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Focusing on Chain Actor Practices to Improve Post-Harvest Product Handling: The Case of the Pineapple Value Chain in South Western Uganda

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Abstract: ***Information gathering and processing often has a great bearing on the decisions and choices value chain actors make to handle an agricultural product in a particular way, at any stage of the value chain. Usually, post-harvest product handling along agricultural value chains is characterized by goal-oriented practices, focused on management of product flow, and innovations in handling the product to meet consumer demands. This paper focuses on the value chain actor at any stage of the chain as the central actor, whose routine practices greatly influence establishment, shaping, and maintenance of the post-harvest handling system. A soft systems approach, employing second order cybernetics was used to better understand pineapple postharvest handling in South Western Uganda, in the frame of facilitating the chain to accrue more satisfactory benefits to the participating chain actors. Pineapple post-harvest handling in SW Uganda was found to be arranged along multiple inter-related activity layers, characterized by decision making, goal setting, handling practices, reflexive observation of handling practices outcomes, rule setting for more purposeful product handling and learning. Handling practices were rooted in the chain actor's interest, aims, role in the chain and were shaped by the operational context in which the value chain is being operated. If any of these changed, the handling practice, its results and benefits also changed.***

Keywords: post-harvest handling, chain actor, handling practices, soft system

1. Introduction

Similar to other processes through which human actors manage socio-ecological systems, post-harvest product handling along agricultural value chains is characterized by goal-oriented practices, focused on improving understanding of involved processes, management of product flow, and innovation to meet consumer demands along fresh produce supply chains. The practices differ in complexity, depending on the specific role of the practicing chain actor and the individual objective being pursued in handling the product at that stage of the value chain. The interaction between the various product handling processes when delivering an agricultural product from harvest to consumption, as all involved chain actors seek to gain economic benefits, constitute a post-harvest product handling system. This is, as system is defined by Spedding (1988), "a group of interacting components, operating together for a common purpose."This paper thus looks at interactions among value chain actors, when handling post-harvest product flow along the pineapple value chain in South Western Uganda, through the lens of a system approach.

The paper further hinges on an observation made by Prussia and Shewfelt(2009), indicating that in applying the systems approach to understanding post-harvest handling in fruits and vegetables, "most studies have treated fresh produce handling as a hard system", focusing mainly on development of technological tools for better handling. Such an approach has often remained deficient in shaping effective strategies for improving post-harvest product handling. It ignores the fact that the produce is usually transferred through various hands of handlers from harvest to consumption, with various points of goal setting, decision making, reflexive observation of ones actions and learning. It also fails to recognize that decisions made at one point in the supply chain usually affects what happens in the subsequent stages of the chain. A soft system approach is deemed more appropriate for understanding fresh produce post-harvest handling.

Adopting a soft systems approach (Checkland and Poulter, 2006), as "an action-oriented and organized way" of examining post-harvest product handling, makes it possible to organize the different perspectives of the various chain actors to initiate systematic improvements in how the post-harvest handling system functions, in a way that is desirably affordable and contextually appropriate. Such an approach also provides deeper insight into "ways to better manage risks and uncertainties in produce supply and information systems", and how to "turn each of them into an opportunity." This way, making changes in the system directly translates intofurther evolution of that system (Banks, 2009), with more benefits to those involved.

In addition, for most agro-based social-ecological systems, the farmer, or any other participating value chain actor, "is the central actor" (Norman, 2000a; Fair-weather, 2010 in Kaufmann, 2011). It is the actor's routine practices that dictate how the system will be established and which direction it will take with regard to its set purpose. Any desired change in the system therefore has to begin with a deliberate focus on the individual practices of the actors and the knowledge upon which these practices are based. We thus sought to comprehensively analyze pineapple postharvest handling practices in South Western Uganda, in the frame of developing affordable and appropriate strategies for facilitating value chain improvement.

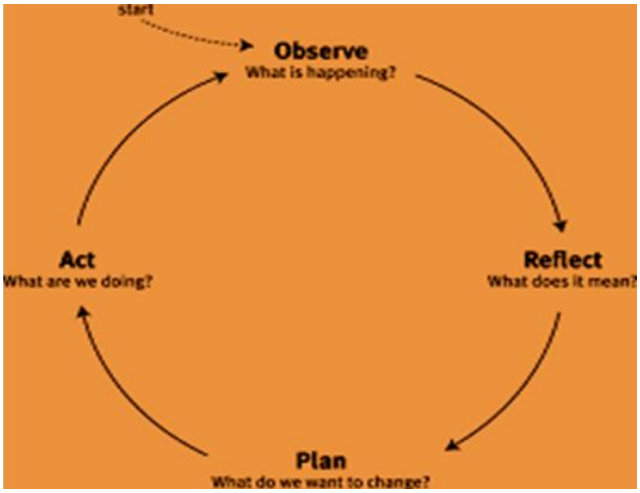
This was based on the expectation that the much sought after improvements in the postharvest handling occur only if chain actors handling practices improve. Such improvements in chain actor product handling practices are also only realized if actors' knowledge, vested interests and ability to effectively direct the system in the direction they desire is first achieved. It is also upon this basis that a conceptual framework for understanding and improving post-harvest handling along the pineapple value chain in South Western Uganda, was deemed relevant to develop.

2. Materials and Methods/Methodology

During the study, we sought to participatorily identify the challenges being faced by actors during handling of the product, in the frame of improving functionality of the system, such that it sustainably and affordably accrues more satisfactory benefits to the chain actors. Gaining a more comprehensive understanding of the post-harvest handling practices of the chain actors at the various stages of the value chain and the reasoning behind the observed practices was an invaluable starting point in establishing a foundation upon which the framework for improving postharvest product handling along this chain could later be developed.

Development of the framework was based on findings from a three year Participatory Action Research (PAR) study on post-harvest management and its implications along the pineapple value chain in South Western Uganda, as part of a collaborative research project-RELOAD, between German and African research institutions, aiming to reduce post-harvest losses and add value along selected priority food chains of East Africa.

This study was conducted as a Participatory Action Research (PAR); an approach to research in communities that emphasizes participation and action, seeking to understand the world by trying to change it, collaboratively and following reflection. Within a PAR process, "communities of inquiry and action evolve and address questions and issues that are significant for those who participate as co-researchers" (Reason and Bradbury, 2008, p. 1). It aimed at finding out why value chain actors do not gain satisfactory economic benefit from their engagement in the value chain with the current postharvest product handling practices, by taking a snap-shot at the whole pineapple value chain postharvest system.



During the study, actor post-harvest product handling practices at various stages of the chain; farmer, collector (middle men), transporter, wholesaler, processor and retailer, were documented through participant observation of actor daily routines, as they handled the product, using a miniature sub-cam. This was combined with informal interviews (n= 57), as a way of obtaining information on the reasons for actors engaging in the observed handling practices.

The study was conducted in south Western Uganda, one of the| 7 administrative regions of the country, which comprises of 13 administrative districts, and is mainly made up of the greater Mbarara and the greater Kigezi sub-regions. The region is covered by three agro-ecological zones; lowland or rift valley with altitude in the range 850 m to 1300 m above sea level, rainfall up to 40 inches annually, plateau zone with an altitude of 1300 m to 1700 m and an average rainfall greater than 40 inches, while the highland zone with a higher altitude (> 1800 m) averages more than 60 inches of rainfall annually.

Uganda's southwest exhibits a good number of common features: bimodal rainfall, hilly terrain, and relatively productive soils, plus a moderate to high population density. Local climate, soil and terrain interacted with farmers' traditions, preferences and markets, resulting in varied agricultural systems and land-use practices (Wortmann and Eledu 1999). During this study, each of the three agro-ecological zones was represented by one district, purposively selected based on the existence of the pineapple value chain in that district; Ntungamo for the highland zone, Bushenyi for the plateau zone and Isingiro for the lowland or rift valley zone.

3. Map of Uganda Showing Study Area

This study was also guided by principles from the Cybernetics theory, to conduct a systematic analysis of post-harvest product handling practices exhibited by value chain actors at each stage of the pineapple value chain in South Western Uganda, as well as examining the knowledge upon which actors' decisions to engage in these activities are founded. Cybernetics is a science of the structure, relationship and behavior of dynamic systems, the post-harvest activity system for the case of this study, and concerns how dynamic systems are regulated, and how the

information within them is processed (Wiener, 1948 in Kaufmann, 2011).

This theory was thus relevant and applicable for explaining the regulation processes within the pineapple value chain postharvest system in South Western Uganda, as a socio-ecological system (Kaufmann, 2007); say for this case how value chain actors at a particular stage of the value chain deliberately engage in specific product handling practices to ensure that they gain maximum economic benefits from their activities, within the existing situational context.

Principles from the Cybernetic theory were used to analyze the automatic control of processes that formerly could only be directly controlled by humans. When analyzing a socio-biological system as a cybernetic one, say the pineapple post-harvest product –handling system for the sake of this study, a process known as second-order observation was employed.

Second-order observation is considered to be "observation of an observer", and in the case of this research, our observation of the observing value chain actor at a particular stage of the value chain. Second-order observation thus brings the analytical focus towards the value chain actor at that stage of the chain and away from the actual post-harvest activity system itself, to understand the element of "human control" in management of the post-harvest activity system (Kaufmann, 2011).

Second-order cybernetics in this case therefore utilized the theoretical and regulatory basis of cybernetics theory as an approach for analyzing how the value chain actors control the post-harvest activity system, based on their processing of observations and actions, as well as through the comparison of different value chain actors' distinctions. This enabled the researcher to effectively answer the question "*why do the value chain actors at any particular stage of the value chain do what they do?*" and allowed for the identification of applicable "improvement options" which are appropriate for the context in which the value chain is thriving (Kaufmann, 2011).

Data collected at each stage of the value chain obtaining to post-harvest product handling was later transcribed; interpreted and systematically analyzed using content analysis and the conventional control loop model (Kaufman, 2011). The control loop model (Kaufman, 2011), was used for activity and knowledge analysis of the postharvest product handling practices observed along the pineapple value chain in Southwestern Uganda. It was useful in reconstructing the value chain actor's reasoning and logic behind the various practices they performed at particular stages of the pineapple value chain.

The reconstruction hinges on the perspective adopted from Kaufman (2011), which postulates that the pineapple post-harvest system was structured in such a way that there are inputs introduced into and allowed to go through the postharvest product handling processes, to finally give a particular anticipated output. This whole system is controlled by the value chain actor at a particular stage of the value chain; in that he sets a target of what he expects as output after the product has gone through his hands, and will always regulate the system through reflexive observation of his product handling actions, to ensure that his goal for engaging in the system is achieved.

He monitors the process by making observations on the output from the process and his own actions which he performs during postharvest product handling, to determine if the output is matching with the anticipated target. If the actual output from the process is found to be matching the anticipated target he was seeking to gain, he is motivated to repeat the same practices he performed on the product as it went through the process. On the other hand, if on observing the output from the postharvest product handling process, the value chain actor realizes that the output falls below his anticipated target, he will perform a corrective action while handling the product as it goes through the process, to ensure that the actual output will once again match the anticipated target.

4. Results and Discussion

This study revealed that post-harvest handling in the pineapple value chain of South Western Uganda is arranged along multiple inter-related layers of value chain actor decision making, goal setting, handling practices, reflexive observation of handling practices outcomes, rule setting for more purposeful product handling and learning, whereby the value chain actor at any particular stage of the value chain is the main controller of all ongoing practices and process, meant to transfer the product of interest from that stage to the next in the chain.

Also noticed was the fact that the observed practices are rooted in the chain actor's interest, aims, role in the chain and are performed within the frame of the operational context in which the value chain is being operated. If any of these change, the handling practice and its effect on the benefits accruing to the chain actor also change. This is in line with the observation made by Leeuwis and Ban (2004, p. 61), who stated that "improper post-harvest handling practices at any step en route may ruin all the efforts made during other steps to preserve the quality of the product. In other words, the final quality of the product is often determined by the worst practice, which acts as a limiting factor. In addition, since no post-harvest intervention can effectively remedy quality which is already damaged, product mishandling at one point may not be compensated by extra care in other steps."

According to Girard and Hubert(1999), "as a way of facilitating value chain actors in improving their post-harvest product handling, there is a need to understand what is relevant to them" and as stated by Magne et al., (2010), "how they select and use the available product handling information to meet their intended goals". To this end, as indicated in the figure 1 below, at the center is the overarching general goal that drives all chain actors at the various stages of the value chain to do whatever they do, regardless of their role, level of power or even influence in the chain. In the case of the pineapple chain in South Western Uganda, it was realized that all chain actors seek to earn satisfactory income from their engagement at any stage

of the chain, and all they do is geared towards ensuring that this is most efficiently and effectively achieved.

The second layer is composed of interrelated, but more specific sub-goals that are set by the various chain actors at particular stages of the chain, based on their specific interests, location and role in the chain, as well as their level of power and influence. All these sub-goals are however pursued as a means of achieving the general goal- *satisfactory income for each actor in this case*, in ways that are more manageable, and put to use the skills and expertise that is specific to each actor. These sub-goals are inter-related in the sense that for many of them, their effective achievement calls for complementary support among actors from different stages within the same chain.

Beyond the sub-goal layer is a layer of post-harvest handling practices that are usually highly specific to a particular value chain actor, because of his special interest, knowledge level, role in the chain, level of power and influence, as well as his ability to harness the various aspects of the operational context in which the value chain is being operated, to his desired end. Much as most practices are largely observed among only particular chain actors, some few are observed to be performed by more than one actor at different stages in the chain, although not exactly to the same level of precision.

It has also been observed that it is at the handling practices level that input of materials into the post-harvest handling system and value addition, mainly happens, while the reflexive observation through which the chain actor controls the system, mainly happens at the two preceding levels. Because all these layers are interacting components of the same system- the post-harvest handling system, any change that occurs in one of the components has a resonating effect on the functionality and benefits accruing from the whole system.

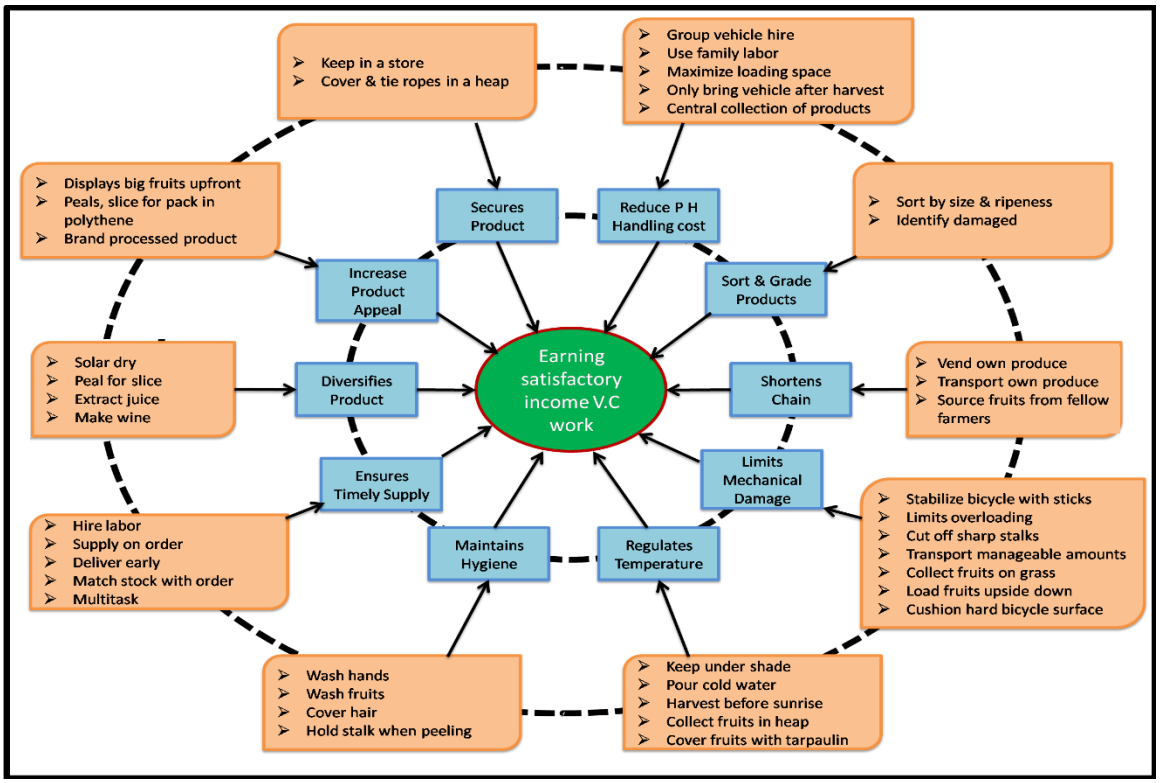


Figure 1: Arrangement of post-harvest handling practices along the pineapple value chain in South Western Uganda

Also observed was the fact that the actor's ability to regulate the system is however also in turn influenced by the contextual frame in which he is operating the value chain. Operational context is usually characterized by either more opportunities or more threats, as these can either facilitate or limit the capacity of the controller to guide the activity system into his most desired direction. This finding greatly agrees with Gereffi (1995), who indicates that"value chain actors operate within an institutional environment, which can either facilitate or hinder its performance Common constraints to effective development of functional agricultural value chains are usually related to market access and market orientation (Grunert et al. 2005), available resources and physical infrastructures (Porter 1990: factor conditions) and institutions (regulative, cognitive and normative; Scott 1995)." All these are factors which characterize the context in which the agricultural value chain functions.

The operation context was composed of various aspects including; access to financial and technical-advisory services, effective/affordable transport and storage infrastructure, affordable and reliable labor, security for the product, availability and access to markets, seasonality and policy regulations. All these aspects of the operational context either empowered or in other cases limited the chain actor's capacity to effectively regulate the post-harvest system, so as to attain the maximum economic benefit from his activities.

Operational context influences the system controller (chain actor) by either enlarging his capacities to more effectively regulate the system or by limiting them. Operating a system therefore in a context with more opportunities than threats enlarges capacities of the controller to more effectively regulate the system hence favoring him to achieve his goal for the action he performs. On the other hand, operating a system in a context with more threats than opportunities limits the capacity of the controller to effectively regulate the system and hence reduces chances of him achieving the goal of his actions.

If the operational context is dominated by threats, as an adaptation mechanism, the controller innovatively devises and tries out new practice approaches to ensure that as much as possible, the objective for engaging in that system activity is still achieved, within the limits of the resource opportunities made available to him by his operational context. This is because manipulation of the operational context to favor achievement of his activity goals is usually beyond the actor's scope of control. He thus can only adapt and operate within the limits of his operational context as it is. On the other hand, operating within a context characterized by many opportunities, the controller decisively selects from available options and may even raise the goal level that he seeks to achieve from his actions.

5. Conclusion

Framework for understanding and improving post-harvest product handling

All agricultural value chains can be used as a key framework for understanding how inputs and services are brought together and then used to grow, transform, or manufacture an agricultural product; how the product then moves physically from the producer to the consumer; and how value increases along the way. Improving these systems requires an understanding of their functioning within the opportunities and constraints of their specific operational context (Herve et al., 2002).

Based on these financings, a framework for gaining better understanding and improving post-harvest product handling along the pineapple value chain in South Western Uganda was developed. In this framework, the value chain actor at any stage of the value chain is considered to be at the heart of, and the main controller of all processes in the whole post- harvest product handling system.

The system is viewed as a human activity system regulated by the value chain actor at a particular stage, through reflexive observation of outcomes of his product handling practices, that are measured against product handling goals that the chain actor sets, prior to engaging in a particular practice, as adapted from the conventional control loop (Kaufman, 2011). The practices the actor decides to perform in handling the product are based on the knowledge he possess about the importance of that practice in maintaining product quality, shelf life and value, the objective he pursues in engaging in that practice, his role in the chain and what the operational context he is working in permits him to do.

If the practice is found effective in achieving the set goal, the actor learns that this particular practice, as a rule, should always be performed under similar circumstances if one seeks to achieve that very goal. This becomes a rule that from hence forth, will routinely be followed by actors under the same circumstances during post-harvest handling. Sometimes however, in performing a particular handling practice, the actor observes that he was unable to achieve his set target and thus performs corrective measures to ensure that his goal is finally achieved. When this works out successful, the actor learns that that a particular practice can always be used as a problem solving strategy whenever a similar situation arises (Kaufman, 2011).

For any improvement therefore to be realized, in the post-harvest system, a sequence of change processes needs to be initiated beginning with the chain actor, whereby the desirable outcomes of one process set in motion changes at the next level until functionality and benefits accruing from the whole system are eventually improved. The framework suggest that through reflexive observation of the outcomes of handling practices, learning and rule setting, the knowledge and interest of the chain actor, as he performs a particular practice, are expected to change and new innovative ways of overcoming contextual constraints to him achieving his set goal are generated.

As a result, the way a chain actor performs a particular handling practice begins to change, eventually leading to a change in the whole post-harvest system, since it will now be composed of interactions of totally different practices and process, even sometimes giving different products. Consequently, the benefits accruing to the chain actors involved are expected to increase, as illustrated below.

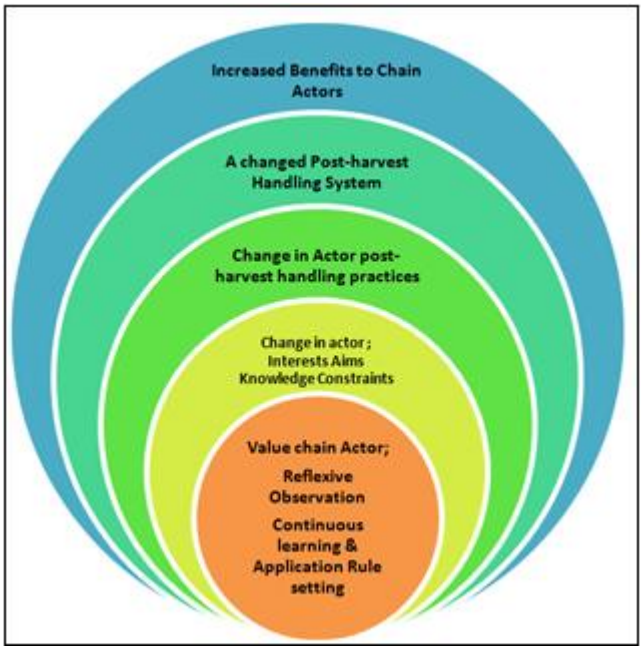


Figure 2: Framework for understanding and improving post-harvest handling along the pineapple value chain in South Western Uganda

References

[1] Checkland, P. and J. Poulter (2006). Learning For Action: A Short Definitive Account of Soft Systems Methodology, and its use Practitioners, Teachers and Students. Chichester: John Wiley.
[2] D.W. Norman(2000): The Farming Systems approach: A historical Perspective
[3] Fairweather, J., 2010. Farmer models of socio-ecologic systems: application of causal mapping across multiple locations. Ecological Modelling 221, 555–562.
[4] GEREFFI, G. (1995), "Global production systems and third world development", *in* B. Stallings (ed.), *Global change, regional response: the new international context of development*, Cambridge, Cambridge University Press, pp. 100-142.
[5] Grunert, K. G. (2005). Food quality and safety: Consumer perception and demand. European Review of Agricultural Economics 32:369 - 391.
[6] Herve D, Genin D, Migueis J (2002) A modelling approach for analysis of agro pastoral activity at the one-farm level. Agr Syst 71:187 – 206
[7] Kaufmann, B.A. 2011: Second-order cybernetics as a tool to understand why pastoralists do what they do, Agricultural Systems 104(9): 655-665
[8] Kaufmann, B.A. 2007: Cybernetic analysis of socio-biological systems: The case of livestock management in resource poor systems.
[9] Leeuwis, C. and van der Ban, A. (2004): Communication for Rural Innovation: Rethinking Agricultural Extension. Oxford: Blackwell Science
[10] Norman D.W., Malton P.J. (2000) Agricultural systems research and technical change, in: Colin J.-P., Crawford E.W. (Eds.), Research on Agricultural Systems. Accomplishments, Perspectives and Issues,
[11] Nova Science Publishers, pp. 17–47.
[12] Ondersteijn, C.J.M., Beldman, A.C.G., Daatselaar, C.H.G., Giesen, G.W.J. & Huirne,
[13] R.B.M. 2003. Farm structure or farm management: effective ways to reduce nutrient surpluses on dairy farms and their financial impacts. Livestock Production Science 84, 171-181.
[14] Porter M.E (1990), The Competitive Advantage of Nations; New York: Free Press
[15] PRUSSIA, S.E., Jordan, J.O., Shewfelt, R.O., Beverley, R.B. 1986. A systems approach for interdisciplinary research on horticultural crops. Georgia Agric. Exp. Station Research Report No. 514. Athens, GA, USA.
[16] Reason, P., & Bradbury, H. (Eds.). (2008). SAGE handbook of action research: Participative inquiry and practice (2nd edn). London: SAGE
[17] Spedding CRW (1988). An Introduction to Agricultural Systems. Elsevier Applied Science; London
[18] Wortman, C.S, & Eledu, C.A (1999). Uganda's Agro-Ecological Zones: A Guide for Planners and Policy makers. Kampala, CIAT.