

Different Methods and Strategies Contribute to the Agriculture Economic Development – A Review

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Abstract – Nowadays the increase of world demography resulted in increasing of food demand, furthermore, the improvement and development of agri-food sector is a requirement for economic development. Thus, different agriculture method and different strategies has been developed and used in agriculture for economic development contribution. In this paper we reviewed some agriculture method and different strategies used in different countries and discussed their techniques and their contribution. Direct seeding mulch-based cropping (DMC), the use of biofertilizers in agriculture, Conservation agriculture (CA) and Agriculture irrigation have been reviewed. Each of these methods has it great contribution and great impact on economy according to the countries and region in which has been used. In addition, we provided future prospectus for the future researchers on their contribution to the economic development through agriculture.

Keywords – Agriculture Irrigation, Conservation Agriculture, Direct Seeding, Economic Development.

I. INTRODUCTION

While world attention has shifted back to agriculture out of concerns about how to feed its 9 billion people by 2050, the precise role of agriculture in economic development remains very much debated [1]. Within the global food production and distribution system, poverty reduction strategies have renewed the focus on the role of smallholders in agriculture, and identified the importance of upstream and downstream linkages, as well as non-farm activities. Food value chains in developing economies are experiencing structural changes due to the rapid expansion of supermarkets and the increasingly strict quality and safety requirements of domestic and foreign customers. [2]

Agriculture plays a key role in overall economic growth and that small-farmers are rational economic agents who can take advantage of new technologies as well as big farmers. Focusing on small-farm agriculture fulfills the objectives of economic growth and improved equity. In terms of rural development, the small-farm first model led to a focus on projects that provide some form of assistance, such as new technologies, inputs, and credit, to small-farmers in order to improve their productivity. The livelihoods approach, while similar to the bottom-up approach of the small-farm first paradigm, takes as a starting point the importance of household assets and the diversity of household activities, and is therefore fundamentally different from the small-farm paradigm [3].

The dual economy models inspired by Lewis (1954) and

popular in development economics in the 1960s and 1970s typically viewed agriculture as a backward unproductive subsistence sector, from which labor and resources were to be drawn to encourage development of the dynamic productive industrial sector. Much of the early development economics literature was thus interpreted as supporting an industrialization strategy [1]. Conservation agriculture (CA), and more specifically direct seeding mulch-based cropping systems (DMC), are increasingly recognized as a valuable option for ecological intensification of agriculture [2].

The experience of the Green Revolution in Asia during the 1970s and 1980s, where traditional agriculture was rapidly transformed into a fast growing modern sector through the adoption of science based technology, provided further confidence in agriculture as an engine of growth. Nonetheless, this belief in the potential of the sector eroded gradually thereafter, especially in Sub-Saharan Africa, following the poor performance of many agricultural development projects, the secular decline in the world price of food and other primary commodities, and the rising appeal of East Asia's export-led manufacturing growth miracle [1], [4].

The most frequently mentioned causes of food price volatility include extreme weather conditions, increased demand from emerging countries caused by growth in incomes, increased costs volatility to farmers due to high oil prices volatility, rapid development of biofuels, adoption of restrictive trade policies by major net exporters of key foods products such as rice, and speculation in commodity markets. So, for the monetary authorities of almost all small open economies, these shocks were perfectly exogenous from their policies or their own country situations, and were unanticipated [5].

The adoption of the Millennium Development Goals (MDGs) by the UN member states at the turn of the millennium added a new dimension to the debate. It shifted the focus in development from fostering economic growth per se to encouraging poverty reduction. Since the latter not only depends on the rate of overall economic growth, but also on the ability of poor people to participate in that growth, this rekindled interest in the specific role of agriculture in the development process. The majority of poor people in the developing world depend on agriculture for their livelihood, and it was argued that the poor stood to gain much more from GDP growth originating in agriculture than from an equal amount of GDP growth generated outside the sector. Achieving 'pro-poor' or

'shared' growth, i.e. growth with a maximum pay-off in terms of poverty reduction would call for policies and investments that support the development of agriculture [1], [6].

A common feature of the newly industrialized countries like India is that they essentially consist of two sectors, an urban sector and a rural sector. Usually the former specializes in a combination of manufacturing and service products whereas the latter specializes almost exclusively on agricultural goods and low-end services. Such a segmentation can be interpreted as the middle phase of the process of economic growth which is accompanied by deep changes in consumption and production patterns reflecting long-term shift away from agriculture to manufacturing and eventually (or even simultaneously) to service economy [2], [7].

II. DIFFERENT STRATEGIES AND AGRICULTURE METHOD

In this present century different strategic method has been developed in order to increase contribution of agriculture to the economic development. In this present paper review we summarized some agriculture strategies used in different countries for economic development.

2.1. Direct Seeding Mulch-based Cropping (DMC)

In 2014 V. Alary with coworkers the made Economic assessment of conservation agriculture options in mixed crop-livestock systems in Brazil using farm modelling. In their studies they describe describes a modelling analysis of the functioning of family farms in rural settlements of the agrarian reform in the Cerrados of Brazil and aim was to assess the impact of the introduction of DMC systems with and without cover crops on crop-livestock management and net household income. Direct seeding mulch-based cropping (DMC) systems are often considered as an efficient way of combining ecological sustainability and economic viability while maintaining or increasing agricultural productivity A bio-economic farm model based on optimization of a utility function under multiple constraints was developed, capturing the interactions between livestock activities and the introduction of DMC systems [4], [8].

DMC systems are based on three principles: the absence of soil tillage with direct seeding into a mulch of crop residues, maintenance of soil cover at all times by leaving crop residues on the field or growing cover crops, and use of suitable crop successions. However, as for many other tropical regions, only a limited number of small-scale family farms have adopted this cropping practice due to the profound changes it induces in farm management, especially related to labor and cash requirements. As highlighted in the context of African smallholder farming. The limited capacity of smallholder farmers to invest, the often low compatibility of DMC systems with farmers' production objectives and activities, and the lack of market conditions for purchase of production inputs and sale of farm products are major constraints of production inputs and sale of farm products are major constraints of adoption of DMC. Besides, farmers often tend to implement

simplified DMC systems that only use the harvest residues of the previous crop as mulch, without the cultivation of cover crops [4], [9].

In 2004 Scopel et al. demonstrated that DMC systems are effective for soil erosion control under the sub-humid tropical climate of the Cerrados by decreasing surface water runoff. However, under this climate, the related increase in soil water infiltration induces an increase in water drainage below the rooting zone. This in turn is likely to increase nutrient losses through leaching. On the other hand, cover crops that are sown in sequence after the main crop have been shown to take up part of the nitrogen that otherwise would have been lost through leaching. And the mulch from their residues is expected to make this nitrogen available to the main crop during the next cropping season. Overall, studies in the Cerrado region have shown that DMC with cover crops have a positive impact on the soil water, nitrogen and carbon balances, resulting in increased maize yields. Consequently, the introduction of cover crops has often been presented as a win-win option for integrated crop-livestock farming systems. Cover crops can provide an economic return in the short term, i.e. when part of their biomass can be commercialized or used in other production processes of the farm, and they can enhance environmental services from agriculture in the longer term, i.e. through more efficient use of the available resources. The main objective of V. Alary et al was to assess the potential impact of the introduction of DMC systems with and without cover crops on crop-livestock management and net household income of farms in the assentamentos of Unaí, also to understand for which type of farms these systems are mostly "economically attractive", especially in relation to the type of livestock activities on the farm [4], [10].

They conclude that the modelling approach described in their study allowed a better understanding of the importance of livestock systems and market opportunities in the adoption process of DMC systems, both from a technical and economic point of view. This integrated analysis of the farm system can lead to re-adjusting DMC systems in line with orientations of livestock activities on the farm. By considering all animal species on the farm, including poultry and pigs, we were able to understand the relative role of each species in determining cropping options and farm benefits in terms of net income. For example, if poultry and pigs would not have been considered in the model the attractiveness of DMC systems would have been minor, since DMCs are based on maize. From their assessment we may derive the potential for adoption of the tested cropping systems. However, actual adoption by the farmers of the new cropping systems may depend on several other factors that are not considered in this model, such as farmers' attitude towards change and/or farming experience [1], [4].

2.2. Use of Biofertilizers in Agriculture

Economic momentum of underdeveloped countries derived from the generation and application of their endogenous knowledge is an essential factor toward achieving social welfare. Since ancient times, biotechnology has been used to attend the needs of the population. Thus, it is important to understand the

development of science and technology within these underdeveloped countries, how the application of that development can address problems in agriculture and food needs, and how that development can offer sustainable options for growth and optimization. In addition, many small farmers in underdeveloped countries are already planting crops based on biotechnological products, which is significant in terms of how these activities influence the development of their lives, particularly with respect to the generation of policies aimed at farming areas. Biotechnology is defined as a science that offers technological solutions from biological organisms, systems and processes related to them, which creates a whole industry in areas such as food, agriculture, and health, among others, and in which the use of technologies employed varies from one application to another in an important manner. Such solutions relate to techniques that go from using fermentation processes to integrating recombinant DNA technology [11], [12].

Thus encouraged Alejandro Barragn-Ocana and Mariadel Carmen del-Valle-Rivera in 2015 to study on the perceptions of peasant producers of the effects of biofertilizers on their environment and their lives. Their research was based on a study of peasant producers of the State of Morelos, Mexico, who use biofertilizers produced from endogenous technological assets, i.e., that involve private actors and public research centers. A case study was performed to investigate the effects that endogenously generated technologies have had on the environment and on the lives of the peasant producers who use them. In addition, the challenges and opportunities that lie ahead for the rural environment, business, academia and the government with respect to policy planning and administration for the proper use of these innovations are identified. Specifically, the case for bio-fertilizers in the area of agricultural biotechnology is affirmed [11]. To improve understanding of the problem, two theoretical sections are developed. These sections aim to explain, on the one hand, how the theory of development and agriculture is constrained in underdeveloped countries and, on the other hand, how the relationship between technology, agriculture and environmental protection supports rural development in such countries. We begin from the hypothesis that it is possible to generate technologies in local areas of knowledge and that, when managed by small national companies, such technologies can contribute to the sustainable development of economies and better conditions for rural producers [11], [13].

The current economy has been characterized as the unity of time and labor, wherever that unity can occur. However, note that not everything assumes the global scale that, for example, appears in the activities of corporations, whose production and employment generation eventually materialize at the regional level. Technology represents a fundamental element in the explanation of regional development. Thus, successful science and technology policies are aimed toward regions in which there are key actors to generate the process of technological change. De Janvry and Sadoulet argue that technological change can help increase the welfare of those who adopt innovations.

This benefit occurs indirectly through the effect of these technologies on, for example, food prices, employment and wages in agriculture. Lyson demonstrates how large corporations function as primary creators and disseminators of the most advanced biotechnological advances and that it is through IP mechanisms that these corporations profit from genetically modified products. Thus, the options for underdeveloped countries concerning IP in agricultural biotechnology are related to the use and acquisition of private and public technologies, to the development and protection of national institutional inventions and to the generation of technology transfer alternatives [10], [14], [15].

Addressing the acceptance of biotechnological products by consumers, Aldrich and Blisard performed a case study on the production of a biotechnological food product of animal origin. The authors conclude that consumers doubted the scientific evidence (i.e., perceived the issue as an aspect of food safety and welfare) and scientific results in matters of biotechnology. Thus, controversy was created. However, even when controversy occurs, consumption demand might overcome adverse effects or minimize them. The absence of reports of harm and government regulation could promote acceptance of the results of the use of biotechnology. Another problem is that the development, promotion and application of biotechnology is controlled by large corporations, despite the long history of genetic research in agriculture that has been conducted in underdeveloped countries such as Mexico, Brazil and. In addition, there are several biotech companies in Latin America, particularly in the health industry, that have achieved success in the market by following innovative strategies that helped them generate competitive advantages. Therefore, similarly, in the area of agricultural inputs, biofertilizers might be an option for the creation of enterprises in underdeveloped countries that, with the cooperation of academia, government and business, create initiatives that favor farming and benefit scientific and technological development in these countries [11], [15], [16].

Alejandro Barragn-Ocana and Mariadel Carmen del-Valle-Rivera (2015) they conclude by saying that the results were positive, which indicate that biofertilizers contribute to improved land productivity, decreased environmental impact and improved social development. It was generally observed that the perception of the effect of biofertilizers on the environment and on the lives of farmers was favorably accepted. However, it is also true that those producers with more education and greater technical and financial resources have been able to use the benefits derived from this biotechnology in a more comprehensive manner. Therefore, the lack of technical skills and the economic conditions characteristic of the rural environment limit the majority of peasant producers in their use of these new technological options. The users should not be limited to using innovations from developed economies and their adaptation to the local environment. The formulation of policies and programs that promote and enable the development of this area of knowledge and other scientific and technological disciplines that provide solutions and

benefits to the field of underdeveloped countries is required. All of these goals must be pursued within a monitoring framework that ensures the biosafety and food security of peasant producers and the general population [11], [17], [18].

2.3. Conservation Agriculture (CA)

The key principles on which CA is based, namely no or minimum tillage, soil cover with crop residues, and the use of crop rotations or associations are attractive from an agronomic point of view. Retention of crop residues under CA is expected to increase soil carbon, compared to conventional, tillage-based cropping where residues are taken from the field. This is seen as an important process explaining the increased soil productivity over time under CA compared to the conventional systems. Besides, based on experimental evidence of increased water productivity under sub-optimal rainfall conditions, CA has been attributed the potential for mitigating negative effects from future climate change, when rainfall is projected to decrease and be more unreliable [4]. Towards this end, conservation agriculture (CA) has been widely advocated by international organizations such as the Food and Agriculture Organization (FAO). Biophysical studies indicate that CA improves long-term crop productivity, yield stability, and ecosystem services, while reducing human and animal labor [16], [19], [20].

A smallholder farmer's investment in CA also involves trade-offs with other livelihood activities. Maintaining a certain level of crop residue such as mulch is one of the anchors of CA. This aspect of CA could be questioned in mixed crop-livestock production, which is a salient feature of many farming systems in SSA. Livestock is increasingly becoming dependent on crop residue for feed due to reduced fallow and grazing land. This means that farmers are confronted with the choice of investing in crop residues as mulch for increasing crop productivity as opposed to feed for livestock production [17], [19].

Marc Corbeels et al (2013) they conducted a research on Understanding of the impact and adoption of conservation

agriculture in Africa: A multi-scale analysis. Their many objective is to seek the better understand the reasons for the limited adoption of CA and to assess where, when and for whom CA works best. CA is analyzed and understood within a framework that distinguishes the following scales of analysis: field, farm, village and region. CA has a potential to increase crop yields in the fields, especially under conditions of erratic rainfall and over the long-term as a result of a gradual increase of overall soil quality [21]. The impact on farm income with the practice of CA on some fields of the farm is far less evident, and depends on the type of farm. The lack of an immediate increase in farm income with CA explains in many cases the non-adoption of CA. Smallholders have often short-term time horizons: future benefits do not adequately outweigh their immediate needs. Another key factor that explains the limited CA adoption in mixed crop-livestock farming systems is the fact that crop harvest residues are preferably used as fodder for livestock, preventing their use as soil cover [22], [23].

Marc Corbeels et al (2013) They selected a number of past and on-going projects on research, development and dissemination of CA practices with smallholder farmers in SSA, and analyzed each project as a case study. All projects were situated in regions where one or more cereals (maize, sorghum, millet or rice) are the main crops grown in mostly mixed crop-livestock farming systems. The projects were chosen on the basis of a set of criteria that included the availability of documentation and data on the CA research and dissemination activities in the project, the interest and impact of the project for the local stakeholders, and the in-depth local knowledge of the project and its dynamics by the researchers and development agents involved. The case studies were considered as specific examples to illustrate more general determinants and principles of CA adoption or refusal by smallholders in SSA [21], [24]. In total 10 case studies were examined, a brief description of the different case studies and the related CA projects is given in Table 1.

Table 1. Description of the case studies and related projects on conservation agriculture [21].

Case study	Project	Project activities	Estimated number of farmers involved	Rainfall	Principal cropping system
South-western Burkina Faso	PRODS/PAIA pilot project, funded by FAO and implemented by INERA	Introduction, adaptation, and dissemination of CA systems through farmer field schools	2000	Uni-modal, 800–1200 mm	Maize, cotton, sorghum, millet
Lake Aloatra, Madagascar	BVLac project, 2003–2013, funded by Agence Franc, ais de development (AFD)	Research, development and dissemination of CA systems through farm organisations	3000	Unimodal, 800–1200 mm	Rice-based and maize, cassava and groundnuts
Vakinankaratra, Madagascar	BVPI project, 2006–2012, funded by Agence Franc ais de development (AFD)	Research, development and dissemination of CA systems through farm organizations	1000	Unimodal, 1200–1400 mm	Rice-based and maize, vegetables
Central Malawi	CIMMYT project, and Total Land Care project, 2005–2013, funded by IFAD and BMZ, Germany	Research, development and dissemination of CA systems (dibble stick, jab planter and planting basins) via lead farmer approach	15000	Unimodal 700–1100 mm	Maize
Bungoma, Kenya	CA-SARD project, 2004–2011, funded by German Trust Fund and implemented by ACT and FAO	Adaptation, development and dissemination of CA systems (direct seeder and, jab planter) via the farmer field school approach	500	Bimodal, 500–1000 mm during 1st rains and 430–800 mm during 2nd rains	Maize-based and beans

Karatu, Tanzania	CA-SARD project, 2004–2011, funded by German Trust Fund and implemented by ACT and FAO	Adaptation, development and dissemination of CA systems (direct seeder and jab planter) via the farmer field school approach	500	Bimodal, 400–1000 mm per season	Maize-based and beans
Kafue, Zambia	Conservation farming unit, funded through a group of donors including Norway, Sweden and Finland, started in the	Adaptation and scaling out of CA (principally planting basins and Magoye Ripper)	1000	Unimodal, 800–1200 mm	Maize-based, cotton, sorghum, millet, cassava
Monze, Zambia	1996CIMMYT project, funded by IFAD	Research, development and dissemination of CA systems via lead farmer approach	100	Unimodal, 750 mm	Maize, cotton
North-eastern Zimbabwe	CIMMYT project, 2005–2013, funded by IFAD and BMZ, Germany and various NGO initiatives	Research, development and dissemination of CA systems (direct seeder, ripper, planting basins and jab planter) via lead farmer approach	2000	Uni-modal, 750–1000 mm	Maize
Mid-Zambezi Valley, Zimbabwe	CIRAD project (2007–2010) funded by the EU	planter) via lead farmer approach Introduction and adaptation of CA systems (direct seeder and ripper)	200	Unimodal, 450–650 mm	Sorghum, cotton

For the assessment of the performance of the CA practices and their potential for widespread adoption we used a framework that distinguishes the following scales: field, farm and village, and region. The performance of CA at field scale was assessed through analyzing crop yield data from conventional experimentation and using the cropping system simulation model DSSAT [21], [25].

However, it is clear that misleading conclusions can be drawn about the attractiveness of CA for farmers by only

analyzing crop yield responses at the field plot level. Other factors at the scale of the farm or above intervene. Given the fact that short-term profitability is a prime factor determining the relative advance smallholder farmers perceive with any new technology over their current practices, an analysis of the farm-scale economics of CA can help assess the potential for adoption of CA [26].

Table 2. Modeling tools with their objectives at each scale and the case studies [21]

Modeling tool	Case studies	Objective	Scale
DSSAT Olympe	North-eastern Zimbabwe and Monze, Zambia Vakinankaratra, Madagascar; Bungoma, Kenya; Karatu, Tanzania; Central Malawi; North-eastern Zimbabwe and Lake Aloatra, Madagascar	To quantify crop yield responses from CA To analyse the effect of CA practice on farm household net income	Field Farm
CLIF	Mid-Zambezi Valley, Zimbabwe	To quantify trade-offs between CA cropping and livestock production	Farm
GANESH	Lake Aloatra, Madagascar	To optimize the allocation of fields for CA and quantify trade-offs between crop and livestock production	Farm
Flow model	South-western Burkina Faso	To quantify trade-offs in the use of crop residues by different types of farmers	Village
QAToCA	South-western Burkina Faso; Bungoma, Kenya; Karatu, Tanzania; Central Malawi; North-eastern Zimbabwe and Kafue, Zambia	To analyse the regional conditions and factors that affect CA adoption	Region

They concluded by saying analysis of CA research, development and dissemination projects in SSA at different scales: field, farm, village and region can inform about the determinants of CA adoption and non-adoption by smallholders. Conservation agriculture can increase crop yields. However, immediate yield benefits are highly variable, and are most likely to occur when crops are drought-stressed. The practice of CA has the potential to conserve soil moisture through the soil cover of crop residues, which makes it an effective technology for mitigating the negative effects from less and more erratic rainfall as a result of climate change. With CA, crops yields are expected to progressively increase in time, as a result of the gradual improvement of soil quality. Yield increases are, however, difficult to predict [27], [28].

2.4. Agriculture Irrigation

Growing demands for food security to feed increasing populations worldwide have intensified the search for improved performance of irrigation, the world's largest water user. These challenges are raised in the face of climate and from growing environmental demands. [29]-[31]. Over the past decade, a growing body of economics research has projected the impacts of climate change on important facets of well-being, such as agriculture, industry, human health, energy demand, and economic growth. Given the natural relationship between climatic factors and plant growth, the agricultural sector is thoroughly researched. Growing demands for food security to feed increasing populations worldwide have intensified the search for improved performance of irrigation, the world's largest water user. These challenges are raised in the face of climate and from growing environmental

demands. Adaptation measures in irrigated agriculture include fallowing land, shifting cropping patterns, increased groundwater pumping, reservoir storage capacity expansion, and increased production of risk-averse crops [29], [32]-[34].

The rain-fed agriculture system is vulnerable to climate change impact. However, such impact may also vary by aggregate and sub-sectoral levels of agricultural production. The impact of climate change and variability on agricultural production would engender appropriate policies and practices towards a sustainable agricultural production system. Much research work and water development planning has been conducted assessing and taking advantage of the economic value of water in irrigation produced by the development of additional irrigation infrastructure for handling uncertain and random water supplies, to protect food security and rural livelihoods. The desire to establish flexible institutions to increase the beneficial use of water in the face of growing demands for scarce, variable, unpredictable, and climate altered supplies is the most compelling issue for economic development for people who live in dry places [29], [35], [36].

Growing human population and increasing demands for protecting endangered species and other environmental values continue to take place in many parts of the arid and semi-arid regions of the world. While policymakers and water managers continue to express growing interest in the economic consequences of expanded groundwater or surface reservoir storage as a climate adaptation measure, much less published scholarly peer reviewed research has addressed these choices. However, some notable academic studies have been conducted. For example, an innovative 2005 study by a team of California investigators examined spatially disaggregated estimates of more than 100 data series on streamflow, ground water, and reservoir evaporation. The authors found that most scenarios with increased precipitation resulted in less available water because of the current storage systems' weak capacity to catch increased winter streamflow to offset reduced summer runoff. While additional reservoir storage could increase the overall economic capacity to handle a series of drought years, no attempt was made to quantify the scale of these economic benefits or cost [29], [37], [38].

III. CONCLUSION

While global has increasing of demography as well as increasing of food demand with result of rapid urbanization, improvement and development in agri-food sector all these have great impact on economic development. It seems agriculture development means economic development, thus different research need to be conducted on different agriculture method and different agriculture strategies for agriculture development. Direct seeding mulch-based cropping (DMC) and Conservation agriculture (CA) has been used in different region like Cerrados of Brazil and in Africa with great impact on agriculture development as well as on economic development based on technic and method suitable in that region. Agriculture irrigation and the use of biofertilizers in agriculture are others agriculture methods

which are oldest methods and have been used in different region all-over the world and have impact on agriculture development according to the method and technic used based on region applied. Every agriculture method has good impact on agriculture development as well as on economic development only when take into account the region, method and capacity of user. Thus give task to the future researchers to study and develop software system or program which can help the users according to their region as well as their economy this will contribute better on developing countries.

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