Journal of Biology, Agriculture and Healthcare
ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)
Vol.5, No.2, 2015

Low External Input Agricultural Farming System for the Increase in Productivity of Resource Poor Farmers.

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Abstract
This paper examined the effect of low external input agricultural farming system on the productivity of resource poor farmer. The majority of farmers in sub-Saharan Africa are small scale entrepreneurs whose farm operations are performed with low input agricultural technologies. Majority of the technologies comprised the refined indigenous knowledge system. Farm size, labour inputs, capital inputs, planting materials and organic manure are the main determinants of the gross income of LEIT farmers. Farmers preferences for low input system vary considerably depending upon the phase of crop production which include technologies for land preparation use of draught animals, natural/organic substitute for inorganic pesticides and fertilizers, seed multiplication technologies, simple irrigation and drainage method, low input processing. There is also a considerable interest among farmers for low input approaches for most phases of production. There is therefore the need for farmers to adopt these cost effective agricultural technologies since they are not only readily available, but also they do not require too much skills and also poses the capacity of making the process of rural development more sustainable.
Key words: low external input agriculture, farming system, resource poor farmer.

Introduction

For several years in some continents like in the Asia-Pacific Region and even Africa, the production of crops had been met by expansion of areas. Nevertheless, with decreasing land availability it has become impossible. Increased production has to depend more on increasing productivity through the use of package of technologies comprising external input like chemical fertilizer, pesticides/herbicides, and better varieties of plants and use of irrigation water. These technologies benefited more the larger, and resource endowed farmers, and its adoption has spread rapidly among the small resource poor farmers. (FAO, 1996). Low adoption has been implicated on ineffective extension system, lack of credit, and market etc. However, more important is the inappropriateness of the technology to the needs of the small farmers, high cost of these external inputs and non availability due to physical isolation. Beside, the sustainability of agriculture for resource-poor fanner in the region has become imperative for practitioners, researchers, policy makers and farmers.

It is worthy to note that this paper tries to show that LEIT can contribute to increasing production and **conserving** resources, if they are compatible with farmers socio- economic condition (Graves *et al,* 2004). The term LEIT is used here to include a wide range of crop management techniques that use local inputs and resources and that take long-term environmental consequences into account.

Low external input technology in (LEIT) is a prominent feature of many discussions about the role of agricultural technology in rural poverty reduction. There is widespread conviction that LEIT is more accessible to resource-poor households and can be the bases for human and social capital formation.

It is against the background that this paper focuses on the effect of low external input agricultural technology on the productivity of resource poor farmers.

Low External Input Technology and Its Types

It has be argued that rural development can be based on an expansion of the Green Revolution Experience or on the promise of biotechnology and are often met by the responses that simpler technologies, more attended to farmers traditional practice and more compatible with environment sustainability are a more appropriate alternative. This concern is expressed in various forms, but often, results in donor and NGO projects that promote the use of low external input technology.

The arguments have considerable strength. Pesticides and other chemicals are responsible for extensive environmental problems and for health risks. Over reliance on synthetic fertilizers may cause soil degradation. In many developing countries, input markets are unreliable, inefficient and out of reach for subsistence cultivators. Knowledge based innovations responding to local conditions with local resources are, it is argued to be preferred. Besides, such technology can be generated and promoted through learning techniques that build farmers human and social capital.

There is no strict definition of LEIT, but the following are among the most prominent examples.

Soil and water management

* Terraces are other physical structures to prevent soil erosion
* Contour planting
* Hedgerows and living barriers
* Conservation tillage
* Mulches, cover crops.

Soil fertility enhancement

* Manures and composts
* Biornass transfer and green manures

Crop establishment

* Planting pits
* Fater cropping

Controlling weeds and pests

* Intercrops and rotations
* Integrated pest management. (Trip, 2006).

Low input technologies in crop sector:

The following low external input technologies are carried out in the crop sector:

Land Preparation: The uses of ruminant farm animals such as cattle sheep and goats to clear bushes and old stalk residues of harvested crops has been practiced in mixed farm yield low input technology.

Low input technologies organic farming crop enterprise: Low input technologies used in soil fertility are ashing, cattle manure, green manure, mulching, urine-manure maintaining slurry and manure tea technology.

Alley farming technology: ft is a multipurpose agro-forestry system involving the cultivation of nitrogen fixing tree crops in rows sufficiently spaced to accommodate 4-6 rows of food crops.

Urine - Manure slurry technology: Slurry (a thick liquid mixture of animal manure and urine from a livestock shed makes a good organic fertilizer because it is rich in Nitrogen and organic matter *(Kuye. et al;* 2006). It is usually applied directly around the crop stand.

Manure tea technology: Fresh manure from cattle, chickens, goats, rabbits or sheep in a mixture, is diluted for foliar application /top dressing. It improves vegetative growth and fruiting (Kuye, et al 2006). Tea manure can also be produced with the entire Tithonia plant *(Tithonia glicidia)* or false sun flower, although not a legume accumulates. Large amount of Nitrogen and phosphorous from the soil (Mkpado and Onuoha, 2008).

Cereals and pulses low input pest space control and storage devices: Grains and legumes are commonly stored in airtight containers and bags but due to poor management of the structure, pests, often destroy these valuable. A number of cheap items such as pepper fruits, ash, lime leaf, neem seeds are active against pests of cereals and legumes such as weevils and beetles. A ground mixture of two or more of the items applied the rate oflO-20g per kg of the stored product offers protection for about one year (Nwachukwu, 2007).

Low input bio-pesticides or organic farming: Bio-pesticides are cheaper to produce and easy to use. About 235 plant families produce over 24,000 species known and used as bio-pesticides (Ahmed Stoll, 1996; Ahaured and Grainge, 1986; Kuye, et al, 2006) see table for detailed preparation and use of bio- pesticides against nematodes and many are effective in controlling Striga weeds. Table 1, 2, 3 and 4 contain a number of organic materials, green manure crops, bio-pesticides and some plant sources of bio-pesticides and their uses.

Surface irrigation and drainage methods used by wet land farmers in sub-Saharan Africa.

These include basin irrigation, border irrigation and furrow irrigation.

What is Sustainability?

Sustainability has been defined, for the purpose of including resource poor as well as resources rich farmers as managing agricultural productivity while maintaining or improving the resource base.

In other words, this means that agriculture must be environmentally solid, economically feasible, socially, scrupulous and flexible (for future needs). One of the most promising paradigms that has emerged for the benefit of scale resource poor farmers is low external input and sustainable Agriculture (LEIT) which can enable such farmers to achieve higher income and attain sustainability by: -

- Optimizing the use of locally reliable resources, thereby achieving a synergetic effect among the various components of the farming systems (soil, water animal, plants etc) so that they complement each other in the production of output.

- Minimizing the use of external inputs, except where there is a serious deficiency and where the effect on system will be to increase recycling of nutrients.

The objective is not to maximize short-term production, but to attain an adequate and sustainable level over the longer term.

To achieve these goals LEISA must explore the most viable indigenous knowledge and practices and ecologically friendly technologies in a given ecological and soil cultural setting. Since the experience is one agro ecological setting may not be appropriate in other areas; there are many cares of fanners using (LEISA) under different agro ecological zones in different countries.

These experiences should be documented to learn more of the principles, constraints and potential in order to produce policy-makers, development workers and farmers (with) alternative and viable strategies to develop sustainable farming systems.

Widespread agreement on a definition of sustainable agriculture is proving to be elusive. EAP believes that the following definition is appropriate. It aims to be comprehensive, positive and descriptive.

Sustainable agriculture: Is both a philosophy and system of farming. It has its roots in a set of values that reflects and awareness of both ecological and social realities. It involves design and management procedures that work natural processes to conserve all resources and minimize waste and environmental damage, while maintaining or improving farm profitability. Working with natural soil process is of particular importance. Sustainable agriculture systems are designed to take maximum advantage of existing soil nutrient and water cycles, energy flows, beneficial soil organisms, and natural pest controls. By capitalizing on existing cycle and flows. Environmental damage can be avoided or minimized. Such systems also aim to produce food that is nutritious, and uncontaminated with product that might harm human health. (EAP Publications 1997) .

Assessing sustainability of low external - input farm management system with the nutrient monitoring approach.

Exploitation of soil fertility through current farm management practices is threatening the food security and position of economically important agricultural sector in many countries in Sub-Saharan Africa (Stoorvogel et al, 1993; Vander Pol, 1993). A good number of solutions to the observed constraints have been suggested (Smaling, and Braun, 1996; Mokwunye *et al,* 1996; Braun *et al;* 1997) but many of these technical options require relatively high capital investment or need a well functioning infrastructure for effective implementation. Low economic reforms to most agricultural production and existing market risks pose constraints to the use external inputs.

Alternative approaches in the form of low -external-input agriculture (LEIA), have been developed to manage resources for agriculture to satisfy changing human needs, while maintaining or enhancing the quality of the environment and conserving natural resources. The effectiveness of the above mentioned is the subject of debate (Reijnties *el al* 1997; Koning *et al,* 1998). A number of attempts have been made to combine low and high input technologies in an Integrated Natural Management (INM) approach with a view to maximizing the use of local resources and optimize application of external inputs (Smaling *et al,* 1996; Pretty, 1995). In a bid to search INM practices, farm management experiences of low-external input and organic farming in Sub-Sahara Africa (SSA) have not been examined systematically. There may be a high potential for LEIA farming systems in increasing both yield in SSA through more efficient and effective methods of nutrient management (Harris, *et al* 1997; Kieft, 1992; UNDP, 1992). It is a well known fact that adoption of the researcher developed high external input technologies (HEIA) in SSA has been very disappointing for a number of reasons (De Jager *et al;* 1998a). Two factors have played a crucial role:

(1). Farmers were involved only in the final stages of technology development;
(2). Technologies were assessed at the crop or livestock activity level only, which mostly does not match with the complex and multiple goals of a farm house hold at farm level. On the other hand, the experiences of LEIA technologies have not yet been fully exploited because, scientist have only recently discovered the potentials of this, often indigenous knowledge in an effort to increase farmers' participation and to make better use of existing knowledge, participatory research approaches like participatory Technology Development (PTD) (Harvcrkort *et al* 1991; Martin and Sherington, 1997) were developed.

The Resource of Poor Farmers and Farm

In Africa, especially Nigeria, about 70-75% of these populations are farmers. Members of the family participate in cultivating family lands with the wealthy ones engaging in clear purchase from others or on lease to produce food and fibres.

Generally, the people are poor and most of them are small scale farmers who produce majority of the food in Nigeria. They arc otherwise called resource poor and practice small scale fanning (0.1 - 2ha), (Ibeawuchi *et al;* 2010). As there are many poor and developing countries in the world today also on the number of resource small portions and hectarage of land and the excess after family requirements and needs are met are pulled together for the market to feed other families who cannot farm or have limited access to land resources. The small scale farmer is central in food and fibre production in the world. They play significant role in economy stabilization and in hunger mitigation. Nevertheless, recent production trends in Africa indicate a serious farming lag (IFPRI, 2004).

The only way out of the woods of hunger is through strongholds in family farms to produce food through confirmed experiments (adapted on farm research) which can sustain and drive small holder productivity forward. It has been reported that there family farms have lower labour related transaction cost and have more family worker per hectares; each motivate to work and each able to find screen supervise hired workers ' (Lipton, 2005). A number of constraints production of resource poor farmers in food productive have been identified by Ibeawuchi *et al* (2010) to include namely;

Soil quality and fertility: Many of the soil in the semi-arid parts of Nigeria have strong liability to surface crusting or sealing which reduces rainfall penetration into the soil, encourage run off and subsequent soil erosion (Babalola, 2002).

Organic Agriculture as a Poverty Reduction Strategy

The world wide promotion of organic Agriculture for poverty reduction was pioneered by farmers themselves and was advocated by NGOs, who worked closely with proof farmers and witnessed the serious negative health and environmental consequences of agro chemicals.

More recently, governments and donors have taken note of organic agricultures potentials as a development strategy due mainly to the following.

i. Increased global demand for safe food and potential price premium for organic products,
ii. Under the WTO agreement, food exports must comply with higher phyto-sanitary standards to be able to meet such agreements.
iii. Mounting evidence Organic Agriculture (OA) can improve the incomes and living standard of poor farmers by building on assets which poor farmers have land free firm intensive use of chemical, excess labour and traditional knowledge of production system and
iv. Studies which have illustrated how Organic Agriculture (OA) can contribute to healthy social development and environmental restoration and or protection

Low External Input Agriculture and Sustainable Rural Development

A number of questions have been asked whether low input technology contributes to sustainable agricultural development.

There has been claim that rural development can be based on an expansion of the Green Revolution experience or on the promise of biotechnology, and it has often been met by the response that similar technologies, the response that similar technologies, that are more accustomed to farmer's traditional practices and more compatible with environmental alternative. This concern is expressed in various forms but often results in donor of low external input technology (LEIT).

The arguments have considerable strength; pesticides and other chemical are responsible for extensive environmental problems and for health risks. Over-reliance on synthetic fertilities may cause soil degradation.

In many developing countries input market are unreliable, inefficient and out of reach for subsistence cultivators.

Knowledge based innovations responding local conditions with local resources are, it is argued to be preferred. In addition, such technology can be spent and promoted through learning techniques that build farmers, human and social capital rural poverty, the high cost of purchased inputs and environmental problems all support to view that farmers should rely as much as possible on local inputs to enhance the productivity of their soil. This some how explains why low external input technology agriculture has attracted so much interest in discussions about the future of small holder farming in developing countries. This technologies using low level of external inputs readily available either on-farm or from nearby off-farm source are seen by some experts as more appropriate and sustainable (Pretty, 1995). This approach often referred to as low external input technology (LEIT) agriculture, emphasizes the use of techniques that integrate natural processes such or nutrient cycling, biological nitrogen fixation soil regeneration and natural enemies of pests into food production process (Pieri, 1995; Snapp *et al,* 1998). A number of efforts have been made to minimize losses from the system, such as by leaching or removal of crop residues. The use of non- renewable inputs such as pesticides and fertilizers that can damage the environment or harm the health of fanners and consumers is also minimized, and more emphasis is plane on the use of such technologies as for example, inter-cropping, agro-forestry, cover-crops, or animal manure. Usually but not always, such technologies are more labour intensive than the HEIT approach (Deugd *et al;* 1998).

In many cases LC1T technologies arc not new but arc variations of those practiced by farmers for generation, who have sought to make use of resources such as vegetation or animal manure that, have always been ready to hand. (Graves et al, 2004).

On the other hand Grave *et al,* (2004) observed that the significant reduction in the total number of the undernourished in the world in the past was as a result of the use of high external input agricultural technologies (HEIT) i.e. high yielding cereal varieties, in addition to high levels of inputs such as water from irrigation nutrition needed by the varieties and pesticides to control any associated weeds, pests and diseases. The technologies according to him generally need a relatively high capital investment and a well functioning economic and physical infrastructure for effective implementation.

Not only did increased use of HEIT raise questions about environmental sustainability, but also the cost of the chemicals, irrigation and mechanization were often subsidized, raising further concerns about the capacity to support there strategies in the long term.

Therefore, the need to examine other cost effective agricultural technologies that are not only readily available but possesses the capacity of making the process of rural development more sustainable.

Table 1: Organic Material. Their quality and how to use

Types	**Quality**	**Content**	**How to use**
Tithonia	High	High in Nitrogen	Incorporate directly into the soil to fertilize crops
Glicicidia		Low in lignin	
Caliandra	Fairly high	High in nitrogen, lignin or phenol	Mix with high quality O.M (such as Lithonia) before incorporating in the soil
Maize stalks – low-quality animal manure twigs	Medium	Low in N_2 low Lignin	Leave on the field to help control erosion and retain H_2O
		High in Lignin	

Source: IIRR (1998)

Table 2: Examples of Green manure Crops

Food legumes	Food legumes	Others
Bambara groundnut (Voandzeca subterranean)	Cover (Trifolium Sp)	Pumpkins (Cuicurbita sp)
Chickpea (Cicer arietinum	Lablab bean (Dolichos lablab)	Sweet potato (ipomea batatas
Cowpea (Vinga strensis)	Luceme (Alfalfa)	Kikuyu grass (Pennisetun clandestinum
Green grain (Phasolue aurens)	(Medicago sativa	
Groundnut (Arachis hypogaea)	Lupin (Lupinus sp)	
Lablab bean (dolichos lablab)	Seatro stylo (Stylothanses spp) sun hemp (Crotalaria juncea)	
Pigeonpea (Cajanus cajan)	Velvet been (Mucure deeringiana) vetch (Vicia spp)	

Kuye et al; (2006)

Table 3: Plants commonly used as bio-pesticides

Plant	Parts used	Major mode of action	Target pest
Acons calamus	Rhizome	Contact poison or repellant	Ants
Alium sativum	Pulp	Fungicide	Psudoperorosora cubensis
Alpinia galangal	Rhizome	Repellent/contact poison	Dacus dosalis, Nilapavata lugens, aphid rot, brown spot
Annona muricata	Leaf	Contact poison	Phyllotrita slimata, P.p punchata
Annona squamosa	Leaf, seed	Contact poison	Body house P sinuta
Azadirachata indica	Leaf, seed	Anti-feed ant growth regulator, repellant ovicidal	Sucking insects, butterflies, aphids larvae
Curcuma domestic	Rhizome	Contact poison repellant fungicide	Red-mite, thripants, xathommonas citri anternaria oorri
Cypobogon nardus	Leaf	Repellant	Docos dorsalis mosquito
Deris eliptica	Stalk, root	Contact poison	Various insects
Diosocorea hispida	Tuber	Contact poison	Various insects
Euphorbia fringona	Whole plant	Contact poison	Various insects
Nicotiana tabacum	Whole plant	Contact poison	Various insects
Stemona tuberose	Leaf, root	Contact poison	Various insects
Tinospora crispa	Vine	Anti-feedant	Diamond back moth
Toona tometosa	Leaf	Contact poison growth regulator	Nilapavata lugens, Aphids spp, butterflies
Zingiber serumber	Rhizome	Contact poison	Aphids larvae, butterflies

Source: Chejew et al (1988); Kuye et al (2006)

Conclusions and Recommendation

Resources such as land, labour, planting materials capital input and organic manure are abundant in the rural areas. Increases in these resource and encourage LEJA will bring about increase in the standard of living of the rural populace, besides, the replacement of inorganic fertilizer/chemicals with organic manures and of inorganic pest control as a means of replenishing the soil and controlling pests, weeds and diseases in the rural areas appear to be more sustaina

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