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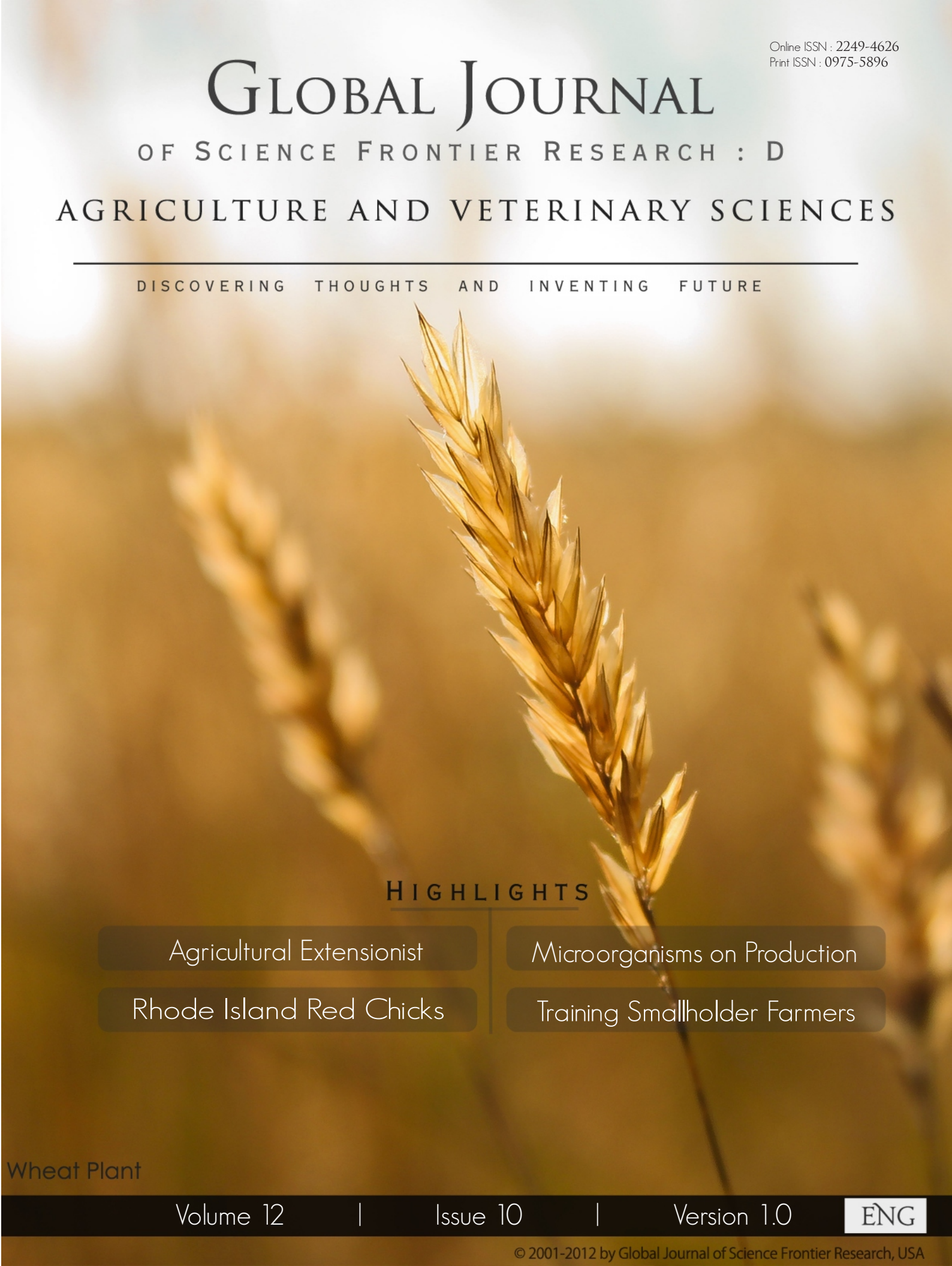
DISCOVERING THOUGHTS AND INVENTING FUTURE



HIGHLIGHTS

Agricultural Extensionist

Microorganisms on Production

Rhode Island Red Chicks

Training Smallholder Farmers

Wheat Plant

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Factors Influencing the Transfer of Learning in Training Smallholder Farmers by Agricultural Extensionist

By N.Mafuse, Muhau. E.M. Gwati & Manyumwa, D
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Introduction - Training is a tool used to empower people so that they are able to lead their own development, solve problems and to participate in meaningful debates of any field of learning. However, training transfer literature asserts that the successful transfer of learning to the workplace is often limited (Baldwin et al., 2009). This trend prevails despite heavy investments of finance, human resources, time and technology in employee training aimed at enhancing worker and organizational performance. There has been very low transfer of learning especially in the Agriculture where the adoption if moisture conservation innovations is very despite heavy investment in all capitals (Andersson and Giller, 2012, Twomlow et al, 2008, Zhou, 2008).This has posed a great challenge in the training of smallholder farmers on new innovations. There is need therefore to find ways of supporting the transfer and application of training for smallholder farmers as they depend mostly on agricultural extensionist trainings for their human resource development.

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Factors Influencing the Transfer of Learning in Training Smallholder Farmers by Agricultural Extensionist

N.Mafuse [α], Muhau. E.M. Gwati [σ] & Manyumwa, D [ρ]

I. Introduction

Training is a tool used to empower people so that they are able to lead their own development, solve problems and to participate in meaningful debates of any field of learning. However, training transfer literature asserts that the successful transfer of learning to the workplace is often limited (Baldwin et al., 2009). This trend prevails despite heavy investments of finance, human resources, time and technology in employee training aimed at enhancing worker and organizational performance. There has been very low transfer of learning especially in the Agriculture where the adoption if moisture conservation innovations is very despite heavy investment in all capitals (Andersson and Giller, 2012, Twomlow et al, 2008, Zhou, 2008).This has posed a great challenge in the training of smallholder farmers on new innovations. There is need therefore to find ways of supporting the transfer and application of training for smallholder farmers as they depend mostly on agricultural extensionist trainings for their human resource development.

According to Mosel, (1957) there are three conditions which are essential if transfer of learning is to occur. The first one is the content of the training which has to be useable. Secondly, the trainee had to learn that content, and lastly, the trainee had to be motivated to change his or her behavior on the job in order to apply these new skills. This means that transfer of learning can vary depending on the types of training, trainees and organization, and the socio-cultural and economic contexts of the organizations (Awoniyi et al., 2002)

Effective transfer of learning for smallholder therefore, deepens on role of agricultural extensionist staff to follow up on factors that enhance and limit the application of training.

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II. Definitions and Models

a) Transfer of learning concepts

Transfer of learning is defined as 'the successful and ongoing application by trainees to their performance of jobs knowledge and skills gained by participating in training program. When transfer of learning occurs, it is in the form of meanings, expectations, generalizations, concepts, or insights that are developed in one learning situation being employed in others' (Merriam and Leahy, 2005).Caffarella (2002) defined transfer of learning as successful putting into practice by trainees of what they learned by participating in a training program. For transfer of learning to take place, trainees and all the stakeholders involved in the training process should have the skills of planning, translating, negotiating, adaptation and decision making. Transfer of learning is observed in behaviour changes that is, what is to be transferred can be seen in observable changes in knowledge, skills and attitudes. There is an assumption that when trainees knows what is to be transferred well in advance and how this will be accomplished, transfer will happen with little or no interventions. However, this assumption is not true in some instances as transfer of learning is more complex than simply knowing the learning needs to be applied and to plan about it. The application of the innovations is considered to be multidimensional and complex and needs knowledge, skill, endurance and artistic. Ford and Weissbein (1997) in Ruona, et al. (2002) defined transfer of learning as the application, generalization and maintenance of new knowledge and skills.

In the context of training smallholder farmers, the definition of Ford and Weissbein seems to be adapted and transfer of learning is taking learning out of the training room or trial plots to the actual farm or the home. The idea of Caffarella (2002) that application of innovations is complex requiring knowledge and skills is also important in transferring of learning in practical planting plots of smallholder farmers. However, the system has influences which can hinder or support transfer to happen.

b) Learning

Gieskes and Hyland (2003) defined learning as a continuous process resulting in the increase and

improving knowledge through processing information and adapting to changes in the environment. It is the acquiring of new or modifying existing knowledge, skill, and behaviour and putting it into practice. The organisation is considered as the entities of processing, distributing, interpretation and storage of information and knowledge.

Learning is the change in behaviour or potential behaviour that comes from experience and it cannot be seen but can be observed from the practices of the trainee (Rollinson, 2008). According to Pretty, et al. (2002) learning can not only come from formal training but from the progression of developing oneself through experience. Training is therefore the creation of the learning environment where all participants are involved to share their ideas, views and experience. Pretty (2002) also suggested that for learning to be successful there is need to actively involve the trainees before, during and after training processes.

Race (2010) said that, 'it is the learners who learn'. He went on to say that it is the trainees who do the learning for themselves, but the trainer only creates the condition suitable for the learner to learn called the learning environment.

Leeuwis (2004) described social learning in the rural communities where farmers voluntarily learn and it is connected with human interests and changes in professional practice. These are also adults who are into farming and other livelihoods activities. The learning is different from the classroom situation of teachers and students.

Adult learning is defined by Pretty, et al. (2002) as learning which is mainly informal and is not done under the school curriculum. Adults are voluntary learners if the environment is unfavourable they stop from learning .This is mainly based on participation of the trainees. For adult learning to be successful trainees need to be actively involved in the learning process.

According to Merriam and Leahy (2005) the goal of all learning is to make information useful, so that learning travels with the learner to the working area. In the working area, the learning is transferred and applied in novel, interesting, and innovative ways and this is referred to as transfer of learning. The definitions show that where successful learning is happening transfer of learning is also happening. The two concepts cannot be easily separated in reality and what affects learning also affects the transfer of learning.

c) Theoretical Models

In training farmers there are many factors which influence learning and most of them are outside the actual training program itself and many researchers have come out with models on the transfer of learning. Baldwin and Ford (1988) in Merriam and Leahy (2005) developed a model composed three sets of factors influencing transfer of learning (a) professional /trainee characteristics including ability, personality and motivation (b) content and design of the training program and (c) the work environment which includes support and opportunity to use the new innovations. Geilen (1996) in Lim and Johnson (2002) came out with a model similar to that of Baldwin and Ford which are training design, trainee characteristics and work environment characteristics. Another model related to that of Baldwin and Ford was developed by Broad and Newstrom (1992) in Merriam and Leahy (2005).This model proposes the matrix to analyse transfer of learning and the partners in the process who are the managers, trainers and trainees. The partners can employ the strategies for transfer of learning before, during and after training.

Hucynski and Lewis (1980) in Lim and Johnson (2002) developed the transfer of learning model to show the relationship of the content of the training, individual motivation and work environment. The model has three phases which are the (a) Planning stage where training needs assessment done and motivation initiation are done (b) the learning phase where delivery of instruction are done and (c) post training phase where management of the work environment is done to promote transfer of learning.

This review focuses on the three factors of learning in Baldwin and Ford model which are training design, trainer & trainee characteristic and work environment. It also look at the three phases of training in Hucynski and Lewis model which are planning, learning and post training. The reason of considering the above factors is that even though learning can happen during the actual training the transfer of learning is influenced by what happens around the training such as the work environment, training planning and the character of the trainer and trainee. This therefore means that transfer of learning can be understood by looking at the whole systems beyond the actual training of the farmer and these are the main factors which influences transfer of learning.

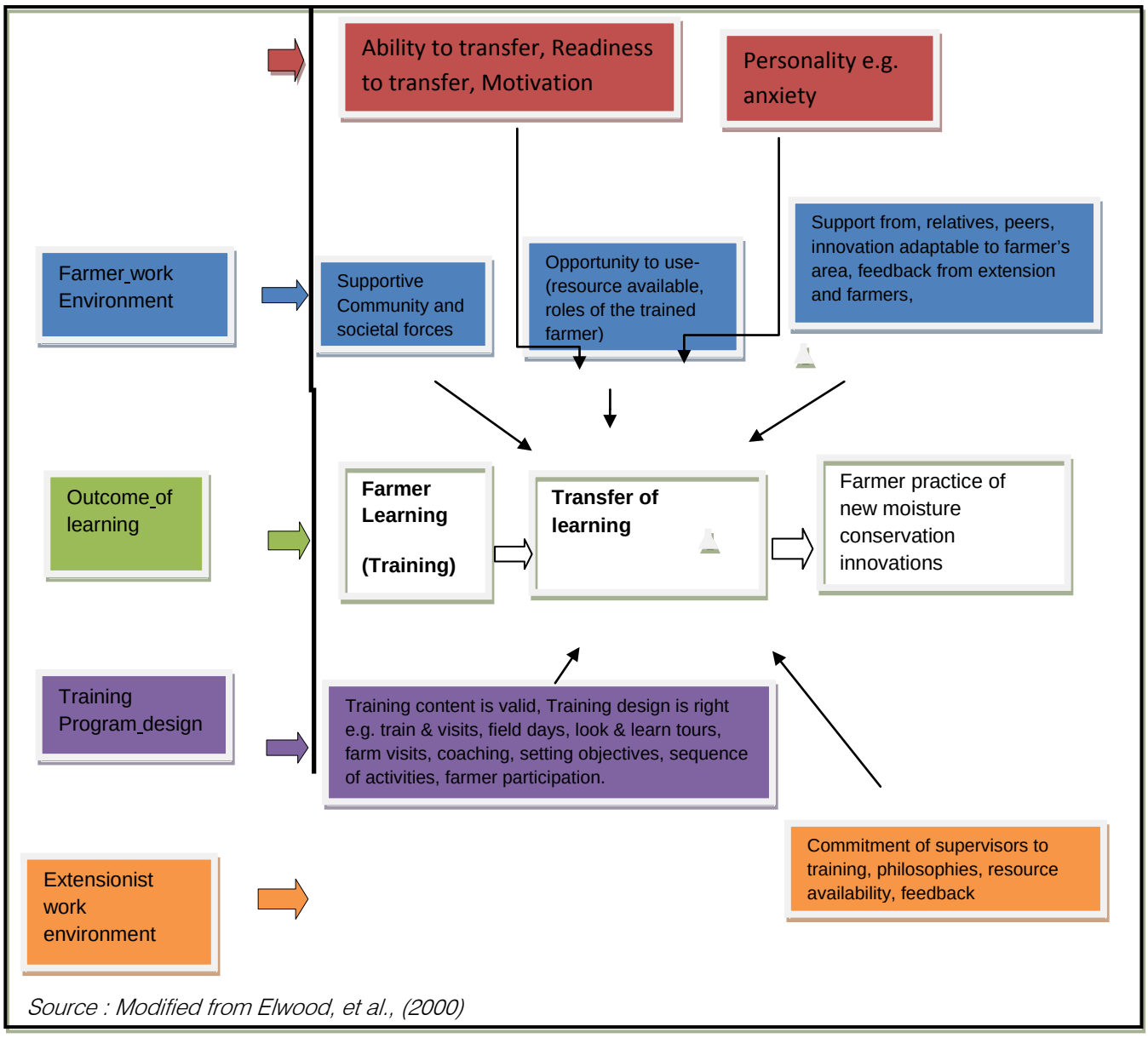
III. Theoretical Model for an Ideal Transfer of Learning

This section describes a hypothetical situation where transfer of learning takes place in an optimal way. Training on moisture conservation innovations case will be described and comparison with other experiences of transfer of learning in other practical situations will be done.

Basing on the models of Baldwin and Ford, Hucynski and Lewis, a modified theoretical model has been used that depicts transfer of learning on moisture conservation innovations. The model shows the factors that influences transfer of learning in Agricultural Extensions organizations. The modification includes the change of the words so that they fit well with the

situation of extension organisation. Trainer and trainee characteristics were changed to agricultural Extensionist and farmer characteristic respectively. The work environment is categorized into extension work environment and farmer work environment. The model shows that, learning outcome (which in this case is the farmer practicing the moisture conservation innovation) is as a result of training the farmers who then transfer learning into their own farms. For this to take place the extension work environment, farmer work environment, extensionist and farmer characteristics and training program design influences transfer of learning. An extensionist and farmer characteristic that affects transfer of learning include motivation, ability to transfer and personality such as anxiety to learn. The farmer work environment includes supportive community and societal forces, opportunity to use, support from peers, and feedback from extensionist and farmers. Extensionist work environments also influence transfer of learning as well as commitment of supervisors to training, support of the supervisors and resource availability. Training program design which includes the validity of the content and transfer design which are the instructional methods also influences transfer of learning. These factors influence the learning outcome by impacting on the farmer learning or trainings thereby hinder or support the farmer to practice the new innovation of moisture conservation. This forms as a guideline to the transfer of learning. This is as shown in fig 1.1 below. The factors which influence transfer of learning are in the coloured boxes while the arrows show the linkage to transfer of learning in the training process of farmers.

Figure 1.1 : Modified model of Ideal transfer of learning.



Source : Modified from Elwood, et al., (2000)

IV. Factors Influencing Transfer of Learning

In this review the focus is on the issues which deals with rural developmental and technology aspects of adult farmers in societal background rather than those at formal education settings. Learning has been looked at from many disciplines some of which are social psychology, adult education studies, innovation studies, policy science and complex systems thinking. This means the learning concepts covers different groups of people in societies.

V. Farm Work Environment and Extensionist Work Environment

Work environment is one of the main factors influencing transfer of learning for instance trainee opportunity to practice the new innovations, incentives to transfer learning, support from supervisors and social support all dependence on the climate of the organisation or the working area. The opportunity comes with the availability of resources at the working area (Merriam and Leahy, 2005). This means for the farmers to be able to transfer what they have learned there should be resources such as seed, fertilizers, labour and implements for them to use. Farmers also need support from extensionists to motivate them by visiting their farms and observing and giving them support. Farmers develop the desire to learn from extensionist initiatives or to practice what is to be learnt. An extensionist have to encourage farmers by providing conducive and friendly learning and working environment for effective learning to take place and farmers cannot get discouraged in doing the work. However, Race (2010) said that 'doing alone is not a guarantee that learning has happened'. For effective learning to take place there is a need to make sense or think about what one is doing. For effective learning to take place, farmers need to process information and turn it into their own knowledge. Brainstorming, problem solving and analysing situations techniques assist the farmers to process the information that will be transformed into useful knowledge. Extensionist plays an important role of transferring learning by encouraging the farmers to practice learned innovations provide their working environment is encouraging and is motivated. This can be done by giving the needed resources to the extensionist such as the training materials and stationery.

Lim and Johnson (2002) on their studies on the trainee perceptions found out that the primary reason for learning transfer to happen was the opportunity to use the new innovations at their jobs. This was found to occur through program planning discussions, program development, information system design and instruction. On the other hand the factors which were found to hinder transfer of learning were that of lack of opportunity to apply the trained practices on the job, the information not directly related to the job, lack of understanding, lack of equipment to use for the technology and difficult to use the technologies at work places (Lim and Johnson, 2002). Similarly farmers can fail to transfer learning for failure to understand the terminologies used during training by extensionist. Again, the innovation might not be related to the farm working conditions of the smallholder farmers. It is therefore imperative for extensionists to use terminologies which the farmers understand without some difficulties. However, at times extensionists find fails translate scientific terms into local languages which farmers understand.

According to Clarke (2002) transfer of learning is affected by information systems, rewards systems, human resource practices, leaders mandate, departmental structures and control systems. Clarke pointed out that management style has a profound influence on the transfer of learning .This has a bearing on the work load of the extensionist. This means overburdening the trainer affects the learning process of farmers unless they supported by the supervisors. The management has to show commitment for the whole process of training either by regularly visiting the training sessions or by supporting the innovations materially.

Gieskes and Hyland (2003) in their studies of learning barriers in continuous product innovation found out that, lack of resources that is time to meet deadlines, lack of budgets, lack of knowledge and capabilities hinder transfer of learning. Klein, et al. (2006) also found out that lack of resources such as time, materials and information affects learning as it reduces the efforts that results in motivation to learn. Farmers' motivation to learn can be reduced if they are not obtaining or purchasing agricultural input before the rain season starts. A shortage of other basic resources such as food, clothing and school fees for their children reduces their concentration to learning thereby reducing transfer. When farmers perceive barriers they become frustrated and lower motivation to learn thereby reducing the effort to transfer learning.

Caffarrela(2002) highlighted that social capital is also an important factor in the transfer of learning. Farmers need support to learn and transfer their learning on new innovation from their relatives, friends, community leaders and the extension organisation. In fact learners need assistance in reflecting changes they must make themselves, before what they have learned can be translated into concrete results (Caffarrela2002). This is supported by (Clarke 2002) who pointed out that social support in the work environment such as the trainee's beliefs about opportunities to use the knowledge, skills as a result of training and support from friends and supervisors have been found to have influence on transfer of learning. However, Facteau, et

al. (1995) in Clarke (2002) in their studies found out that supervisor support was negatively related to transfer of learning.

VI. Training Program Design

Lim (2000) derived two variables from the studies on transfer of learning. These are instructional design and instructional methods. The two variables are called the transfer design of training and they maximized through instructional design, identical stimulus response elements in training and transfer settings when a variety of relevant training stimuli are employed in the training content Baldwin and Ford (1992) in Lim (2000).

On instructional methods Lim found out that teaching, explaining and coaching helps to support the transfer of learning. This help to deepens learning of the trainees. The trainees can explain what they have done to other students and it helps to process the information into their own knowledge.

There are two types of coaching which are, peer coaching and one to one coaching. Peer coaching is where colleagues who work together reflects on the current innovations refine and build new skills and share the ideas and teach one another. The colleagues first have a meeting and discus what is to be monitored and then observe. For instance at schools teachers can observe ones lecture and then discus it later. This was found to foster development among the peers committed to share their knowledge and encourages people to learn from each other hence improves on transfer (Beverly,1994; Sherman & Freas, 2004).This can be done by farmers when they are arranged into groups and observe what the other farmers are doing at their farms. They can record what to observe on the farm and discus it later. They can also explain to other farmers what can be improved in the trainings and on the innovations. This can be planned by farmers together with the extensionists. Observing other farmers can improve learning and keep the innovations in their minds and use it in their own fields hence improving transfer.

Another type of coaching is when the trainer coaches the trainee on one to one level. In a study conducted by (Merriam and Leahy, 2005), found out that training which is followed by one to one coaching improves transfer of learning. In a study of 31 managers who were trained in managerial skills it was found out that training alone increase the managers productivity by about 22%, while coaching which included feedback, setting of goals, involving supervisors and practical increase their productivity by about 88% .In this case the extensionists can discuss with the farmer after the training or on individual farm visits. This can be arranged by both the extensionists and the farmers. The extensionists can coach the farmers at their farms where they will involve their spouses giving feedback and practicing the innovations in their fields. However, extensionists have to know the individual farmer's abilities and limitations at hand and how they can help each other to solve the problem so the farmer can learn new innovations. Visiting farmer's fields by the extensionists can support transfer of learning especially if they give positive feedback and also considering their plights. This is where the extensionists can coach individual farmers to practice the new innovation at farm level and this supports transfer of learning.

Content is one of the factors that has an influence on transfer of learning at work places Lim and Johnson (2002).It has both hindering and facilitatory characteristics which influence transfer of learning. The hindering factor of training are lack of sufficient time to preview the training content, lack of thorough needs assessment for each trainee, not enough practice and exercise session, lack of clarification of technical terminology.

The supporting factors are participatory learning method and use of visual material during training. The ability to coordinate training activities especially in guiding the trainees with appropriate suggestions plays an important role in supporting transfer of learning. The extensionists have to find proper methods that facilities the transfer of learning. For instance assigning the work roles that are related to the training content and trainee work requirements before, during and after training.However, the extensionists have to understand the farmer work environment if effective transfer is to occur (Lim, 2000).

Farmers participation during training can be enhanced by use of visual aids like chalk boards, flip charts and handouts. The Extensionist has to use bright colours and write legibly so that the trainee can see clearly. Visual aids make learning lively and improve the attainment of the training objectives and support transfer. They also help to explain complex ideas and capture attention of the trainees. Lecturing without use of some visual aids can be minimised to make them participate.

Training involves creating an environment where knowledge, skills and experiences are shared. This is, in most cases meant to improve the skills, knowledge, performance and organisation results (Leeuwis, 2004; Pretty, et al., 2002).It is therefore imperative to use participatory methods in programme design and planning. Extensionists have to plan the training programme together with farmers. The farmers should be involved in the selection of the training date, venue and the topic to be trained as this encourages to select what is best of them hence supports transfer of learning. Farmers have very important local knowledge so they must be consulted and put their ideas into the programme. A study by (Elwood, et al., 2000) on training design showed that designed training should be similar

to the transfer tasks and that the training content should be consistent with job requirements. However, farmers' needs to be supported on technical issues as they may lack the expertise on some detailed needed.

Giving feedback to trainees during training program improves transfer of learning. Positive feedback motivates the trainer and encouraged to do the work hence support transfer. Negative feedback affect negatively to transfer as it discourages the trainer and leads to less learning hence reduce transfer. Merriam and Leahy (2005) in a research of students in studying aircraft landing skills found out that those students who were given feedback during training were able to transfer their training to the real flying situation than those who were not given feedback. According to Agritex training manual (2006) feedback gives knowledge of the results and guides the farmer in his or her own efforts. This rewarding to farmers encourages further efforts and interests in practicing the new innovation. Farmers can also be given feedback during the training by the extensionists and from other farmers. This can be done by openly discussing with the extensionists during training and after training that is at individual farm visits.

One of the crucial factors that may hinder the transfer of learning is timing of the activities. Farmers are like to follow the sequence of activities in the field. For instance the digging of basins should be trained when it is time for digging basins. This avoids training farmers the technologies which farmers do not want to use in the near future as this discourages the participation of farmers during training. This may also avoids overloading farmers with too much information thus giving them time to take what they need at the right time (Farming for the future guide, 2009).It is necessary to train them on what they doing so that there is no loss of information due to memory loss.

VII. Extensionist and Farmer Characteristics

Frazis, et al., (2000) as cited in Merriam and Leahy (2005) said that the motivation of the trainer and trainee influence transfer of learning. Giving farmers the opportunity to provide input into the training decision will help improve the motivation of trainees.

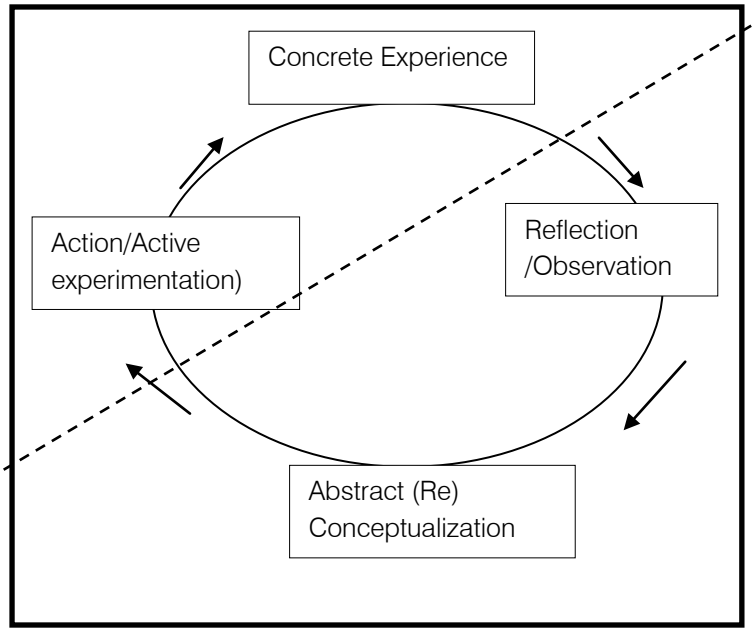
Motivation to learn is the need or wish of the trainee to participate and learn the content of the training program. This is influenced by the farmers and the situational conditions of the training (Klein, 2006). This is the factor which influences the farmers to decide to attend or not to. Rollinson (2008) said that people chose a course of action which is influenced by one's expectations that results in profitable gains. There is a relationship between rewards and the effort one applies to the job. As farmers are adult they attend training voluntarily because of their expectation they will get from the training and this will influences transfer. Forcing farmers to attend trainings might not encourage the transfer of learning.

The decision to adopt new innovation or not to by farmers is entirely influenced by the innovation characteristics. Attitudes toward the innovations are influenced by its alleged usefulness, ease of use, and availability of technical and personal support by the trainee (Griffith, 1996; Martins & Kellermanns, 2004 in Klein, et al., 2006).Transfer of learning for the trained innovations to farmers depends on perceived difficult and its usefulness to the farmer. Extensionist can however enhance the transfer of learning of new innovation by proper training techniques like emphasizing on the benefits of the innovation.

VIII. Adult Experiential Learning Model

Studies of experiential learning together with the concept of reflective practitioner are important issues to consider with regard to transfer. One of the models of experiential learning is the Kolb's cycle explained in Leeuwis (2004). The four stages of the cycle are concrete experience, observation and reflection, abstract concepts and generalizations and then testing the learning in new situations. Experience takes place as first step learning opportunity and is then reflected upon and the new learning or behaviour is then applied in new situation with the cycle. This is a continuous process as shown in fig 1.2 below. Conclusions drawn from the people's own experiences have greater impact than results formulated by others. The model therefore shows that learning occurs from a continuous interaction and iteration between thinking and actions. The model also suggests that learning can be improved by actively supporting the basic steps and translations that take place during the learning process and giving new opportunities for learning.

Figure 1.2 : Experiential learning cycle.

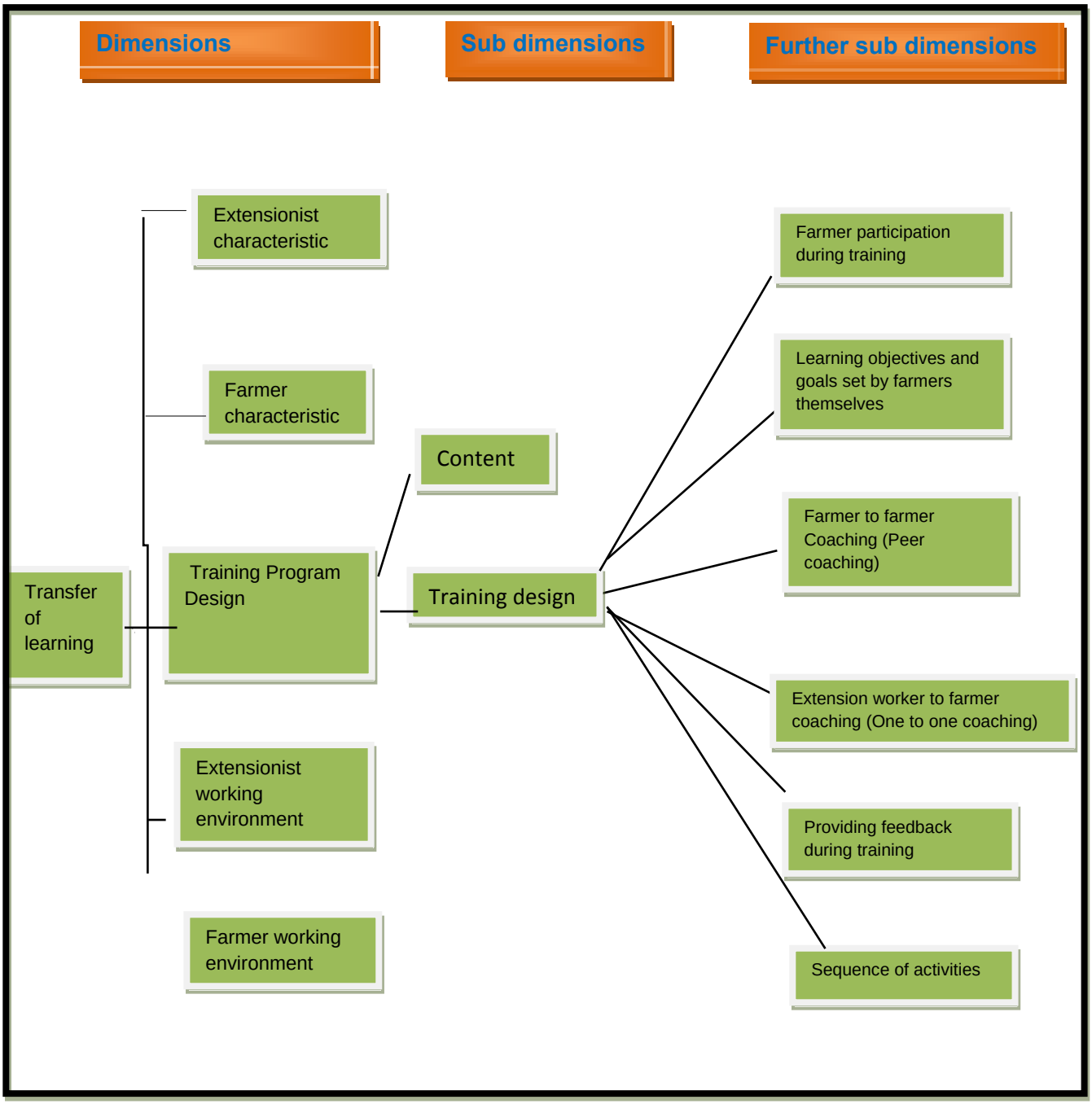


Source : Leeuwis, (2004)

IX. Operationalization Framework

The discussed factors affecting the transfer of learning can be categorized into four main dimensions which may serve as training analytical framework of new innovation for farmers. These are farmer work environment, extension work environment, farmer/ extensionist characteristic and training program design. The training program design is selected to represent the sub dimensions which are content and training design because it is the core of training .This is further categorized into the subdivisions which acts as indicators as shown in the fig 3 below.

Figure 1.3 : Operationalization framework for training new innovation by extensionist.



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Use of Newly Bred β-Carotene Cassava in Production of Value-Added Products: Implication for Food Security in Nigeria

By Aniedu, C. & Omodamiro, R. M.
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Abstract - The investigation into food qualities of six (6) newly bred **β**-carotene cassava namely; NR07/0427, NR07/0432, NR07/0326, NR07/0506, NR07/0497 and NR07/0499 of the National Root Crops Research Institute (NRCRI), Umudike, Nigeria using TMS 30572 as control was carried out. The chemical composition of the fresh roots to determine their carotenoid, moisture and starch contents was also carried out. Furthermore, the six of newly bred **β**-carotene cassava and the TMS 30572 (control) were processed into high quality cassava flours (HQCF) with which their physico-chemical properties were determined. The HQCF were also used in making 10% cassava bread, chin-chin, cakes, strips and salad cream and evaluated organoleptically. The result showed that the moisture contents of the fresh cassava roots ranged from 71.27% (TMS 30572) to 75.26% (NR07/0427) while the starch contents ranged from 11.69% (NR07/0427) to 29.16% (NR07/0499)

Keywords : β-carotene, cassava, carotenoid, physico-chemical, high quality cassava flour, value added products.

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Use of Newly Bred β-Carotene Cassava in Production of Value-Added Products: Implication for Food Security in Nigeria

Aniedu, C. [α] & Omodamiro, R. M. [σ]

Abstract - The investigation into food qualities of six (6) newly bred β-carotene cassava namely; NR07/0427, NR07/0432, NR07/0326, NR07/0506, NR07/0497 and NR07/0499 of the National Root Crops Research Institute (NRCRI), Umudike, Nigeria using TMS 30572 as control was carried out. The chemical composition of the fresh roots to determine their carotenoid, moisture and starch contents was also carried out. Furthermore, the six of newly bred β-carotene cassava and the TMS 30572 (control) were processed into high quality cassava flours (HQCF) with which their physico-chemical properties were determined. The HQCF were also used in making 10% cassava bread, chin-chin, cakes, strips and salad cream and evaluated organoleptically. The result showed that the moisture contents of the fresh cassava roots ranged from 71.27% (TMS 30572) to 75.26% (NR07/0427) while the starch contents ranged from 11.69% (NR07/0427) to 29.16% (NR07/0499).The starch contents of the flours produced from the roots ranged from23.18(NR07/0427) to 61.05% (TMS30572), crude fibre ranged from 0.62 to 1.74% and ash ranged from 0.93 to 1.85%; Packed bulk density ranged from 0.68 to 1.53g/ml, loose bulk density ranged from2.3 to 3.5g/ml and pH from 5.05 to 5.70. The carotenoid content of fresh root samples had values from 0.528 μg/g for TMS 30572 (control) to 3.876μg/g for NR07/0326. The values for the HQCF ranged from 0.146 μg/g to 0.877μg/g TMS30572 and NR07/0326 respectively. The sensory evaluation result of the 10% cassava bread, *chin-chin*, cakes, strips and salad-cream produced from β-carotene cassava varieties revealed that in general acceptability, all the samples were acceptable to the panelists. This study showed that the processed β-carotene cassava varieties contained adequate quantities of carotenoid to combat vitamin A deficiency. The physico-chemical properties and sensory evaluation indicated that β-carotene cassava varieties are good sources of starch, minerals and fibre and could be very useful in nutritional applications and diet formulations.

Keywords : β-carotene, cassava, carotenoid, physico-chemical, high quality cassava flour, value added products.

I. Introduction

Cassava (*Manihot esculanta* Crantz) is cultivated in the tropical regions for its starchy roots. The roots are used for human consumption, animal feed and as raw material in many industries (Vimala *et al,* 2008). Cassava is drought tolerant, requires limited land preparation and grows well in poor soil, all these attributes makes it an extremely adaptable crop. Bradbury and Holloway (1988) reported that cassava tuber generally posses a cream or white flesh colour and contain legible amount of carotenoids. Vitamin A remains very important component of human nutrition, as it involved in vision, cell differentiation, synthesis of glycoprotein, reproduction and overall growth and development (Woolfe, 1992).Vitamin A problem and the severity of the consequences, prevention and therapy become a ubiquitous concern (Noel, 2001 and WHO, 1995). Million of Nigerians irrespective of age, gender or geographical location get less vitamin A than they require. To address Vitamin A deficiency (VAD), Nigeria provides Vitmin A supplements to children (6months to 5 years) during immunization days and has mandated the fortification of wheat and maize flours, vegetable oil, and sugar vitamin A since 2000. The development and dissemination of yellow root cassava will compliment current efforts to address VAD by delivering vitamin A through a staple food consumers eat every day (www.harvestplus.org). Cassava roots are rich in carbohydrates, but deficient in proteins and many essential micronutrients. The recent introduction of yellow root cassava or β-carotene cassava varieties is ideal and proper. .

In recent years, National Root Crops Research Institute (NRCRI), Umudike in collaboration with International Institute of Tropical Research Institute (IITA), Ibadan was involved in the development of highly nutritious root and tuber crops including cassava through a process known as biofortification in other to complement Nigeria Government's efforts to check Vitamin A malnutrition in Nigeria. The new yellow root cassava varieties have potential of providing up to 25% of daily Vitamin A requirements of children and women.

Since the presence of pro-vitamin A (β-carotene) in the new cassava would improve the nutritional status of the consumers, there is therefore need to evaluate various food forms from these newly bred crops for value addition to enhance better and wide range utilization of the crop. Since cassava is a major staple food crop in Nigeria, consumption of this β-

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carotene cassava can help in combating vitamin A deficiency, which is a serious public health problem in many parts of the World. Formulation of different food products from these cassava varieties will also help to enhance it consumption. Studies have shown that the variety, processing method and initial carotenoid content of the fresh root influences the retention of carotenoids (Bai Vimala *et al*, 2010, Sagar K. T *et al*, 2009 and Omodamiro, *et al* 2011).

II. Materials and Method

Six (6) varieties of newly bred β-carotene cassava namely; NR07/0427, NR07/0432, NR07/0326, NR07/0506, NR07/0497 and NR07/0499 with TMS 30572 (control) were obtained from the Cassava Programme, NRCRI, Umudike.

a) Preparation of flour samples

The different cassava varieties were processed into high quality cassava flour (HQCF) and starch, following the methods described by Anabolu *et al* (1998). By harvesting, peeling, washing, grating and dewatering fresh cassava root samples. The caked dewatered cassava mash was broken down and spread out to dry on a raised platform. The dried grated cassava was then milled into flour using Hammer miller. The flour samples were then sieved with a muslin cloth and the resultant HQCF were used in production of 10% cassava bread, cakes, *chin-chin* and strips as described by Anabolu *et al* (1998).

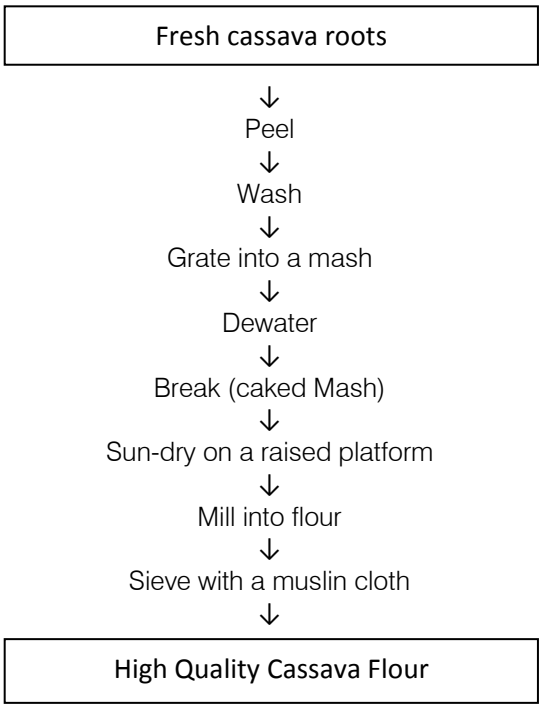

Figure 1 : Production of High Quality Cassava Flour (HQCF).

b) Preparation of starch samples

The starch samples were produced by harvesting cassava roots, peeling, washing and grating fresh cassava roots. The cassava mashed produced was then soaked in water 10 times the volume of the cassava mash, then the soaked mash was sieved with muslin cloth to produce starch samples. The samples were washed 4 times to produce food quality starch used in the preparation of salad-cream.

The starch samples were used in production of salad-cream as described by Anabolu *et al* (1998).

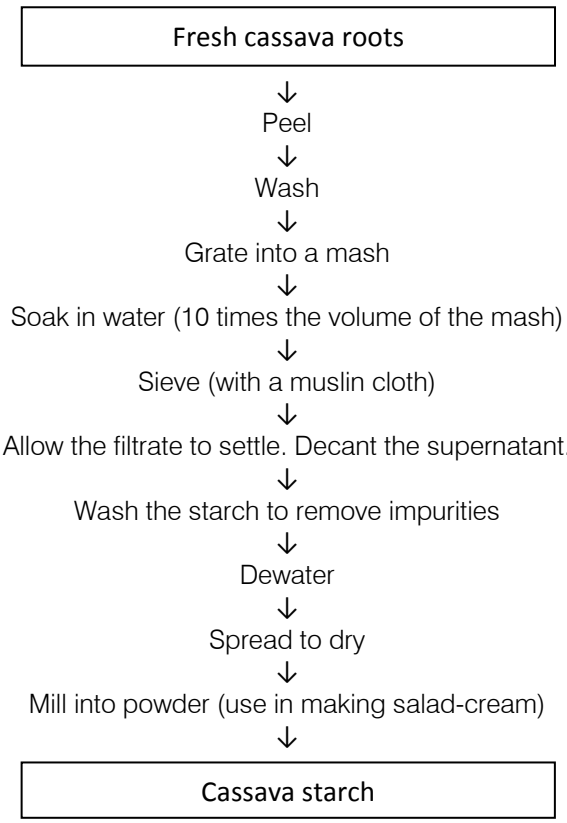

Figure 2 : Production of food quality Starch.

c) Preparation of 10% cassava bread samples

The process was measuring out 900g of wheat flour and 100g of HQCF to which 100g sugar, 120g margarine, 3g instant yeast, a level teaspoon of nutmeg and salt were added and thoroughly mixed together. Then ½ litre of lukewarm water was added to the mixture to form bread dough which was kneaded until smooth and fluffy. The fluffy dough was put into greased bread pans and baked in a hot oven at 200˚C until golden brown to produce 10% cassava bread samples.

d) Preparation of cake samples

The cakes samples were produced by first creaming together 240g sugar and 240g margarine until fluffy. Then 480g of HQCF, 120ml milk, 2 eggs, 10ml vanilla and ½ teaspoon of nutmeg and a pinch of salt were added to the margarine and sugar mixture to form cassava cake batter. The batter samples were put in

greased cake pans and baked at 175˚C until evenly brown.

e) Preparation of chin-chin samples

In producing the *chin-chin* samples 120g g of HQCF was cooked in boiling water. Thereafter, 360g of HQCF, 80g sugar, 60g margarine, one egg, pinch of salt and nutmeg were added to the cooked HQCF to form *chin-chin* pastry samples. The pastry samples were spread on a board and cut into bits and the bits were fried in deep hot oil until attractively brown in colour.

f) Preparation of strips samples

The cassava strips samples were produced by mixing together 120g of HQCF, 225g bean paste, 50g grated onion and salt to taste. The product of this mixture was then passed through manual extruder into deep hot oil and allowed to fry until golden brown.

g) Preparation of salad-cream samples

The food quality starch samples were used in producing salad-cream samples by mixing together 100g starch, 2g mustard, 15g sugar, 2g salt, 175ml vinegar, 225ml water in a pot and cooked until the starch gelatinized. The gelatinized product was mixed with the yolk of 2 eggs and 225ml of vegetable oil. Then the whole mixture was put in a kitchen blender and allowed to run for about 5mins to produce a homogenized salad-cream samples.

h) Chemical Analysis

The fresh root samples and the flour samples were analyzed in duplicates for their starch, crude fibre, ash and pH using AOAC (1995) methods.

i) Physical Properties

The methods described by Onwuka (2005) were used to determine the dry matter and moisture content of the fresh cassava samples. Also, the same method was used to determine the packed bulk density and the loose bulk density of the flour samples.

j) Carotenoid Analysis

The method of Harvest-plus for carotenoid analysis was used for the determination of the total β-carotene content of the samples. Five (5) grams of each fresh root sample was grinded with the aid of hyflosupercel in 50ml of cold acetone and filtered with suction through a Buchner funnel with filter paper. The filtrate was extract was extracted with 40ml of petroleum ether (P.E.) using separating funnel. Saturated sodium chloride solution was used to prevent emulsion formation.

The lower phase being water was discarded while the upper phase was collected into a 50ml volumetric flask, making the solution pass through a small funnel containing anhydrous sodium sulfate to remove residual water. Then, the separating funnel was washed with P.E. and the standard flask made up to 50ml mark. The absorbance at 450ml of the solution was taken using specffophtometer and the total carotenoid content was calculated as follows;

$$\text{Total Carotenoid } (\mu/g) = \frac{A \times \text{volume (ml)} \times 10}{A1\% \times \text{sample weight (g)}}$$
$$1\text{cm}$$

Where A = absorbance, Volume = total volume of extract (50ml), A1% 1 cm = absorption coefficient of β-carotene in P.E. (2592)

k) Sensory Evaluation

The sensory evaluation of the food products were carried out with a 20-man Taste Panel drawn from the staff of NRCRI, Umudike. A seven (7) point hedonic scale (where 1 represented dislike extremely and 7 represented like extremely) was used to evaluate for attributes such as colour, taste, texture/mouth-feel and general acceptability (Iwe, 2002).

l) Statistical Analysis

The Genstat Discovery 3.0 version was used for the statistical analysis of the sensory scores. This involved analysis of variance (ANOVA) and mean separation by Least Significant Difference (LSD) at 5% probability level.

III. Results and Discussion

Table 1 shows that the moisture contents of the cassava roots ranged from 71.27% (TMS 30572) to 75.26% (NR07/0427) while the starch contents ranged from 11.69% (NR07/0427) to 29.16% (NR07/0499). The moisture content of NR 07/0427 was exceptionally high and hence the low starch content. Apart from NR07/0432, the β-carotene cassava varieties had high starch contents.

Table 1 : Moisture and Starch Contents of β-carotene Cassava Fresh Roots.

Cassava Variety	Moisture Content (%)	Starch Content (%)
NR 07/0427	75.26	11.69
NR07/0432	72.05	17.07
NR07/0326	74.48	27.58
NR07/0506	74.68	29.13
NR07/0497	73.91	29.16
NR07/499	73.75	24.31
TMS 30573*	71.27	29.13

** Nota β-carotene Variety; a control sample*

Table 2 shows that starch contents of the flours produced from the roots ranged from 23.18 to 61.05%, crude fibre ranged from 0.62 to 1.74% and ash ranged from 0.93 to 1.85%; Packed bulk density ranged from 0.68 to 1.53g/ml, loose bulk density ranged from 2.30 to 3.50g/ml and pH from 5.05 to 5.70. High bulk density increases the rate of dispersion (Brenen *et al*, 1976), which is important in the reconstitution of cassava flours in hot water to produce cassava *fufu* whereas the varieties with low bulk density are appropriate in bakery industry. The pH values were not low because no fermentation was allowed to occur in the processing of the cassava roots into HQCF. This precluded production of organic acids which would have imparted some flavour to the flour. The values obtained for the proximate composition complies with Standard Organization of Nigeria (SON) specifications.

Table 2 : Some Physico chemical Properties of Total β carotenoid Cassava Flours

Sample	Starch (%)	Crude Fibre(%)	Ash (%)	Packed Bulk Density (g/ml)	Loose Bulk Density (g/ml)	pH
NR07/0427	23.18	1.38	1.05	1.17	3.00	5.05
NR07/0432	37.51	1.20	1.05	1.10	3.00	5.21
NR07/0326	53.56	1.74	1.85	1.53	3.50	5.49
NR07/0506	43.02	0.62	0.93	0.68	2.30	5.70
NR07/0497	48.54	1.17	1.82	1.02	3.10	5.63
NR07/0499	50.42	1.20	1.60	1.01	3.00	5.47
TMS30572*	61.05	1.63	1.15	1.42	2.80	5.49

*Values are means of duplicate data. *Not a β-carotene Variety; a control sample*

The result of the carotenoid content of the fresh and high quality cassava flour (HQCF) in Figure 1 showed that the fresh root samples had values from 0.528 μg/g for TMS 30572 (control) to 3.876μg/g for NR07/0326. The values for the HQCF ranged from 0.146μg/g to 0.877μg/g for NR07/0326 and TMS30572 respectively. The sharp reduction in carotenoid content observed may be as a result of losses during processing. It was observed by Kosambo *et. al.* (1998) that as much as 41% of carotenoid content of orange flesh sweetpotato was lost during dehydration and boiling of the food.

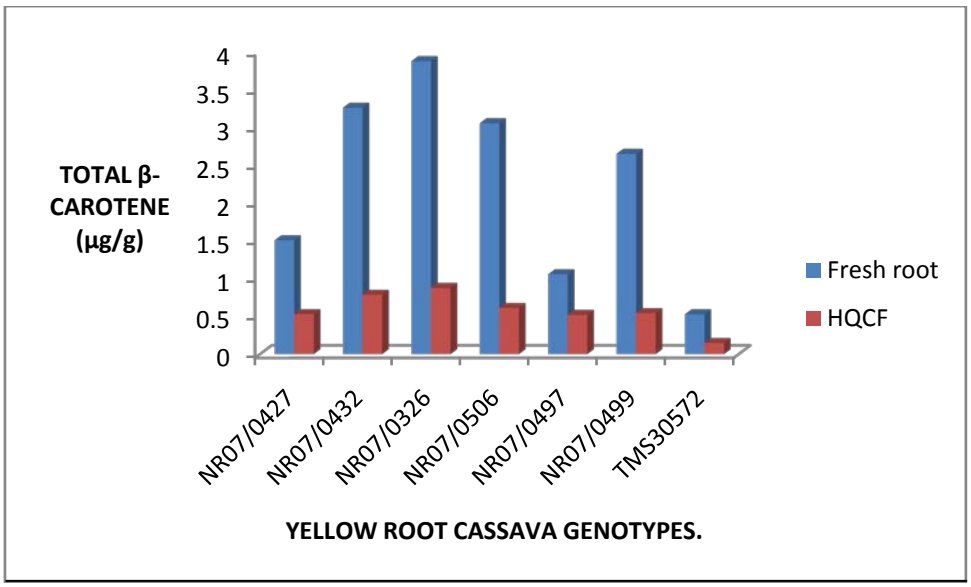

Figure 3 : Total Carotenoid Content of the Yellow Root Cassava Genetypes.
NB : 30572 is white root (control).

The sensory evaluation result of the cake, bread, chin-chin, strips and salad-cream produced from β-carotene cassava genotypes are as shown in Table 3. On the bases of general acceptability, all the samples were acceptable to the panelists. There was no significant difference among the products in all the genotypes.

Table 3 : Sensory Evaluation of the β-carotene Cassava Confectioneries.

10% CASSAVA BREAD				
SAMPLE	COLOUR	TASTE	TEXTURE/ MOUTH-FEEL	GENERAL ACCEPTABILITY
A	5.88	5.24	5.06	5.76 [a]
B	5.71	5.06	5.29	5.41 [a]
C	5.59	5.29	5.53	5.71 [a]
D	5.82	4.76	5.00	5.29 [a]
E	5.88	5.76	5.59	5.82 [a]
F	5.71	5.47	5.41	5.94 [a]
G	5.94	5.88	5.76	5.82 [a]
LSD	0.68	0.93	0.95	
CHIN-CHIN				
A	5.41	5.06	5.18	5.47 [a]
B	5.65	4.88	5.18	5.29 [a]
C	5.35	5.24	5.65	5.94 [a]
D	5.76	5.18	5.24	5.71 [a]
E	5.94	5.65	5.59	6.12 [a]
F	5.33	5.67	5.36	5.79 [a]
G	5.80	5.60	6.00	6.00 [a]
LSD	0.68	0.79	0.81	
CAKES				
A	5.50	5.69	5.44	5.69 [a]
B	5.82	5.65	6.00	6.00 [a]
C	5.63	4.75	4.88	5.31 [a]
D	5.76	4.82	5.29	5.53 [a]
E	5.76	5.47	5.29	5.47 [a]
F	6.12	6.00	5.65	5.94 [a]
G	5.94	5.81	5.75	5.94 [a]
LSD	0.76	0.87	0.87	
STRIPS				
A	6.24	5.18	5.65	5.71 [a]
B	5.53	5.06	4.94	5.24 [a]
C	5.53	5.24	5.53	5.17 [a]
D	5.65	5.29	5.35	5.24 [a]
E	5.88	5.94	5.94	6.06 [a]
F	5.63	5.75	5.38	5.88 [a]
G	5.33	5.50	5.17	5.67 [a]
LSD	0.67	0.85	0.82	
SALAD-CREAM				
A	4.67	4.80	4.67	5.33 [a b]
B	4.53	5.07	4.67	4.60 [b]
C	4.93	5.00	5.40	5.13 [a b]
D	5.13	4.93	5.53	5.60 [a b]
E	4.07	4.20	4.67	5.40 [a b]
F	5.73	5.13	5.40	5.73 [a]
G	3.40	4.73	4.27	4.53 [b]
LSD	1.17	1.06	0.93	

A=NR07/0499, B=NR07/0497, C=TMS30572, D=NR07/0427, E=NR07/0506, F=NR07/0326, G=NR07/0432.

IV. Conclusion

The results obtained in this study showed that the processed β-carotene cassava varieties contained adequate quantities of carotenoid to combat vitamin A deficiency. The results obtained for the physico-chemical properties and sensory evaluation indicated that β-carotene cassava varieties are good sources of starch, minerals and fibre and could be very useful in nutritional applications and diet formulations.

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A Comparative Analysis of Profitability of Cotton Production Under Contract and Non-Contract Farming

By Never Mafuse, Munyati Vincent , Mataruse Professor Edward , Manyumwa Dadirayi & Chimvuramahwe Joseph

Bindura University of Science Education

Abstract - It has been widely argued that agriculture is undergoing a process of vertical integration with allied industries to which contract farming is most acceptable. As a continually evolving process, contract farming has taken many dimensions and has become the most popular issue in cotton production. An analysis was done on 50 Zaka district cotton farmers inorder to come up with the real operations on the ground concerning cotton production by the smallholder communal farmers. The rationale was to compare the two farming systems in terms of productivity and viability of cotton production concerning contracted and self funded farmers. Questionnaires and interviews were used in data collection whilst the respondents were the sampled farmers from Zaka district to obtain primary data. Agritex, Cottco and Windmill were the sources of secondary data about production trends and activities in the district. The data was analyzed using the t-test and profitability ratios. The difference in yield of the two groups of farmers was insignificant considering the two seasons.

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A Comparative Analysis of Profitability of Cotton Production Under Contract and Non-Contract Farming

Never Mafuse [α], Munyati Vincent [σ], Mataruse Professor Edward [ρ], Manyumwa Dadirayi [Ω] & Chimvuramahwe Joseph [¥]

Abstract - It has been widely argued that agriculture is undergoing a process of vertical integration with allied industries to which contract farming is most acceptable. As a continually evolving process, contract farming has taken many dimensions and has become the most popular issue in cotton production. An analysis was done on 50 Zaka district cotton farmers inorder to come up with the real operations on the ground concerning cotton production by the smallholder communal farmers. The rationale was to compare the two farming systems in terms of productivity and viability of cotton production concerning contracted and self funded farmers. Questionnaires and interviews were used in data collection whilst the respondents were the sampled farmers from Zaka district to obtain primary data. Agritex, Cottco and Windmill were the sources of secondary data about production trends and activities in the district. The data was analyzed using the t-test and profitability ratios. The difference in yield of the two groups of farmers was insignificant considering the two seasons. However cotton farming proved viable despite the system used by the farmer with self funding proving to be more profitable considering the current economic situation. From the study it proved better for the smallholder communal to produce cotton on their own to increase market access until proper regulations are put in place with also the economy changed its atmosphere. Also the researcher recommended that the government should put strong regulations that protect both the farmers and the cotton companies in terms of prices and problem solving of other issues.

I. Introduction

Contract farming has been recognised in Zimbabwe and as a system that has the potential to increase productivity and reduce rural poverty. Apart from provision of inputs contract farming has the following benefits: access to credit and loans, provision of extension and technical advice, appropriate knowledge and management systems. These benefits are actually relevant to Zimbabwe's small holder farmers who until recently (when the multicurrency system came into effect) were experiencing continuous economic hardship due to inflation; also input supply was still on a critical condition since shortages are noticed, (Dawes *et al*, 2009).

Agriculture growth in 2011 remained in line with projections of 19.3%, largely attributed to better preparedness through support from Government and cooperating partners, timely availability of inputs through the open market, contract farming arrangements as well as own farmer resources. Due to some uncontrollable circumstances such as draught in 2010-2011 season agriculture produce increased but with an insignificant margin.

Over the years, huge resources were committed to agriculture without the requisite impact on production and productivity. This paper compares the returns per dollar between the contract farmers and non contracted farmers in Zakadistict.

II. Problem Statement

Most farmers are used to produce cotton under the contract. Contract farming has become the conventional system which farmers are implementing and are failing to neglect even with the introduction of new dealers in cotton such as those from China. There is lack of information on the extent to which contract farming of cotton has contributed to alleviation of poverty of communal farmers. The condition of communal farmers has not been significantly changed which has been attributed to the burden passed by the contractors as the prices per bale that is being offered by contract farming companies is far below the world prices which are given below, (IMF, 2011). This has led to side marketing of cotton in Zimbabwe; the Ministry of Finance (2011) noted that incidences of side marketing activities by contracted farmers are threatening the existence of financial schemes which leaves a lot as to which production is perfect considering smallholder farmers.

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World Prices Of Cotton

Actual Market Price for Agricultural Commodities Annual Average					2011 Monthly Averages					
Commodity	Units	2008	2009	2010	Jan	Feb	Mar	Apr	May	Jun
Cotton	Cts/lb	71.4	62.8	103.5	178.9	213.2	229.7	216.6	165.5	164.9

Source : ***International Actual Average Commodity Prices, IMF Data & Statistics***

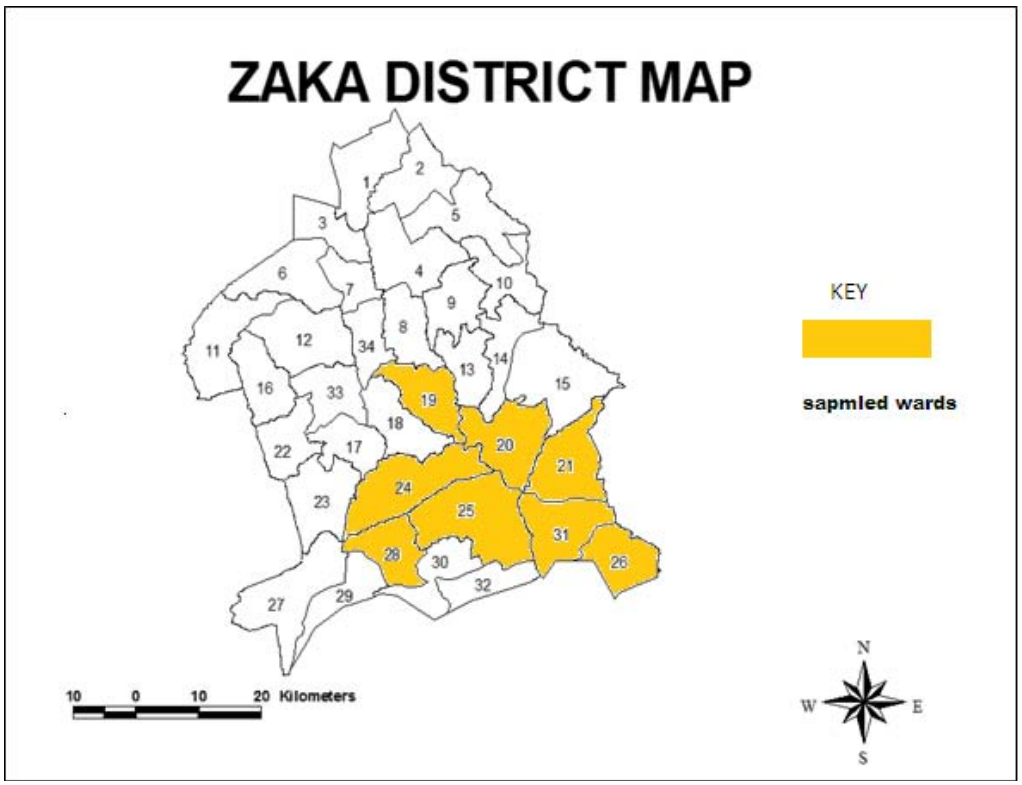
III. Methodology

a) Description of the Study Area

Zaka district is located in Masvingo province, southern Zimbabwe, about 130 kilometers from the city of Masvingo and 70km from Chiredzi town. It lies in natural region V characterized by an annual average temperatures of about 26^{0}C and an average annual rainfall of about 500 mm (Agritex Annual Report, 2009). The district is mostly characterized by sandy loamy soils and black clay loamy soils suitable for cotton production. In addition to cotton production, Zaka farmers are also into production of maize, sorghum, bambara nuts and ground nuts. Crop production including cotton is mostly dry land with irrigation practiced in few areas mainly for subsistence. Beef production is mostly done in the the eastern parts of Zaka district in addition to small ruminant production.

Cotton production is grown as a cash crop with no other use or processing in the area. The communal farmers sell to the contract farming company deport, the only deport in the district located at Jerera growth point. Therefore the study was carried out in Zaka district as cotton is vastly grown in the area; however cotton contract farming contribution to poverty alleviation has not been evidenced with improvement in the standards of living of the communal farmers.

b) Zaka District Map



Source: Ocha Zimbabwe

III. Research Design

a) Sampling Procedure.

The target population were cotton farmers in the wards where cotton is mostly grown as indicated in the map of Zaka district above. In the 8 wards targeted in the study the population of cotton producers amounted to 2800 farmers.

The sample size was obtained using the formular below:

$$\text{Sample Size} = \frac{X^2NP(1-P)}{d^2(N-1) + X^2P(1-P)}$$

X^2 = Table value of Chi-Square at d.f (0.5 confidence level)

N= population size

P = population proportion (assumed to be .50)

d = degree of accuracy (expressed as a proportion-0.05)

Therefore sample size

X^2=3.84, N = 2800, P = 0.50, d = 0.50

$$n = \frac{3.84^2 * 2800 * 0.50\ (1 - 0.50)}{0.05^2\ (2800 - 1) + 3.84^2 * 0.5\ (1 - 0.5)} = 247$$

The respondents were clustered depending on whether they had produced cotton under contract farming or self funding which formed the stratus. In line with selecting the actual farmers on the ground stratified random sampling was used and it was facilitated by the use of lists of cotton farmers obtained from the Agricultural, Technical and Extension services department (AGRITEX). Separate random samples were taken from each stratum of which if put together they form the population. Names of farmers were selected randomly from the lists using random number tables. To avoid bias for the farmers two thirds was selected from the contracted farmers and one third from the non contracted farmers.

b) Data Collection and Tools

The data collected included both qualitative and quantitative including socio demographic factors such as gender, age and marital status; yield, prices of cotton and prices of inputs. Primary data was collected using a structured questionnaire which included the yield and sales of cotton in the 2009/2010 and 2010/2012 seasons. The cost of inputs: seed, pesticides, fertilizers, transport and packaging material which form the marketing bills for the farmers as factors to consider to work out productivity and returns per dollar. Questionnaires and interviews were preferred as they allow active participation of the farmers in providing information.

Secondary data collection was also collected as part of the research. Data collected included the production trends, input usage, sales and the cotton prices in the seasons 2009/2010 and 2010/2011.

c) Data Analytical Tools

T- *Test*

To compare the performance of contract farming and self funded production of cotton for the two seasons was done using the **t-*test.*** This was used in order to clarify whether there was significant difference between the two systems in terms of production capacities or that production capacities are the same or by chance.

d) Gross Margin and Profitability Ratios

Gross margin analysis was used to asses which production system is more viable than the other. Gross margin (also called gross profit margin or gross profit rate) is the difference between revenue and cost before accounting for certain other costs. Generally, it is calculated as the selling price of an item, less the cost of goods sold (production or acquisition costs, essentially).Considering the research, the sales included average sales obtained by the farmers of each production system which included all the grades that is grade A, B, C and D in the two seasons. Costs also included the average cost incurred by farmers of each farming system. The average costs were derived from the cost of fertilizers, seed, pesticides (fernkill and cabryle), transport, labour and packaging costs. The reason why the researcher opted to use the gross margins was to determine the value of incremental sales between the two production systems which were subjected to profitability ratio analysis.

Gross margin ratio was obtained to which it reflects what the farmer has left with from each dollar of net sales to pay operational and other expenses plus make a profit.

Fomular: gross profit / revenue

Earnings on sales also known as return on sales for each farming system was also obtained which shows the return per dollar realized from each dollar of sales per each farming system.

Formular: net income/ sales

a) Return on capital was also calculated which reflects the percentage by which each farmer is earning per dollar invested that the money dedicated by the famers in each season.

b) Formular: net operating profit / invested capital

c) Real prices were used to compute the ratios and they were calculated using 2009 as the base year since this was the time when the $US dollar was officially approved to be used as the country's official currency.

IV. Results

a) T-test Results

These were the t-testresults that were obtained after the data was subjected to SPSS version 16.5 to compare means.

Table 4.2 : t-test summary.

Season		Laverne's test for Equality variances		t-test for equality of means		
		F	Sig	t	df	t-sig
2009-2010	*Equal variance assumed*	.708	.404	-.086	48	.932
	Equal variance not assumed			-.092	43.469	.927
2010-2011	*Equal variance assumed*	5.297	.026	.693	48	.492
	Equal variance not assumed			.803	47.981	.426

Source : survey data 2012

The lerverne's test for variance showed an insignificant F value (.404) to which it suggests the use of equal variance assumed for t test in the season 2009-2010. Also for 2010-2011 the F test value on the leverne's test for variance was significant under 0.05 significant level as it is less than 0.05 which means that the t values under equal variance not assumed are important for analysis.

b) Profitability Ratios for Two Seasons

Profitability ratios indicate the extent to which the farmers benefited from the sales that they have in each season. This gives the idea of how the farmers by production system earned from each dollar of sales and return from each dollar invested.

c) Profitability Ratios Output

Profitability Measure	2009 – 2010 Season		2010 – 2011 Season	
Farming System	*Contract Farming*	*Self Funding*	*Contract Farming*	*Self Funding*
Operation ($)	(1,777.99)	339.40	3,257.95	1,587.75
Earnings On Sales($)	(0.14)	0.07	0.17	0.17
Return On Capital(%)	(12.50)	6.98	20.15	20.87

Source : survey data 2012

The table presents results from the gross margin to which the ratios were calculated using Microsoft excel. It shows ratios that are lucrative when it comes to production in the season 2010/2011 season. However, as for 2009/2010 season ratios for the contracted farmers were to a negative which is disappointing.

V. Discussion

The t-test table shows that F value for the 2009-2010 seasons was insignificant.The t-significant value for equal variance for the seasons that was considered. The t-significant value was 0.932 which is greater than 0.05.This means that it is insignificant meaning that there was an insignificant difference between the yield means for the two groups of farmers (contracted and self- funded) for the period under review. This means that both groups of farmers (contracted and non-contracted) have similar production potentials. This similarity in production for the farmers could be due to climatic and socioeconomic factors prevailing in the district as the rains are very erratic. All farmers are affected by the climatic conditions even though their resources may differ. They are also affected by macro environment factors of the country such the political will, and the shortages of money in the economy. In terms production capabilities for the two groups is therefore not significant.

For the 2010-2011 season, F-sig value was significant hence the t-test value under the equal variance not assumed was considered. Again the t sig value (0.426) was insignificant as it was greater than

0.05.Thus there was no significant yield difference related to growing cotton under contract farming by smallholder farmers when compared to production by self -funding communal farmers. This could be attributed to edaphic factors in the district. The soil in the area is exhausted such that yield levels are almost similar for everyone despite the differences in resource endowment. However, The small differences noticed was due to management practices by the contracted farmers. This is because they are monitored by the cottico extension officers on sound agronomic practices. The yield levels in each farming systems was very low than expected by the contract farming company of 7 tonnes per hectare. This shows that yield levels are marked towards production systems but to climatic factors like droughts. This actually contradicts with the mainstream perception that if the utility associated with new technological innovations is the same with the status quo, then decision makers are less likely to adopt these innovations (Roggers 1995).

The economic returns that are realized by the farmers from the different farming systems are crucial, as this affect the farmer's livelihood quality since the disposable income will be affected. There was a significant difference between revenue obtained by the farmers in the season 2009/2010. This entails that the margin between the profit earned by the self-funding farmers was far much higher than that of the contracted farmers. A negative return on capital and return on sales obtained by the contracted farmers indicated serious losses, as this implies that, for every dollar that was invested by the farmer a shortfall was realized, that of 12.5% which discourage participation in cotton production. Considering that the average yield obtained by farmers of the two farming systems were statistically insignificant, it shows that somehow the contract farming system deprived farmers in their operations, marketing and hence returns. Again the costs of production were almost the same for both contracted and self funding farmers, with also the marketing bill for contracted farmers being very much lower than that of the self funding farmers. This brought a fair advantage of contract farming over self funding production. However as for the disposable income for the farmers, self funding farmers were better off in terms of returns than the contracted farmers. This was attributed to better prices that were offered to the cotton seed by other companies that were coming to purchase the produce in the district were paying exceptionally higher prices than the contract farming company hence self funding farmers benefited more than contract farmers.

The results however, show that the shortfall by the contracted farmers was not permanent. This was indicated by the lucrative returns on capital that were above 20% hence reflecting that both the farming systems in the season were paying back a good margin for each dollar that was invested for the production by the farmers whether contracted or non contracted. A rate of 20% explains that 20% of all the money the farmer spends in production and the marketing bill was recovered as profit. Also as for the profit generated from each dollar of sales, contracted farmers stirred up from a dismal negative margin in 2009/2010 season to a positive margin which happens to be equal to that of self funding farmers that is 17% of the dollar of sale which is a better level in terms of operations. This implies that for every dollar of sales that the farmer realized 17% was realized as profit. Cotton production is therefore a lucrative endeavor provided marketing strategies is in favor.

VI. Conclusion

Cotton production under contract farming was found to be the norm of the farmers in Zaka district. Basing on the two farming seasons that is 2009/2010 and 2010/2011 season, farming systems were found adding no value to the output of the farmer. This bears the picture that contract farming system as a recommended system in cotton production adds not much value other than encouragement of land size increment due to input provision for production in a season hence the hypothesis that farmers in contract farming produce more cotton than self funded farmers is rejected

The production capacities of the farmers despite the system are equal. As the yields for the two farming systems were the same.

Despite the fact that contracted farmers realized. serious losses in the first season, both farming systems showed signs of viability hence cotton production in Zaka district by the smallholder farmers is viable. This led to the acceptance of the hypothesis that cotton production by smallholder farmers is viable.

Self-funding, proves to be a better system as the farmer is left with a vast wide market option to consider and realizes a better margin in terms of income as compared to contract farming

VII. Recommendations

Considering the outcomes of the survey, the researcher recommends that farmers should negotiate better cotton prices if they are to remain in the contract. The farmers can lobby for better cotton prices through the government or through the Agricultural Marketing Authority in Zimbabwe.

The cotton companies are taking advantage of the underrepresented or unrepresented contracted farmers. They are being paid less for their produce than self- funded farmers due to the obedience of the contracts that they have with the contractors even if the contractor is offering uncompetitive prices. The researcher recommends that the farmers should form

strong cotton producers association that would represent their interest rather than to be individualistic.

Producing cotton as a self-funding farmer is more profitable than contract farming since there is flexibility in the market options that maximizes their revenues. The researcher recommends that farmers should concentrate on more paying self- funding production systems instead of being exploited by contract farming companies.

The Cotton companies should offer prices that can leaves the farmer appreciating producing the white gold. This would reduce the incidences of side marketing which affects the profit margins of the organization.

The cotton company of Zimbabwe, should lobby for f setting favourable regulations for the farmers such as pre-season setting of cotton buying prices and again put measures that can eliminate side marketing by discouraging firms to buy cotton in areas which they do not have contracted farmers.

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Evaluation of Effective Microorganisms on Production Performance of Rhode Island Red Chicks

By M. Simeamelak, D. Solomon & T. Taye
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Abstract - Effective Micro-organism (EM) is a product characterized by a mix of aerobic and anaerobic microorganisms and reported to have successfully be used for increasing productivity in integrated animal units and poultry farms in many countries including South Africa. The objective of this study was to evaluate the effect of EM on the production performance of Rhode Island Red (RIR) chicks. A total of 348 RIR day old chicks were randomly divided into twelve groups of 29 chicks each and each group was housed in separate individual pen thoroughly cleaned and prepared in advance. Finally 4 treatments containing 0, 4, 8 and 12 ml of EM/litre of drinking water were randomly assigned to the experimental chicks in completely randomized design with 3 replicates for study period of 12 weeks. Feed consumption, chick growth, feed conversion efficiency and survival rate were used as evaluation parameters. The results showed that there was no significant difference between all the treatment groups ($P>0.05$) in mean weekly feed consumption though the groups placed on the treatment containing 0 ml/liter of water tended to consume more.

Keywords : *effective microorganisms, growth performance, RIR chicks, survival rate.*

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Abstract - Effective Micro-organism (EM) is a product characterized by a mix of aerobic and anaerobic microorganisms and reported to have successfully be used for increasing productivity in integrated animal units and poultry farms in many countries including South Africa. The objective of this study was to evaluate the effect of EM on the production performance of Rhode Island Red (RIR) chicks. A total of 348 RIR day old chicks were randomly divided into twelve groups of 29 chicks each and each group was housed in separate individual pen thoroughly cleaned and prepared in advance. Finally 4 treatments containing 0, 4, 8 and 12 ml of EM/litre of drinking water were randomly assigned to the experimental chicks in completely randomized design with 3 replicates for study period of 12 weeks. Feed consumption, chick growth, feed conversion efficiency and survival rate were used as evaluation parameters. The results showed that there was no significant difference between all the treatment groups ($P>0.05$) in mean weekly feed consumption though the groups placed on the treatment containing 0 ml/liter of water tended to consume more. There was no significant difference ($P>0.05$) between all the treatment groups in growth performance during the first 4 week of brooding. However, the mean survival rate (90%) and mean weakly body weight gain to an age of 8 weeks were significantly higher for the groups assigned to the treatment containing 12 ml of EM/liter of drinking water ($P<0.05$) as compared to the others. The groups placed on the treatments containing 4-12 ml of EM/liter of drinking water showed significantly ($P<0.05$) higher feed conversion efficiency than the groups assigned to the negative control treatment. In summary the result of this study clearly showed that inclusion of 4-12ml of EM/liter of drinking water resulted in significant improvement in growth performance, feed conversion efficiency and health status during the brooding period of RIR chicks. Investigating into the feasibility of extending EM technology to indigenous chicks could be the future direction of research.

Keywords : effective microorganisms, growth performance, RIR chicks, survival rate.

I. Introduction

In the central highland of Ethiopia, almost every rural family owns chickens indicating that chickens are the most widespread and affordable source of animal protein and family income (Tadelle et al., 2003). However, there is no exact figure representing the Ethiopian poultry population. According to CACC (2003) and FAO (2005) the Ethiopian indigenous chickens are estimated at 42.9 and 39 million, respectively while the Central Statistical Authority (2004-2005) reported 31 million for both indigenous and commercial chickens. The imported chickens are estimated to be about 2.18% of the total national chicken population of the country and consist of significant proportion of Rhode Island Red (RIR) breeds of chickens. The national chick (0-8 weeks of age) population is estimated to be about 42% of the total chicken population and characterized by high mortality of about of 40–60% and periodic devastation by disease (Reference). Moreover the productivity of the indigenous chicks is low, while the survival rate of the exotic chicks are poor at the rural household levels. It have been seen that the provision of vaccination and better health care, improved feeding and the use of Effective Microorganism improve the production performance of the both indigenous and exotic chicks.(Teketel, 1986 and Abebe, 1992, Chantsawang and Watcharangkul 1999 and Konoplya and Higa 2000)

The concept of Effective Microorganisms (EM) was developed by Professor Teruo Higa, University of the Ryukyus, Okinawa, Japan (Higa, 1991; Higa and Wididana, 1991) and the first solution of EM developed contained over 80 microbial species isolated from Okinawa and other environments in Japan. The original EM technology was gradually refined to be a mix of aerobic and anaerobic microorganisms consisting of photosynthetic bacteria, lactobacillus bacteria and yeasts and/or fungi (Higa and Wididana 2007).At present EM is produced in many countries and found to be safe, effective and environmentally friendly (Sangakkara, 2001). Effective Micro-organism is found to be useful in a wide variety of fields. Studies conducted in Asia (Chantsawang and Watcharangkul 1999) and Belarus (Konoplya and Higa 2000) reported the successful use of EM in poultry feeding. The improvement in production performance of poultry fed on the ration containing EM was reported to be attributed to the improvement in feed bioavailability, balance of gastrointestinal microorganisms, and enhancement of the immunity status of the birds. It was reported to be successfully used for increasing

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productivity in integrated animal units and poultry farms in South Africa (Hanekon *et al.*, 2001, Safalaoh and Smith, 2001). There is no environmental and public health hazard reported from the use of EM technology in animal feeding (SCD, 2010 citing Kitazato Environmental Science Center, 1994). These being the cases, the objective of this research project were to evaluate the effect of Effective Micro Organisium on the production performance of Rhode Island Red chicks.

II. Methodology

a) Description of the Experimental Site

This experiment was conducted at Jimma University College of Agriculture and Veterinary Medicine (JUCAVM), located at 357 km southwest of Addis Ababa at an altitude of 1710 meter above sea level.The mean maximum and minimum temperature of the study area is 26.8^{0}C and 11.4^{0}C, respectively and the mean maximum and minimum relative humidity is 91.4% and 39.92% respectively. The mean annual rainfall of the area is 1500mm (BPEDORS, 2000).

b) Experimental Treatments

Adequate quantities of extended/secondary EM packed in plastic jar was obtained from Weljijie P.L.C. located in Debre Zeit which intern located at 70 km east of Addis Ababa. Weljijie P.L.C. obtains the primary culture from EMROSA P.L.C. found in Sweden. The EM was transported to JUCAVM poultry farm and stored properly until required for the formulation to the experimental treatments. Four experimental treatments shown in (Table1) were prepared by inclusion of 0, 4, 8 and 12 ml of EM solution/liter of chlorine free drinking water.

c) Management of Experimental Birds

A total of 350 unsexed day old chicks of Red Island Red (RIR) breed were purchased from Southern Regional State poultry breeding and multiplication canter located in Bonga, 108 km South of Jimma town. Three hundred forty eight chicks were divided into 12 groups of 29 chicks each. Each group was housed in a separate individual pens (JUCAVM brooder house) thoroughly cleaned and well prepared in advance. Each group was randomly assigned to the four treatments in completely randomized design with 3 replicates for a study period of 12 weeks (Table 1). All the treatment groups were fed to appetite with commercial starters ration and clean water was made available all the times. Data on body weight gain, feed consumption, feed conversion ratio, survival rate and related parameters were collected throughout the study period of 12 weeks., Body weight was measured every week whereas; feed intake was measured daily. Mortality and disease conditions were recorded as occurred.

Table 1 : Treatment Allocation to the Experimental Chicks.

Treatments	Rep/Treat.	Chicks/Rep	Total
0 ml of EM/liter of drinking water, control (T1)	3	29	87
4 ml of EM/liter of drinking water (T2)	3	29	87
8ml of EM/liter of drinking water (T3)	3	29	87
12ml of EM/liter of drinking water (T4)	3	29	87
Total	12	116	348

III. Statistical Analysis

Collected data on non-random repeated measurement (body weight, Body weight gain, feed consumption and feed conversion efficiency) were subjected to Repeated Measures Design (RMD) of SAS 9.00 version for analysis (SAS institute, 2002). Least square mean were used for comparison.

IV. Results

a) Feed Consumption

The mean weekly feed consumption of the experimental chicks placed on different levels of EM are shown in Table 2. There was no statistically significant ($P>0.05$) difference between all the treatment groups in mean weekly feed consumption during the entire brooding period (Table 2). The mean weekly feed consumption of the experimental chicks was calculated to be 269.8, 260.3 260.00 and 259.4 gm/head for the treatment groups placed on the treatment containing 0, 4, 8 and 12 ml of EM/liter of drinking water respectively indicating that the groups placed on the control treatment (T_1) tended to consume more.

Table 2 : Weekly mean feed consumption (gm/head) of the experimental chicks placed on different levels of Effective Microorganisms.

Age	T_1	T_2	T_3	T_4	s.e.	p-value
Week 1	32.67	33.27	34.7	33.8	2.50	>0.05
Week 2	61.47	56.83	60.50	60.67	0.75	>0.05
Week 3	93.10	91.70	92.63	101.50	1.99	>0.05
Week 4	148.37	143.83	141.43	160.17	4.10	>0.05
Week 5	182.00	174.33	186.00	177.00	2.15	>0.05
Week 6	235.00	225.20	222.57	227.03	8.18	>0.05
Week 7	249.87	231.30	240.10	245.77	5.77	>0.05
Week 8	329.40	305.53	309.90	325.37	9.92	>0.05
Week 9	399.60	392.67	398.13	384.67	11.17	>0.05
Week 10	460.87	437.43	439.77	436.40	11.12	>0.05
Week 11	501.60	500.00	483.77	449.97	13.00	>0.05
Week 12	543.20	530.00	510.53	510.87	14.44	>0.05

**s.e. = standard-error; Means in a row without superscripts are statistically not significant (p>0.05); T_1 = control, T_2 = 4ml of EM/lit of water, T_3 = 8ml of EM/lit of water; T_4 = 12ml of EM/lit of water.*

b) Growth performance

As shown in Table 3, there was no statistically significant (P>0.05) difference in growth performance between all the treatment groups during the first four weeks of brooding. The groups placed on the treatment containing 12 ml of EM/liter of drinking water was found to be superior to all the others in mean weekly body weight gain to an age of 12 weeks, followed by the groups placed on the treatment containing 8 ml of EM/liter drinking water. On the other side the groups placed on the control treatment (T_1) was significantly lower (P<0.05) than all the others in mean weekly body weight gain to an age of 12 weeks indicating that the administration of 4-12 ml of EM/liter of drinking water resulted in better growth performance of the experimental chicks as measured by the mean weekly body weight gain.

Table 3 : Weekly mean body weight gain of the experimental chicks placed on different levels of Effective Micro organisms (gm/head).

Age	T_1	T_2	T_3	T_4	s.e.	p-value
Week 1	5.87	6.2	6.3	8.0	0.47	>0.05
Week 2	25.50	28.27	27.17	32.2	1.50	>0.05
Week 3	53.70	57.23	56.07	62.27	2.18	>0.05
Week 4	113.17	129.23	132.63	153.00	11.61	>0.05
Week 5	152.93^{b}	181.17^{b}	187.93^{b}	209.53^{a}	11.24	<.0001
Week 6	211.83^{b}	241.97^{ab}	252.57^{ab}	266.00^{a}	6.31	<0.01
Week 7	266.70^{b}	287.60^{ab}	308.67^{ab}	318.30^{a}	7.50	<0.05
Week 8	344.67	368.60	377.80	385.13	10.38	>0.05
Week 9	391.67^{b}	407.87^{ab}	401.93^{ab}	462.20^{a}	10.71	<0.05
Week 10	425.47^{b}	458.77^{ab}	510.82^{a}	534.58^{a}	11.85	<0.05
Week 11	458.83^{b}	504.58^{ab}	576.7^{a}	589.72^{a}	12.50	<0.0001
Week 12	517.10^{b}	567.13^{ab}	619.2^{a}	639.05^{a}	7.96	<0.0001
Average	247.29^{d}	269.05^{c}	288.15^{b}	305.02^{a}	3.96	<0.05

**s.e. = standard-error; Means in a row having similar superscripts are statistically not significant (p>0.05); T_1 = control, T_2 = 4ml of EM/lit of water, T_3 = 8ml of EM/lit of water; T_4 = 12ml of EM/lit of water.*

The mean weekly growth performance of females and males were separately recorded during the 9^{th} – 12^{th} weeks of the feeding period (Table 4). There was no statistically significant difference (P>0.05) between all the female treatment groups in body weight gain during the 9^{th}-12^{th} weeks of feeding, though the groups placed on the treatment containing 8 ml of EM/liter of drinking water tended to be higher than the others.

Table 4 : Weekly body weight gain of females placed on different levels of EM (gm/head).

Age	T_1	T_2	T_3	T_4	s.e.	p-value
Week 9	50.87	51.00	52.56	50.23	14.63	>0.05
Week 10	108.40	110.47	139.30	150.40	16.77	>0.05
Week 11	139.93	143.83	214.10	194.70	15.34	>0.05
Week 12	197.37	209.50	261.37	248.93	16.72	>0.05
Average	124.14	128.70	166.83	161.07	8.70	>0.05

**s.e. = standard-error; Means in a row without superscripts are statistically not significant (p>0.05); T_1 = control, T_2 = 4ml of EM/lit of water, T_3 = 8ml of EM/lit of water; T_4 = 12ml of EM/lit of water.*

The mean weekly body weight gain of the groups of males receiving 8-12 ml of EM/liter of drinking was significantly (p<0.05) higher than the others indicating that males are more reactive to administration EM in drinking water than the females as measured in terms of weekly body weight gain. There was no significant difference (P>0.05) between the groups of males placed on the treatment containing 0 ml and 4 ml of EM/liter of drinking water in weekly body weight gain during the 9th-12th weeks of feeding.

Table 5 : Weekly body weight gain of cockerels placed on different level of EM (gm/head).

Age	T_1	T_2	T_3	T_4	s.e.	p-value
Week 9	51.03	67.53	73.00	62.20	14.88	>0.05
Week 10	115.20^{b}	118.60^{ab}	155.73^{ab}	173.53^{a}	15.56	<0.005
Week 11	141.73^{b}	166.87^{ab}	212.70^{a}	229.50^{a}	15.17	<0.05
Week 12	210.83^{b}	236.30^{ab}	250.43^{ab}	273.93^{a}	16.66	<0.05
Average	129.70^{b}	147.33^{ab}	172.97^{a}	184.79^{a}	12.02	<0.05

**s.e. = standard-error; Means in a row having similar superscripts are statistically not significant (p>0.05); T_1 = control, T_2 = 4ml of EM/lit of water, T_3 = 8ml of EM/lit of water; T_4 = 12ml of EM/lit of water.*

c) Feed Conversion Efficiency

The results of feed conversion ratio of the experimental chicks placed on the different treatments are shown in Table 6. There was no statistically significant (p>0.05) difference between all the treatment groups in feed conversion ratio expressed as grams of feed consumed /gram body weight gained during the brooding period. The treatment groups receiving 12 ml of EM/liter of water showed significantly better (p<0.0001) feed conversion ability than the others during the first week of brooding. However, there was improvement in feed conversion ratio as a result of addition of 4-12 ml of EM/liter of drinking water as compared to the control group. Statistically significant (P<0.01) difference in feed conversion ratio appeared starting from the 10th week of the feeding trial (Table 6). Significantly larger amount of feed was consumed per unite body weight gain brought by the groups (p<0.05) assigned to the control treatment (0 ml of EM/liter of water)indicating that there was improvement in feed conversion efficiency as a result of inclusion of 4-12 ml of EM/liter of drinking water starting from the 10th week keeping.The mean weekly feed conversion ratio brought by the groups assigned to the treatment containing 0 ml/liter of drinking water was significantly (P<0.001) higher than all the others.

Table 6 : Weekly feed conversion ratio of chicks placed on different levels of EM (gm of feed /gm body weight gain).

Age	T_1	T_2	T_3	T_4	s.e.	p-value
Week 1	5.64^{a}	5.49^{a}	5.84^{a}	4.23^{b}	0.68	<0.0001
Week 2	3.75	3.20	3.51	2.93	0.22	>0.05
Week 3	3.50	3.19	3.35	3.15	0.13	>0.05
Week 4	2.39	2.54	2.52	2.35	0.31	>0.05
Week 5	3.35	2.77	2.77	2.55	0.22	>0.05
Week 6	3.57	3.00	2.93	2.85	0.12	>0.05
Week 7	3.76	3.33	3.17	3.16	0.12	>0.05
Week 8	3.87	3.52	3.41	3.46	0.07	>0.05
Week 9	4.43	4.06	4.20	3.71	0.14	>0.05
Week 10	5.18^{a}	4.57^{b}	4.16^{b}	4.03^{b}	0.14	<0.0001
Week 11	5.92^{a}	5.14^{ab}	4.53^{b}	4.41^{b}	0.19	<0.01
Week 12	6.28^{a}	5.51^{ab}	5.04^{b}	4.87^{b}	0.16	<0.0001
Average	4.35^{a}	3.86^{b}	3.78^{b}	3.48^{c}	0.13	<0.001

**s.e. = standard-error; Means in a row having similar superscripts are statistically not significant (p>0.05); T_1 = control, T_2 = 4ml of EM/lit of water, T_3 = 8ml of EM/lit of water; T_4 = 12ml of EM/lit of water.*

d) Rate of Survival

About 90% of the experimental chicks assigned to the treatment containing 12 ml of EM/liter of drinking water survived to an age of 4 weeks, the value of which is higher than all the others. The highest survival rate to an age 8 weeks was recorded from male chicks receiving treatment containing 12 ml/liter of water (Table 7).

Table 7 : Mean weekly survival rate of experimental chicks placed on different level of Effective Microorganisms.

Age	T_1	T_2	T_3	T_4
Week 4	82.76	87.36	87.36	89.66
Week 8	75.86	86.21	87.36	87.36
Week 8 females	73.56	93.1	82.76	66.67
Week 8 males	78.27	71.74	84.79	94.21

Cost benefit analysis (table 8) showed both T_2 and T_3 had positive net return over the control, while T_4 was showed negative return over the control.

Table 8 : Partial budget analysis on different level of Effective Microorganisms (currency in Ethiopian Birr, ETB).

Trt/parameters	T1	T2	T3	T4
Total cost/T	637.49	700.48	714.07	736.49
Total income/T	1213.33	1423.33	1350.00	1233.33
Net return/T	575.85	722.85	635.93	496.84
Net return over the control	-	147.00	60.08	-79.01

**Total cost = cost of birds, feed, EM, labor water and electric*

**Total income = sale of birds and eggs*

V. Discussion

a) Feed Consumption

The mean weekly feed consumption to an age of 12 weeks was calculated to be 269.76, 260.25, 260.00 and 259.43 gm/head for the groups assigned to the treatment containing 0 ,4, 8 and 12 ml of EM/liter of drinking water respectively indicating that the groups placed on the control treatment tended to consume more. In line with this results Safalaoh (2006), reported that groups of broilers fed diets supplemented with EM, at the rate of 1ml/liter of drinking water had lower feed consumption compared to the groups fed on control treatment. The current results are also in agreement with that of Santoso et al. (2001) who reported that inclusion of 0.5% fermented product of *Bacillus subtilis* reduced feed consumption of the experimental chicks. A trial conducted by Botlhoko (2009) to study the effect of EM, AGP (antimicrobial growth promoter) and combination of EM and AGP at the rate of 50 ml/ per liter of water showed that feed consumption to an age of 21 days was higher for the groups of broilers fed on the control treatment. Feed additives usually play roles by regulating feed intake and increasing digestibility of nutrients and energy (Wenk, 2000). On the contrary, the results of this study disagree with that of Ashraf, et al. (2005), who reported higher feed consumption from groups of broilers supplemented with mixture of probitic microbs as compared to those placed on the negative control treatment. Similarly in an attempts made to study the effect of probitic (Bio-Plus 2B®) on broilers both during growing and finishing periods. Rahimi (2009) reported that the supplemented groups tended to consume more than the groups placed on the control treatment.

b) Growth Performance

The treatment groups placed on the control treatment was significantly lower ($P<0.05$) than all the others in mean weekly body weight gain to an age of 12 weeks indicating that the administration of EM in drinking water resulted in better growth performance of the experimental chicks. This result is in agreement with that of Wenk (2000), who reported that feed additives usually play rolls by regulating feed intake and increasing digestibility of nutrients and availability of energy. The results of this study showed that there was no significant difference between the groups placed on the treatment containing 8-12 ml of EM/liter of drinking water in mean in weekly mean body weight gain to an age of 12 weeks. These results are in agreement with that of Kalavathy et al., (2003) who reported improved body weight gain of broiler with supplementary administration of Lactobacillus. Rahimi (2009) also reported significantly higher ($P<0.05$) body weight gain of broilers placed on a probitic (Bio-Plus 2B®) organisms both during growing and finishing periods. Similarly Safalaoh (2006) reported, significantly ($P < 0.05$) higher body weight gain from experimental broilers fed diets supplemented with EM, at the rate of 1ml/liter of water.

c) Feed Conversion Efficiency

The amount of feed consumed per unite body weight gain was significantly ($p<0.05$) higher for the

groups receiving control treatment indicating that there was improvement in feed conversion efficiency as a result of inclusion of 4-12 ml of EM/liter of drinking water. There was no significant ($P>0.05$) difference in feed conversion ratio between the groups receiving 4 and 8 ml of EM/liter of drinking water. These results are in agreement with that of (Kalavathy et al., 2003) who reported improved feed conversion ratio of broiler offered supplementary administration of Lactobacillus. Rahimi (2009) also reported significantly better ($P<0.05$) feed conversion ratio of broilers placed on a probitic (Bio-Plus 2B®) organisms during the last phase of the finishing period. He reported significantly better feed conversion ratio from the groups of broilers placed on a probitic (Bio-Plus 2B®) organisms during the first three weeks of rearing.

d) Rate of survival

About 90% of the experimental chicks assigned to the treatment containing 12 ml of EM/liter of drinking water survived to an age of 4 weeks, the value of which is higher than all the others. The highest survival rate was recorded from male chicks placed on 12 ml of EM/liter of water to an age of 8 weeks. On the contrary significantly lower survival rate was recorded from the group paced on the control treatment. This result agrees with the report which indicated that inclusion of live microorganisms in feed or water in adequate amounts confers a health benefit on the host animals (Wenk, 2000). The results of a survey conducted by Hoyle (1992) on small scale poultry keeping in Welaita, North Omo region also indicated that the most challenging period for indigenous chicks kept under natural brooding condition in Ethiopia is from is 2 to 4 weeks after hatching (Solomon, 2007). There has been no mortality recorded from all the treatment groups starting from the 9th week of the experimental period showing that all the mortality recorded occurred during the first 8 weeks of brooding. The majority of the death recorded during the first 8 weeks of brooding was attributed to sticking of feces on anus and mechanical damage.

The result of this study is similar to that of Jin et al (1998), who reported improved survival rate of chicks with the administration of EM. He reported reduction in mortality of the experimental chicks from 8.2% to 3.2% as a result of administration of EM. Timmerman *et al.* (2006) showed marked decrease in mortality after EM administration. According to Barrow (1992),the absence of normal micro flora in the cecum of poultry has been considered as a major factor in the susceptibility of chicks to bacterial infection. Hanekon *et al.* (2001) and Safalaoh and Smith (2001) reported that EM was successfully used for increasing survival rate in integrated animal units and poultry farms in South Africa. Improvement in health status of the birds seems to be attributed to the colonization of chicken intestinal tract by lactic acid bacteria which controls the population of pathogenic microorganisms such as Salmonella, Enterococci and E. coli spp, Edens *et al.* (1997). Cost benefit analysis (Table 7) seems to agree with that of Dahal (1999) who reported that the use of EM (either in water or feed) in broiler production was found to be safe and profitable. He reported higher profit per bird from the use of EM in water as compared to the use of EM in feed due to additional cost of bokashi preparation.

VI. Conclusion

The result of this study showed that EM could improve production performance of RIR chicks. Even though, the three EM treatment levels (4ml, 8ml, and 12ml) showed their own merits to improve overall performance of RIR growers, based on key parameters treating chickens with different rate of EM based on their age is recommendable.

Since T_4 showed highest feed conversion ability for the first week and high percent survival between day-old to four weeks age, 12ml of EM/lit of chlorine free water (or spring or dug well water) is recommendable for this age group. Due to lack of significant difference for the EM treated groups (T_2, T_3 and T_4) between four and eight week age 4ml of EM would be economical for this age groups in a chlorine free (or spring or dug well water). Since there was insignificant survival difference between all treatment groups (T_1, T_2, T_3 and T_4) after eight week it is economical to terminate EM provision for chicks. Due to lack of difference in survival rate after eight week of growth and insignificant feed intake, feed conversion efficiency and age at maturity, treating pullets after 8weeks could not be economically feasible due to unreasonable EM cost.

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Levels of Aflatoxins in Some Agricultural Commodities Sold at Baboko Market in Ilorin, Nigeria

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Abstract - This study was carried out to investigate the levels of aflatoxins in some agricultural commodities sold at Baboko market in Ilorin. The agricultural commodities were grains, root and tuber products, onions, cray-fish and stock-fish. Aflatoxin B1 (AFB1) in grains ranged between 2.57±0.61 in wheat and 21.72±2.92 ppb in sorghum, while AFB2 ranged between 0.46±0.23 and 6.66±2.11 ppb in all the samples investigated. Varying levels of AFB2, AFG1 and AFG2 were detected in grain samples. AFB1concentrations in root and tuber were: 5.66±1.69 ppb in yam chips and 4.20±0.90 ppb in cassava chips, whereas AFB2 was observed to be 2.97±1.69 and 1.58±0.30 ppb respectively. AFG1 concentration in yam chips was 3.52±0.24 ppb while that of cassava chips was 4.80±0.31ppb. Cumulative higher levels of aflatoxins B were observed for onion samples when compared to aflatoxin G. It was generally observed that stock-fish had higher levels of aflatoxins when compared to cray-fish with exception of AFG2 in cray-fish which was higher than that of stock-fish.

Keywords : aflatoxins, agricultural commodities, levels, market.

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Abstract - This study was carried out to investigate the levels of aflatoxins in some agricultural commodities sold at Baboko market in Ilorin. The agricultural commodities were grains, root and tuber products, onions, cray-fish and stock-fish. Aflatoxin B1 (AFB1) in grains ranged between 2.57±0.61 in wheat and 21.72±2.92 ppb in sorghum, while AFB2 ranged between 0.46±0.23 and 6.66±2.11 ppb in all the samples investigated. Varying levels of AFB2, AFG1 and AFG2 were detected in grain samples. AFB1concentrations in root and tuber were: 5.66±1.69 ppb in yam chips and 4.20±0.90 ppb in cassava chips, whereas AFB2 was observed to be 2.97±1.69 and 1.58±0.30 ppb respectively. AFG1 concentration in yam chips was 3.52±0.24 ppb while that of cassava chips was 4.80±0.31ppb. Cumulative higher levels of aflatoxins B were observed for onion samples when compared to aflatoxin G. It was generally observed that stock-fish had higher levels of aflatoxins when compared to cray-fish with exception of AFG2 in cray-fish which was higher than that of stock-fish.

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I. Introduction

Aflatoxins are secondary metabolites produced by some strains of Aspergillus flavus and Aspergillus parasiticus. Aflatoxin B1 is the most toxic of the aflatoxins. It causes a variety of adverse effects in different domestic animals. Effects on chickens include liver damage, impaired productivity and reproductive efficiency, decreased egg production in hens, inferior egg shell quality, carcass quality and most importantly from human perspective, increase susceptibility to diseases. Aflatoxin contamination of various food stuffs and agricultural commodities is a major problem in the tropics and sub-tropics where climatic conditions, agricultural and storage practices favour the growth and aflatoxin production by *Aspergillus flavus* and *Aspergillus parasiticus* – the main aflatoxin producers.

Aflatoxins are being consumed daily by the populace especially in developing and under-developed economies since most food stuffs are transported from the farm to the market without proper inspection of produce by the regulatory agencies and this puts everyone at risk of the dangers of aflatoxins.

Various researchers have reported high levels of aflatoxins (5000 μg/Kg) in groundnuts and maize (Kumar *et al.*, 2008), 15 μg/Kg of G_1 in Brazil nuts (Oslen *et al.*, 2008), 600μg/kg in shea – nuts (Stephen, 1982), 45 μg /Kg in sesame paste (Feng-Qin-Li *et al.,* 2009), 45 μg /Kg in sesame paste (Feng-Qin-Li *et al.*, 2009), 97.5 μg/Kg in red pepper (Marin et al., 2008).

This study is therefore targetted at getting information on the levels of aflatoxins in some selected produce sold at baboko market in order to create awareness for the populace on the levels of aflatoxins in some commodities sold in our markets.

II. Materials and Methods

Samples of maize, sorghum, wheat, yam chips, cassava chips, onions, stock fish and cray fish were bought from Baboko market, blended (waring commercial) to powder.

a) Extraction of aflatoxins from maize, sorghum and onions

Extraction and purificattion of total aflatoxins in these samples was done by the method described by Atehnkeng *et al.*, (2008) for maize. 20g sample was blended with 100 ml methanol/water (70: 30) at high speed for 3 minutes. This was shaken for 30 minutes and filtered through whatman no 1 filter paper. Purification of aflatoxin was done by partitioning the filtrate with 10 ml distilled water and finally into 25 ml dichlormethane. The extracts were concentrated and detection of aflatoxins was done by spotting on HP-TLC plates which was developed in diethyl ether /methanol/water (96:3:1). Total aflatoxins was quantified with a spectrodensitometer by CAMAG (Wincats software).

b) Extraction of aflatoxins from yam chips and cassava chips and wheat

Extraction and purification of total aflatoxins in samples was carried out by the method described by Adegoke et al., (1993) using high performance thin layer chromatography (HP-TLC). 20 g of samples was extracted with 100 ml methanol/water (85:15 v/v). The samples were blended at high speed for 3 minutes. This

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was shaken for 30 minutes and filtered through whatman no 1 filter paper. Purification of aflatoxins was done with 40 ml 10% NaCl, and 25 ml n-hexane and finally into 25 ml dichloromethane. The extracts were concentrated and detection of aflatoxins was done by spotting on HP-TLC plates which was developed in diethyl ether /methanol/water (96:3:1). Total aflatoxins was quantified with a spectrodensitometer by CAMAG (Wincats software).

c) Extraction of aflatoxins from stock fish and cray fish

Extraction and purification of total aflatoxins in samples were carried out by the method described by Hassan et al., (2011) using high performance thin layer chromatography (HP-TLC). 20 g of samples was extracted with 100 ml acetone/water (50:50 v/v). The samples were blended at high speed for 3 minutes. This was shaken for 30 minutes and filtered through whatman no 1 filter paper. Purification of aflatoxins was done with 40 ml 10% NaCl, and 25 ml n-hexane and finally into 25 ml dichloromethane. The extracts were concentrated and detection of aflatoxins was done by spotting on HP-TLC plates which was developed in diethyl ether /methanol/water (96:3:1). Total aflatoxins was quantified with a spectrodensitometer by CAMAG (Wincats software).

III. Results and Discussion

Table 1 : Levels of Aflatoxins in Agricultural Commodities.

Sample	AFB_1	AFB_2	AFG_1	AFG_2
Maize	9.67± 1.67	4.41± 0.19	3.67± 1.26	0.61± 0.30
Sorghum	21.72± 2.92	1.77±0.49	6.21±1.83	2.10± 0.82
Wheat	2.57± 0.61	1.70± 0.76	4.52± 0.61	18.02± 9.03
Stock fish	3.14± 0.35	6.66± 2.11	10.61± 2.74	1.04± 0.14
Cray fish	1.66± 0.75	3.06± 0.45	6.42± 0.38	4.19± 2.62
Onions	1.89± 0.68	0.46± 0.23	0.52± 0.21	0.27± 0.24
Yams chips	5.66± 0.97	2.97± 1.69	3.52± 0.24	--
Cassava chips	4.20± 0.90	1.58± 0.30	4.80± 0.31	7.48± 2.26

(--) means not detected

Table 1 shows the levels of aflatoxins in commodities investigated. The cumulative total aflatoxins in this study were : 18.36 ppb in maize, 31.80 ppb in sorghum, 26.81 ppb in wheat, 21.45 ppb in stock fish, 15.33 ppb in cray fish, 3.14 ppb in onions, 12.15 ppb in yam chips and and 18.06 ppb in cassava chips. The values obtained for sorghum, wheat and stock fish were higher than the regulatory limits of 20 ppb recommended by USFDA for agricultural commodities, while the values obtained for other commodities were within the range recommended by USFDA. Although, slightly higher values were observed in this study for some agricultural commodities, such as sorghum, wheat and stockfish.These values were still lower than 5000ppm reported in groundnuts and maize by Kumar et. al.,(2007). With this observation, there is need to sensitize market women/commodity traders on good postharvest handling practices with the view of reducing the levels of aflatoxins in agricultural commodities sold in our markets. Maize is a major food crop in Nigeria and just like groundnut, it is highly susceptible to aflatoxin contamination. The total aflatoxins in maize in this study was18.36 ppb. This is similar to the work carried out by Opadokun and Ikeorah (1989) who found that 50% of the maize samples procured from Apomu market had values lower than 20 ppb.

IV. Conclusion

The results of this study revealed that some agricultural commodities sold in our markets have higher levels than 20 ppb recommended USFDA levels. Therefore, there is need to create awareness by sensitizing the commodity traders and the populace on the dangers associated with the consumption of high levels of aflatoxins in agricultural commodities.

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Diversity and Characteristics of Potato Flakes in Nairobi and Nakuru, Kenya

By Dr. George Ooko Abong & Jackson Ntongai Kabira
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Abstract - Potato flakes are some of the most important form of dehydrated potato products that can be used in different ways including substitution for fresh mashed potatoes. Unlike French fries and crisps whose consumption patterns and diversity is well established, little or no information can be obtained on flakes in Kenya. This study was, therefore designed to assess the diversity and characteristics of potato flakes in Nairobi and Nakuru, Kenya. Potato flakes diversity and characteristics were determined through a structured questionnaire administered to attendants in 148 retail outlets followed by sampling and laboratory analysis of the available brands. Out of the 148 supermarkets surveyed, only 3.4% stocked potato flakes. There were only 2 brands of flakes, one imported and local brand. The sales were reportedly low due to the high cost (55%) of the products, lack of public awareness of the product (35%) and inadequate supply (15%). The oil and moisture contents of potato flakes from supermarkets in Nairobi and Nakuru significantly ($P<0.05$) differed between the brands being generally lower in the imported brand compared to local brand, it ranged from 0.13% to 0.32%.

Keywords : *flakes, lightness, mash potatoes, dehydration.*

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Keywords : flakes, lightness, mash potatoes, dehydration.

I. Introduction

All over the world, potatoes are highly consumed and utilized and hence ranked as third most important food crop with over a billion people depending on it thereby providing food security (CIP, 2012). Kenya is a very significant producer of potato which is important both as food and cash crop and plays a major role in food security millions of people who depend on the crop as a staple food (Ministry of Agriculture 2007).

Potato tubers are used in different ways depending on communities and choice. Tubers are boiled, steamed, baked and roasted. As an industrial crop, chips, starch, flakes, flour and crisps and many recipes have been developed. In Kenya for instance, chips and crisps processed from potatoes have tremendously gained popularity especially in major towns (Abong' et al., 2010a). The potato in Kenya, just like the other roots and tubers in the Sub-Saharan Africa (SSA) is a major source of sustenance and hence a source of energy and the abundant vitamin C (Abong' et al., 2011a). It accounts for more than 20 % of calories consumed world over. The potato has high nutritive value and can supply considerable amounts of energy, minerals and vitamins (Woolfe, 1987; Abong' et al., 2009b).

Potato flakes are dehydrated potato products mostly processed by cooking, mashing and dehydration to produce a conveniently packaged and easy to reconstitute by adding hot water or milk making them desirable to many consumers (Lamberti et al., 2004). Together with potato granules, powder, shredded and sliced potato, potato flakes are some of the most important form of dehydrated potato products consumed world over (GAS, 2011). They can be used as substitute for fresh mashed potatoes. Flakes can, however, be stored for longer duration on the shelf (Kumar and Tiwari, 2006; Mardiah et al., 2010) compared to most fresh potato products and raw potatoes that can only store for up to 12 weeks in cooler highland areas (Abong' et al., 2009a). Depending on the manufacturers; flakes have different flavors such as onion, chilly, garlic, and butter and can be used as a thickener enhancing creamy frozen desserts, gravies and chocolate milk.

Unlike industrially processed chips and crisps whose consumption patterns and diversity is well established, little or no information can be obtained on potato flakes especially in Kenyan context. This study was designed to assess the diversity and characteristics of potato flakes in Nairobi metropolitan and Nakuru, Kenya.

II. Materials and Methods

a) *Survey of diversity and characteristics of potato flakes*

This study was carried out between July 2011 and February 2012. Nairobi and Nakuru were purposively selected due to the large number of factories and supermarkets with diversity of processed potato products. Due to inadequate information on potato flakes sample size determination was not feasible

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and hence all supermarkets in Nairobi metropolitan and Nakuru town were targeted in the survey. A total of 148 supermarkets were surveyed and data collected using a structured questionnaire which had previously been pre-tested in 10 randomly selected outlets in Nairobi. Data was collected on frequency of purchase or sale, the preferred brand, package size and type, flavor, and trends in consumption or prices.

b) Sampling of marketed potato flakes

Duplicate samples of available brands of potato flakes were purchased from supermarkets selling the products. Samples were taken to Food Chemistry Laboratory, University of Nairobi for analysis of salt content, moisture content, color and oil content.

c) Laboratory analysis

i. *Moisture content*

Moisture content was determined on triplicate samples by standard analytical methods (KEBS, 2007).

d) Oil content

The oil content was determined by extraction of 5 g of finely ground samples of flakes in Soxhlet apparatus for 8 hours using analytical grade petroleum ether (boiling point 40-60 ^{o}C) according to method of KEBS, 2007 and the oil content calculated as a percent.

e) Total salt content

Salt content was determined using the modified FAO/WHO method No. 16.209 (AOAC, 1980). About 5 g accurately weighed finely ground samples were dispersed in 100 ml of distilled water and allowed to stand for 5-10 min with occasional swirling. Approximately one milliliter of 5% potassium dichromate solution was added and titration performed with 0.1 N silver nitrate solution to the first appearance of an orange-brown color that persisted for 30 sec. The sodium chloride was calculated as percent as follows:

% NaCl= 5.85N (V_1-V_0)/W; where N= normality of silver nitrate; V_1= ml silver nitrate for titrating the sample; V_0= ml silver nitrate for titrating the blank, and W= weight of sample in g.

f) Potato flakes color

Flakes color was measured using a color spectrophotometer (NF 333, Nippon Denshoku, Japan) in the CIE Lab L*, a* and b* color scale where 'L*' value is the lightness parameter indicating degree of sample lightness varying from 0=black to 100=white. On the other hand 'a*' which is the chromatic redness parameter whose value means red color when positive (+) and green color when negative (-) while 'b*' is yellowness chromatic parameter corresponding to yellow color when positive (+) and blue color when negative (-).

g) Data analysis

Data from supermarket interviews were analyzed for frequencies and means using SPSS version 11.5 while data from laboratory evaluation were subjected to analysis of variance (ANOVA) and means separated by least significant difference test using Statistical Analysis System (SAS version 9). Significant differences were considered 5% level of significance.

III. Results and Discussion

a) Diversity of potato flakes sold in retail outlets in Nairobi and Nakuru, Kenya

Out of the 148 supermarkets surveyed, only 5 (3.4%) sold potato flakes which were mainly stocked once a month in quantities of 5-10kg. However, all the outlets stocked other processed potato products including chevda (flavored pieces of potato), potato sticks and potato crisps. There were only 2 brands of flakes, one imported and one local brand. The sales were reportedly low due to low consumption rate which was attributed to the high cost (55%) of the products and lack of awareness of the product (35%) and inadequate supply (15%). Unlike potato crisps which is well established industrially and is also popular with many consumers (Abong' et al., 2010b), potato flakes or dehydrated mashed potatoes are not well known in Kenyan market. Inadequate information on flakes is an indication of low processing output, lack of research and general public awareness on the product. In the contrary, potato flakes are used in many occasions in the developed world especially where long shelf life is a key product requirement (Neilson et al., 2006).

The units of packaging were in the range of 201-300g and were selling at US$ 2-3. The imported brand from United States of America was however, more expensive than the local brand. The fact that very few units of packaging for flakes existed in the available supermarkets means that customers have no choice in terms of quantity and prices. This may serve to partly explain the low consumption of the product. The major packaging material was polyethylene bag for local brand, and combination of polyethylene and carton box for the imported brand which were recommended to be stored in cool dry places. The type of packaging determines product shelf life (Abong' et al., 2011b). Packaging does not only protect flakes from adverse atmospheric conditions such as air and light, but also retards deterioration and ensures product quality and safety (Marsh and Bugusu, 2007). Flakes can be stocked for at least 1 year without any reported loss or deterioration. The double packaging on the imported flakes brand would therefore ensure longer shelf life.

The main consumers of potato flakes are the grownups who normally purchase the products during end months when there exists disposable income. About 70% of the shops reported product scarcity and lack of variety of processors/suppliers and consumers. Few suppliers (2) are probable cause of high retail costs due to manufacturers dictating the product prices which

were reported to have been increasing for the last 2 years. On the other hand, high product costs can be attributed to cost of production. This was generally attributed to changes in exchange market. Consumption has, however, remained constant due to lack of awareness and low supplies.

b) Characteristics of potato flakes sold in retail outlets in Nairobi and Nakuru, Kenya

The oil and moisture contents of potato flakes from supermarkets in Nairobi and Nakuru significantly ($P<0.05$) differed between the brands that were sold (Table 1). The oil content was generally lower in the imported brand compared to local which is local brand and it ranged from 0.13% to 0.32%. There were no significant ($P>0.05$) differences in levels of sodium chloride with the maximum recorded being 2.11% in imported flakes which is within the standard limits (EAS, 2010). The moisture content ranged from 8.52% to 10.51% in local and imported brands, respectively.

Table 1 : Oil, sodium chloride and moisture contents of potato flakes from Supermarkets in Nairobi and Nakuru, Kenya.

Sample	Source	Oil content (%)	NaCl (%)	Moisture content (%)
Imported brand	Nakuru	0.13 ± 0.01c	2.11 ± 0.11a	10.51 ± 0.09a
Imported brand	Nairobi	0.24 ± 0.01b	1.26 ± 0.00b	10.49 ± 0.08a
Local brand	Nairobi	0.31 ± 0.03a	1.58 ± 0.52ab	8.89 ± 0.02b
Local brand	Nairobi	0.32 ± 0.01a	1.72 ± 0.00ab	8.52 ± 0.07c

The amount of oil in any given potato product has a major influence on the flavor and storability and depends on potato cultivar and processing parameters which may explain the observed differences noted in the two brands (Kita et al., 2007; Ziaiifar et al., 2008). The levels of oil in flakes are extremely low since unlike deep-oil-fried crisps and French fries, they are processed without addition of oil. Flakes would therefore form part of menus of many consumers who are health conscious and watch there oil intake (Hagenimana et al., 1997).

The level of sodium chloride consumed is becoming increasingly important since its high consumption is related to several health disorders including high blood pressure (Vardavas et al, 2007). However, the levels observed in the marketed flakes brands are within statutory limits of Kenya. The moisture content determines the shelf-life of any given product and depends on processing and packaging (Marsh and Bugusu, 2007). Potato flakes being dehydrated products are expected to have <10% moisture content to be able to have longer storage life. Higher levels of moisture content in imported could be due to environmental conditions they are subjected during shipment.

Color parameters of the flakes differed significantly ($P<0.05$) among the brands as indicated in Table 2.

Table 2 : Color parameters of potato flakes from supermarkets in Nairobi and Nakuru.

Sample	Source	L*	a*	b*
Local brand	Nairobi	79.43 ± 0.91b	-0.71 ± 0.05b	14.11 ± 0.23a
Local brand	Nairobi	79.50 ± 0.71b	-0.65 ± 0.02b	17.94 ± 3.53a
Imported brand	Nairobi	85.40 ± 0.49a	0.89 ± 0.03a	16.55 ± 0.71a
Imported brand	Nakuru	86.10 ± 1.28a	-0.11 ± 1.07ab	18.76 ± 0.66a

The lightness parameter (L*) was significantly ($P<0.05$) lower in local brand (79.43) and higher in imported brand (86.10). The same trend was observed in the redness (a*) parameter that ranged from -0.71 to 0.89 while there was no significant ($P>0.05$) differences noted in the yellowness (b*) parameter. The lightness parameter indicates how close food product color is close to whiteness; the closer it is to 100, the whiter the product. It therefore shows that the imported brand has better color than the local brand. Flakes of both the brands tended towards green than red as indicated by the negative redness parameter values which is an indication that the processing parameters for the flakes may not yield dark red products resulting from maillard reaction such as those produced from crisps or chips (Hassanpanah et al., 2011). Color is an important sensory attribute that determines the capacity of any food product to be accepted by the consumer at first

site (Surkan et al., 2009). Any manufacturer must, therefore, endeavor to conform to consumer requirement (Krokida et al., 2001). The differences in color parameters between the two brands could be related to potato variety which determines the content of reducing sugars and proteins and dehydrating temperature (Mendoza et al., 2007).

IV. Conclusion

There exist only two brands of potato flakes sold in retail outlets in Nairobi and Nakuru, Kenya, which are in short supply due to inadequate production. Though they differed, the brands had characteristics most of which conformed to the statutory standards. The sale of potato flakes can, however, be increased if the processors produced smaller unit weight packages that are more affordable and create awareness to the general public consumer.

V. Acknowledgements

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Challenges and Prospects of Village-Based Exotic Chicken Development Strategy in Amhara Regional State, Northwest Ethiopia

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Abstract - A study was performed from September 2009 to August 2011 to identify the major challenges and prospects of village-based exotic chicken production in Amahara Regional State. In this study ,village chickens were found raised mainly for income generation (76.0%) and home consumption (14.5%).The exotic chickens in this study were kept in scavenging type (61.5%) feeding with seasonal supplementation of grain .Among the maim problems related to poultry feed preparation are less availability of feed ingredients (48%) both in quality and quantity. It was found that individuals engaged in chicken rearing activities had higher preference for LOH (27%) than RIR (22.0%) breeds. But RIR breeds (52.5%) were more adapted the existing environmental conditions than LOH breeds. About 81.5% of respondents were found able to construct separate chicken houses and 94% of the respondents have incriminated disease as the most important constraint for chicken production.

Keywords : *lohmann white/Rohde island red/exotic chicken breeds / mortality rates.*

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Abstract - A study was performed from September 2009 to August 2011 to identify the major challenges and prospects of village-based exotic chicken production in Amahara Regional State. In this study ,village chickens were found raised mainly for income generation (76.0%) and home consumption (14.5%).The exotic chickens in this study were kept in scavenging type (61.5%) feeding with seasonal supplementation of grain .Among the maim problems related to poultry feed preparation are less availability of feed ingredients (48%) both in quality and quantity. It was found that individuals engaged in chicken rearing activities had higher preference for LOH (27%) than RIR (22.0%) breeds. But RIR breeds (52.5%) were more adapted the existing environmental conditions than LOH breeds. About 81.5% of respondents were found able to construct separate chicken houses and 94% of the respondents have incriminated disease as the most important constraint for chicken production. The overall mortality rate of distributed exotic chickens in the three agro-climatic zones of Amahara regional State was 45.00%. The mortality rate of LOH breed of chicken (29.34%) was found higher than that of RIR (*16.18%*). There was also statically significant difference ($p<0.05$) in mortality rates between the two breeds of chicken. The present study indicated that the exotic chickens distributed in mid-altitude areas were with low mortality rates than high and low-altitude areas. Therefore, the bureau should fill the gaps with respect of inputs like identifying areas where exotic chickens adapt more, extension services and health and feeding packages for better implementation of the strategy.

Keywords : lohmann white/Rohde island red/exotic chicken breeds / mortality rates.

I. Introduction

Among the different food sources, poultry products contribute significantly to the Ethiopia's food demand. With the increasing population of the country, there is an increasing demand for the supply of food. Under the prevailing management situations, it may be difficult to fulfill these demands in short time. Therefore, intensification and upgrading of the potential of birds will be inevitable to provide surplus products. In line with this aim different chicken breeds have been introduced into this country (Alemu, 1995; Ashenafi, 2000; Tadelle and Ogle, 2001).

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Accordingly, the Bureau of the Amhara Regional State of Agriculture and Rural Development (BoARD) schemed poultry development strategy starting from 2003. The main purpose of the strategy was to enable farmers to generate income through rearing day-old chickens of two exotic breeds, Rhode Isle land Red (RIR) and Lohmann white breeds (LOH) which are hatched and distributed from poultry multiplication centers located at Andassa and Kombolcha. For this purpose 16 districts in 5 zone of the region were selected to be included in this new strategy. These districts were selected based on their market accessibility for poultry and poultry products. Farmers in different village and livestock experts at district level were trained on poultry development packages. The training included on methods of producing hay-box brooders technology, formulate ration from locally available feed resources, prevention of Newcastle disease vaccine and on general biosecurity measures for prevention of poultry diseases. At the end of training, every farmer in this program was given 50 ,100 and 500 day-old chickens of either the two breeds and/or both breeds with formulated ration enough for 2 months and disease prevention packages. During the periods of 2003 to 2011 over 500,000 day-old chickens were distributed to 6,000 farmers in the region. This study tries to identify the major challenges and prospects of exotic chicken distributed across three agro-climatic zones of the region

II. Materials and Methods

a) Study area

The study was conducted in sixteen districts of Amhara regional state which were included in poultry development strategy through distribution of exotic day-old chicks .the districts were located in three agro-climatic zones based on altitude ranges. The low altitude agro-climatic zones were found in altitude ranges from 1500-2000 masl. Similarly, the mid-altitude and high altitude districts were in the ranges of 2000-2500 masl and above 2500masl respectively. In all study agro-climatic zones, the rainy season lasts from june to august and the dry season from December to march. Similarly, months from April to May were classified as before rainy season and months from September to December as after rainy seasons.

Figure 1 : Map of Agro-climatic zones in poultry production strategy.

(Source: CSA, 2010).

b) Study design

Both cross-sectional and longitudinal studies were employed in the three agro-climatic zones of Amahara regional state where the poultry development strategy was launched.

c) Questionnaire survey

Questionnaire survey was conducted on different aspects of the exotic chicken production systems and its constraints. Information as to the constraints of chicken production were collected through predesigned questionnaire from farmers involved in the poultry development strategy. Emphases were given on causes of mortality, associated risk factors and in respective agro-climatic zones.

d) Longitudinal/cohort study

Starting from day one, the birds were closely observed, maintained for one year (September 2009 to August 2010 and individual farmers' day-old chicks were recorded by enumerators and animal health experts. All those birds died were recorded and examined following the standard procedures for identifying the cause of mortality. Based on their age, the birds were conventionally grouped as 0- 2 weeks, 2 weeks to 2 months and above 2 months of age groups.

e) Data analysis

Descriptive statistics was utilized to summarize data on constraints chicken production, and mortality. Chi-square test statistics was employed to see if there is any significant difference in constraints of poultry production among different groups. Tests were considered significant at $p \leq 0.05$.

III. Result and Discussion

a) Socioeconomic status of farmers

This survey indicated that village-based exotic chicken production under backyard become common practice in Northwest Ethiopia. In this system of production, village chickens were raised for income generation (76.0%), hatching (0.50%), home consumption (14.5%), egg production (7.50%) and other purposes (1.5%). This finding is in line with the reports of Halima *et.al.* (2007)and Fisseha *et.al.* (2010) which indicated that village chicken are raised in northwest Ethiopia for various purposes. The average age (years) of the respondents were 37.36, 36.97 and 34.19 years respectively for high, mid and low-altitude areas respectively. The average land size per household was higher in low-altitude areas (3) than that of mid-altitude (2.74) and high-altitude (2.68 ha). On the other hand, the mean family size of farmers was higher in middle-altitude (5.85) than that of high altitude (5.76) and low-altitude (5.64) agro-climatic zones. However, this finding is higher than the reports of Halima *et.al.* (2007) which indicated the average land size per house hold is below 2 ha.

The educational level of the households in this survey indicated that only 21.5% were illiterate and 31.5%, 21.5% and 13.5% of the respondents were completed their high school, grade 7-12 and able to read and write respectively. This may be due to the fact that for exotic chicken rearing activity education was considered by extension experts for selection of farmers. Similarly, assessment of the occupation of the respondents indicated that 49.0% of them were farmers and the remaining were merchants (15.0%), teachers (8.0%), students (17.0%) and unemployed (11.0%) respectively (Table1).

The overall mean day-old chicks distributed all agro-climatic zones of Amhara Regional State was 70.06. The mean day-old chick distributed was higher in mid-altitude (71.89) than that of high-altitude (53.29) and low-altitude (69.11) areas. The mean of RIR day-old chicks (39.38) distributed were found higher than that of LOH (30.64) (Table1).The variation in the mean number of chicken distributed in the three agro-climatic zones

may be the accessibility of mid-altitude zones Government poultry Farms to mid-altitude areas than that of low-and high altitude agro-climatic zones.

b) Farmers' perception on the use and management practices of exotic chickens

In this survey, it was indicated that respondents engaged in day-old chick rearing activities have higher preference of LOH (27.0%) than that of RIR (22.0%) breeds. However, 39.0% of them have a preference of both breeds of chickens (Table 2).The reason for high preference of LOH than LOH may be associated with high egg production capacity of LOH breeds of chickens. However, the respondents indicated that RIR breeds (52.5%) are more adapted the existing environmental conditions where as 27.0% and 20.5% of the respondents indicated LOH and both breeds more adapted in their locality respectively. This finding is in line with the report of Sonayia (1995) which indicated RIR breed is a multipurpose breed, whereby farmers in the study sites and in many African and Asian countries rear them mainly for the purpose of meat and egg production and in addition they have higher prices on market when sold alive.

Table 1 : Socioeconomic status of households involved exotic chicken rearing activities in three agro-climatic zones of Amahara Regional State.

Parameter	Agro-climatic zones			
	Low altitude	Mid-altitude	High altitude	Total
Purpose of exotic chicken raising (%)				
Income	5.5	56.0	14.5	76.0
Hatching (breeding stock)	0.00	0.50	0.00	0.50
Consumption	0.50	11.0	3.00	14.5
Egg production	1.00	5.5	1.00	7.50
Others	0.00	1.00	0.50	1.50
Average age of respondents (years)	34.19	36.97	37.36	36.47
Education level (%)				
Illiterate	2.0	15.0	4.5	21.5
Reading and writing	0.5	8.5	4.5	13.5
Grade 7-12	1.0	15.5	5.0	21.5
Above grade 12	2.0	25.5	2.0	31.5
Occupation (%)				
Farmers	4.0	34.0	11.0	49.0
Merchants	1.0	10.5	3.5	15.0
Teachers	0.5	7.0	0.5	8.0
Student	3.0	13.5	0.5	17.0
Unemployed	1.0	9.0	1.0	11.0
Sex (%)				
Male	9.5	46.0	2.5	42.0
Female	4.5	28.0	9.5	58.0
Mean land size (ha)	3.00	2.74	2.68	2.75
Mean family size (no. of persons)	5.64	5.85	5.76	5.82
Mean day-old chicks distributed	69.11	71.89	53.29	70.06
Lohmann white day-old chicks distributed	21.84	34.13	17.57	30.64
Rhode Island Red day-old chicks	47.18	37.72	35.71	39.38

On the other hand, the perceptions of individuals on the reasons of adaptability were ability to survive in high and low temperature extremes (40.0%), disease resistance (33.5%), and low predation (15.5%) and productive in the adverse conditions of feed shortage (11.0%) (Table 2). The reason for high adaptive characteristics of low and high temperature may be associated with optimum temperature requirement of day-old chicks for survival and growth.

Respondents of this survey have also indicated the preconditions for involving in village-based exotic chicken development strategy were access for market and extension service (43.0%), preparation of brooders and feeding equipment (25.5%), supply of formulated chicken feed (24.0%) and chicken house construction (7.5%) (Table 2).This finding is not in line with Kama *et al.* (2000) which reported, chickens in rural areas of Angola were left without structural investments for extension services and preventive sanitary measures.

Table 2 : Farmers perception on the use of exotic chickens and management practices across the study agro-climatic zone.

Parameter	Agro-climatic zones			
	Low altitude	Mid-altitude	High altitude	Total
More preferred breed for production (%)				
Rode Island Red	1.5	14.0	6.5	22.0
Lohmann White	2.5	31.0	5.5	27.0
Rode Island Red & Lohmann white	3.0	29.0	7.0	39.0
More adapted breed in the locality (%)				
Rode Island Red	4.5	39.5	8.5	52,5
Lohmann White	1.5	20.0	5.5	27.0
Rode Island Red and Lohmann white	1.0	14.5	5.0	20.5
Criteria for adaptability (%)				
Disease resistance	1.5	25.5	6.5	33.5
Low predation	2.5	12.5	0.5	15.5
Productive in the adverse conditions of feed shortage	1.5	7.5	2.0	11.0
Survive in high and low temperature extreme	1.5	28.5	10.0	40.0
Breed of chicken growing in you locality (%)				
LOH	12.0	32.5	2.5	47.0
RIR	7.0	41.5	3.5	52.0
Both	0.0	0.0	1.0	1.0
Criteria for increased number of flocks				
Disease resistant	1.5	12.0	1.5	15.0
Fast growth	1.5	10.0	1.0	12.5
Large number of day-old distributed	14.0	44.0	4.0	62.0
Hatchability is high	2.0	8.0	0.5	10.5
Precondition for rearing exotic chickens				
House construction	0.5	6.5	0.5	7.5
Supply of formulated chicken feed	1.0	18.0	5.0	24.0
Preparation of brooders and feeding equipment	1.5	17.5	6.5	25.5
Access for market and extension service	4.0	32.0	7.0	43.0

c) Feed and feeding

In this study, 61.5 % of the chickens were found to be managed under scavanging system where chickens roam freely in the surrounding environment with grain supplementation (Table 3). This finding is lower than the reports of Halima *et al.* (2007) from Ethiopia and Mapiye and Sibanda (2005) from Zimbabwe. Both authors have reported that about 96.6% of the farmers practiced poultry rearing in the backyard system with partial supplementation of feeds to chickens. The supplementation of grains such as maize, millet and rice) (58.5%) lower than the findings of Halima *et al.* (2007) and Mapiye and Sibanda (2005), who reported that about 99.27% and 96.6% of chickens to be managed under extensive management system by scavenging freely with little or no supplementation of feeds of any kinds. Low availability of feed ingredients is one of the major constraints during feed formulation and 97.5% of the individuals faced feed shortage during rainy season. On the other hand cease of egg production (45%) and body weight loss (18%) were the main problems associated with feed shortage.

Table 3 : Feeding system of village-based exotic chicken and major constrains related to feed and feeding in Amahara Regional State, Northwest Ethiopia.

Parameter	Agro-climatic zone			Total
	High altitude	Mid-altitude	Low altitude	
Provision of supplementary feed (%)				
Yes	16.0	61.5	6.0	83.5
No	3.0	12.5	1.0	16.5
Type of chicken rearing system				

Scavenging	0.0	0.5	0.0	0.5
Scavenging + seasonal supplementation	12.5	43.5	5.5	61.5
Intensive system	6.5	30.0	1.5	38.0
Types of supplementary feeds				
Maize, millet and rice	7.0	47.0	4.5	58.5
Wheat ,oat and barley	10.5	19.5	1.5	31.5
Home left over	0.5	1.5	1.0	3.0
Bran and oil seed cakes	0.5	1.5	0.0	2.0
Constraints during feed formulation (%)				
Low availability of feed ingredients	5.0	40.5	2.5	48.0
High cost of feed ingredients	5.0	21.0	2.5	28.5
Lack of knowledge on feed formulation	9.0	12.5	2.0	23.5
Season of year faced feed shortage (%)				
Rainy	17.0	73.5	7.0	97.5
Dry	1,5	0.5	0.0	2.0
After rainy	0.5	0.0	0.0	0.5
Problems associated with feed shortage (%)				
Cease of egg production	8.5	33.0	3.5	45.0
Body weight loss	3.0	13.5	1.5	18.0
Increased in mortality rate	2.0	9.0	0.0	11.0
Decreased in hatchability	1.5	8.5	0.5	10.5
Cannibalism	4.0	10.0	1.5	15.5

d) Housing type, hygiene and health status

About 81.5% of individuals were found able to construct separate chicken houses and 60.5% of them constructed a type of chicken house which is stone made with grass roof. It was also indicated that 83% of individuals were found regularly cleaning chicken houses (Table 4). . Yongolo *et al.* (1996) also indicated that about 69 % of the farmers in Tanzania occasionally clean the night shelter for their village chickens. The majority of individuals engaged in village-based chicken production (94%) have incriminated disease as the most important cause of death in chickens. Local names of diseases of chicken that have been frequently mentioned were *Fengle* (95.60%) and *Fentata* ((2.5%). Disease symptoms described for these diseases were dullness and roughling feather (50.50%) and greenish/yellowish diarrhea (22.0%).In this survey, it was also indicated that 95.5% of them have got vaccinated day-old chickens at least once (Table 4). At present, the most important challenge at the door is the failure of early diagnosis and reporting of the different poultry diseases when they occur and this has hindered the success of control mechanisms implemented in some parts of the country (Tadelle and Jobre, 2004). Lack of integrated approaches for the control of predisposing diseases has led to the ineffectiveness of vaccination programs.

Table 4 : Housing system, hygienic and health status of village-based exotic chickens in Amhara Regional State, Northwest Ethiopia.

Parameter		Agro-climatic zone		Total
	High altitude	Middle altitude	Low altitude	
Construction of separate house (%)				
Yes	15.0	61.0	5.5	81.5
No	4.0	13.0	1.5	18.5

Type of poultry house (%)				
Stone made with grass roof	12.0	45.0	3.5	60.5
Stone made with corrugated iron	5.5	14.5	2.5	22.5
Wood made with grass roof	0.5	5.5	1.0	7.0
Wood made with corrugated roof	1.0	9.0	0.0	10.0
Regular cleaning of chicken house (%)				
Yes	15.0	62.0	6.0	83.0
No	4.0	12.0	1.0	17.0
Occurrence of chicken disease (%)				
Yes	18.5	68.5	7.0	94.0
No	0.5	5.5	0.0	6.0
Local name of the disease (%)				
Fengile(Newcastle disease)	17.0	65.5	6.0	88.5
Cannibalism (biting)	0.0	1.0	0.0	1.0
Fentata(Pox)	0.5	2.0	0.0	2.5
Unknown name	1.5	5.5	1.0	8.0
Disease of symptoms (%)				
Loss of appetite	0.5	5.0	0.5	6.0
Diarrhea	6.0	15.0	1.0	22.0
Dullness and roughling feathers	9.0	39.0	2.5	50.5
Dropping of wings and heads	0.0	1.5	1.0	2.5
Circling and paralysis	0.0	3.0	0.0	3.0
Increased respiration rate	2.0	4.0	1.0	7.0
Torticolis and noise before death	1.5	6.5	1.0	9.0
Vaccinating chickens against at least once NCD (%)				
Yes	18.0	71.5	7.0	96.5
No	1.0	2.5	0.0	3.5

e) Comparative mortality rates of chickens

The overall mortality rate of distributed exotic chickens at the age day-old in the three agro-climatic zones of Amahara regional State was 45.00% (Table 4). This finding is in line with the previous reports from both Ethiopia (Alamargot, 1987) and other countries (Farooq, 2001) which indicated the mortality of commercial chickens from egg to adult is in the range of 20% to 50%. However, this finding is lower than the reported by Mazengia and Eshetie (2008) which indicted the overall mortality rate in parent stock flocks of Andassa Poultry Farm was 29.9%.

The mortality rate of LOH breed of chicken (29.34%) was found higher than that of RIR (16.18%) and there was also statically significant difference ($p<0.05$) in mortality rates between the two breeds of chicken. The higher mortality rate in LOH breeds, compared to the RIR breeds, may be due to cannibalism in which LOH breed of chicken are known to have high tendency of cannibalism (Chauhan and Roy, 1998). This finding are in agreement with the works of others (Susan and Asamays, 1998; Chauhan and Roy,1998) which suggest that LOH breeds are more prone to cannibalism when there is deficiency of protein and increased temperature in poultry houses than other chicken breeds.

The age dependence mortality rates in 0-2 weeks, 2 weeks to 2 months and above 2 months of age were 5.67%, 7.73% and 2.79% for RIR breeds and in LOH-12.63%, 12.09%, and 4.61% respectively. There was no any statistical significance ($p>0.05$) in mortality rates among the three age groups of LOH and RIR

chicken breeds. The mortality rate declined in both breeds above 2 months of age. The pronounced age dependence of the mortality rate observed was in line with previous findings of Farooq (2001) and Mazengia and Eshetie (2008) in which the total mortality of young chicks were up to 24% and 4-5 mortality rates in older groups. This may be due to the increased resistance acquired with age increased and thus through previous exposure to infectious agents prevalent in the farm (Susan and Asamays, 1998; Chauhans and Roy, 1998, Mazengia and Eshetie, 2008).

The mortality rate of exotic chickens in low-altitude districts (52.98%) was found higher than high altitude (48.88%) and mid-altitude (43.25%) districts. The higher mortality rate of exotic chickens in low-and high-altitude areas may be associated with extreme cold and hot temperature for newly distributed day-old chicks in these areas.

The mortality rate of chickens vaccinated against NCD up to booster doses (44.58%) was lower than that of the mortality rates of chickens not vaccinated up to booster doses of NCD vaccine (56.58%) but was no any statistical significance($p>0.05$) in mortality rate was observed between the two vaccination regimens (Table 4). This finding in line with reports other countries (Spradbrow, 1995) which indicated vaccination is the most important method of Newcastle disease control which results in a quite significant increase in chick survival. The mortality rates of chickens in dry, rainy, before rainy and after rainy seasons were 47.35%, 47.51%, 44.90% and 43.66% respectively but there was no any statistical significance ($p>0.05$) in mortality rates of chickens among different seasons of study period (Table3). This finding is not in line with previous reports of Mazengia and Eshetie (2008) which reported higher mortality rate in wet season than dry season in parent stock flocks of RIR and LOH in Andassa Government Poultry Farm. On the other hand, among the major causes of chicken loss in the study agro-climatic zones, disease (47.35%) and cannibalism (45.50 %) were identified as major cause of chicken loss (Table 3).This finding is in line with the previous report of Mazengia and Eshetie (2008) which indicated that majority of chicken losses in Anadssa poultry Farm is due to diseases of many types. Similarly, Mavale (2000) from Mozambique and Bamhare (2000) from Namibia have reported that the main causes of village chicken losses identified were disease and parasite, predators, theft and cold weather.

Table 5 : Comparative mortality rates and associated risk factors for mortality of RIR and LOH chicken breeds in Amhara regional state, northwest Ethiopia.

Risk factors	RIR				LOH				Overall
	0-2 wk	2wk-2mths	>2moths	Sub total	0-2 wk	2wk-2mth	>2moths	Sub total	
Agro-climatic zone									
High altitude	8.02	7.98	3.61	12.89	13.78	13.10	6.51	33.40	48.88[a]
Mid-altitude	6.13	7.74	2.42	16.29	11.89	11.33	4.02	27.25	43.25[a]
Low altitude	1.74	8.26	5.05	19.71	17.32	17.43	5.69	40.45	52.98[a]
Vaccination against NCD up to booster doses									
Yes	5.67	7.96	2.88	16.51	5.67	11.63	4.67	28.61	44.58[b]
No	5.71	1.43	0.00	7.14	5.71	25.01	2.91	49.44	56.58[b]
Season of mortality									
Before rainy	5.83	5.38	2.41	13.63	13.74	9.79	5.99	29.52	42.81[c]
Rainy	5.68	6.97	4.18	16.83	13.87	14.34	2.37	30.59	47.51[c]
After rainy	6.27	10.11	2.44	18.83	9.27	11.34	5.45	26.07	44.90[c]
Dry	4.52	8.97	1.18	14.68	13.79	12.40	5.52	31.72	43.66[c]

Causes of chicken loss									
Disease	6.02	7.94	3.27	17.23	12.30	12.83	4.88	30.02	47.35[d]
Cannibalism	2.71	5.14	0.00	7.86	21.11	17.39	6.28	44.79	45.50 [d]
Suffocation	5.58	9.84	2.51	17.93	12.25	8.09	2.75	23.09	40.00 [d]
Predation	5.37	5.56	1.55	12.48	9.46	7.97	3.78	21.21	33.99 [d]
Overall mortality	5.67	7.73	2.79	16.18[e]	12.63	12.09	4.61	29.34[e]	45.00

Figures with similar superscripts indicated non-significant differences.

IV. Summary

The present study discloses the most important aspects of village-based exotic chicken production in three agro-climatic zones of Amahara Regional State, Northwest Ethiopia. In exotic chickens, more emphasis is placed on its genetic potential for higher production, rather than on its acclimatization to odd environments or ability to resist disease. Better care of the flock starting from the age of hatching, maintenance of healthy environment, protection of birds from extreme climatic conditions, proper cleaning and disinfection of houses, equipment and workers, and appropriate floor and house construction are the key factors in preventing higher mortality.

The farmers engaged in village-based exotic chicken development strategy manage chickens under backyard low input system in all three agro-climatic zones. Farmers raising improved exotic chickens have been applying various husbandry practices and managenmt while rearing these chickens. However, low supply of inputs for like formulated feed, veterinary drugs and vaccines are the major bottle-necks for production of village-based exotic chickens. Moreover, higher mortality of chicken is seriously affecting the survival of these chicken breeds and contribution of chickens to the households.

The present observations indicated that exotic chicken distributed to farmers in different agro-climatic zones are exposed for to various risk factors that predispose for high chicken losses. Furthermore, the existing improper management such as improper nutrition, substandard hygienic standard, lack of appropriate disease prevention and control program are major constraints for exotic-chicken production and these contributed for high mortality rates chickens.

Hence, an important measure to improve the situation is the Bureau of Agriculture should fill the gaps with respect of inputs like extension services and packages for better implementation of poultry development strategy. Further in-depth researches on the heath status and management schemes of chickens are needed.

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3. Submission of Manuscripts,

4. Manuscript's Category,

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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.
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- 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:

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- 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:

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- Submit to work done by specific persons (including you) in past tense.
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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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