	2.6	4.5x3.0	Aug	55	3.8	Yes
11	75	250	300	25	2000	2.5	4.5x3.0	Aug	60	4	Yes
12		500	300	25	4000	2.4	4.5x3.0	Aug	70	5.5	Yes
13	100		200			2.3	4.5x3.0	Aug	30	2	No
14	50	100	250			2.1	4.5x3.0	Aug	25	1.8	No
15	100	200	200	10	3000	2.6	4.5x3.0	Feb	35	2.9	No
16	100	200	300	25	2400	2.7	4.5x3.0	Feb	55	4.6	Yes
17	100	250	275	25	2000	2.8	4.5x3.0	Feb	70	5.8	Yes
18	100	400	320	25	2500	2.4	4.5x3.0	Aug	60	6.4	Yes
19	100	200	250			2.5	4.5x3.0	Aug	50	3.2	No
20	100	250	280	20	2500	2.3	4.5x3.0	Aug	50	4.1	Yes

t test for Pomegranate Farming:-

t test for equality of two means-

We have performed T test for comparison of mean yield of Pomegranate farmers who follows the EMA and does not follow EMA.

Our null hypothesis is that there is no difference between the mean yield of Pomegranate farmers which follow EMA and does not follow EMA. Our alternative hypothesis is that there is difference between the mean score of farmers which follow EMA and does not follow EMA.

Group Statistics

	res	N	Mean	Std. Deviation	Std. Error Mean
yeild	1	15	5.2200	1.91505	.49446
	2	5	2.5800	.63403	.28355

Sr. No.	Test	Df	T statistic	p-value
1	For equal variance	18	2.981	0.008
2	For unequal variance	17.934	4.632	0.000

Conclusion-

Here the p value is less than 0.05 so reject null hypothesis.

That is, there is difference between the mean score of farmers which follow EMA and does not follow EMA.

Findings and Recommendations

1. Findings and Recommendations

Findings

1) There is lack of awareness in farmer for implementationof EMA.
2) Agriculture is resource intensive; there is an increasing pressure on natural resources (EPI) with increasing agriculture activity.
3) Farmers agreed that EMA has tremendous potential to improve productivity of crops. They are also aware that the EMA technology is beneficial for sustainable agriculture.
4) Although farmers are in favour of EMA use but it is seen that they are not using EMA for sustainable agriculture.
5) Farmers understood the Importance of the use of EMA in managing agricultural entities for sustainable agriculture.

Recommendations

1) There is requirement of more study on EMA (and EPI) in agriculture processes. This problem can be solved by increasing awareness of EMA among farmers.
2) Government should provide promotion and subsidies for sustainable agriculture.
3) Farmers should be motivated to use EMA techniques for agriculture.
4) There is requirement of well-educated EMA consultant. The farmers should actively participate in implementation of EMA techniques.

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