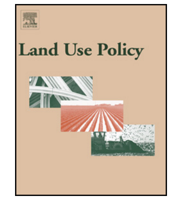
Land Use Policy 37 (2014) 40–51

Contents lists available at ScienceDirect

Land Use Policy

journal homepage: www.elsevier.com/locate/landusepol



Comparing conventional and organic agriculture in Karnataka, India: Where and when can organic farming be sustainable?

Sheetal Patil[a,*], Pytrik Reidsma[b], Pratik Shah[b], Seema Purushothaman[a], Joost Wolf[b]

[a] Ashoka Trust for Research in Ecology and the Environment, Royal Enclave, Srirampura, Jakkur Post, Bangalore 560 064, Karnataka, India
[b] Plant Production Systems Group, Wageningen University, P.O. Box 430, 6700 AK Wageningen, The Netherlands

ARTICLE INFO

Article history:
Received 12 September 2011
Received in revised form
30 December 2011
Accepted 1 January 2012

Keywords:
Policy impact assessment
Sustainability indicators
Agro-ecological relationships
Developing countries

ABSTRACT

Karnataka is one of the south-western Indian states where agrarian distress as a major problem. Crop yields have been stagnant in the last decade, and coupled with increased input costs, this has led to reduced incomes and debts. There is an urgent need to study options to improve the sustainability of farming systems in Karnataka. One adopted strategy to stabilize agriculture in the state is organic farming, which is less dependent on external inputs. In this paper, we assess the sustainability of conventional and organic farming practices using the model TechnoGIN. TechnoGIN calculates inputs and outputs of farming practices, allowing assessment of its impacts on economic and environmental indicators. Data on inputs and yields have been collected in two districts in 2009 from farms with conventional and organic cultivation at the same time. Additional data were collected from literature and experts. Next, the current situation was assessed and projections were made towards 2015 for two scenarios per village, using either conventional or organic practices.

Modeling results show that for the study site situated in a dry region, Chitradurga, profits with organic farming are higher than in conventional farming, except for rotations that include onion. Input costs are lower resulting in lower financial risks with organic farming. Nutrient balances in organic agriculture were however found to be negative for all crop rotations indicating imbalanced supply of nutrients. This suggests it may not be possible to sustain current yields in the long term with current nutrient applications.

In the second site situated in a transition zone with intensive cultivation of commercial crops, Mysore, yields and profits are similar in organic farming compared to those under conventional practice, except for commercial crops like cotton and coconut where the profits are lower. The debt risk in case of crop failure appears to be practically similar for both types of farming practices in Mysore. Nutrient balances are generally positive, indicating that NPK supplies are not the main yield limiting factor.

It is concluded that organic farming can be a sustainable farming practice in Karnataka depending on regional conditions and the crops cultivated. Policies stimulating organic farming should therefore consider the regional differences and farmer's preferences.

Introduction

A majority of households around the globe are dependent on land and other natural resources to meet their immediate needs and also long term livelihood ambitions. For rural families, land is often the only available resource to rely on. In India, agriculture has been practiced for over 4000 years, resulting in its own rich culture and knowledge about cultivation practices. The last five decades are referred to as green revolution period in post independent India. During this period, productivity increased due to advancements in science and technology along with increased investments in irrigation projects and rural electrification, development in research and credit networks, and support prices for outputs and subsidies for inputs (Pal and Byerlee, 2003; Vaidyanathan, 2010; Joshi et al., 2001; Thorat and Fan, 2007). High yielding varieties (HYV) were introduced, which increased yields with the use of fertilizers, and were therefore successful in increasing food stocks to feed the growing population of the country (Bhattacharyya and Chakraborty, 2005). The government supported cultivation of HYV and market liberalization to mitigate the problems of food shortage (Deshpande and Prachita, 2005; Government of Karnataka, 2006; Government of India, 2007).

Introduction of HYV, however, also required extensive irrigation facilities, technological innovations, water management, plant protection and storage and market infrastructure in place. Intensification was thus required to increase profits. Besides increased

* Corresponding author. Tel.: +91 80 23635555; fax: +91 80 23637070.
E-mail address: sheetal@atree.org (S. Patil).

0264-8377/$ – see front matter © 2012 Elsevier Ltd. All rights reserved.
doi:10.1016/j.landusepol.2012.01.006

food security and profits for some of the farmers, this intensification resulted in environmental impacts including ground water depletion (Matson and Parton, 1997), soil degradation (Giller et al., 1997; Singh, 2000), loss of crop genetics diversity (Thrupp, 2000; Tilman et al., 2002) and increased pesticide concentration in food products (Gupta, 2004). Furthermore, the lack of effective institutions monitoring the demand and prices of commercial crops made the dependence on commercial agriculture very risky (Government of Karnataka, 2006; Chander et al., 2008). The risks involved in the production of low yield, high value commercial crops, and reduced acreage and non-profitability of traditional crops led to food insecurity and increasing indebtedness of small-holder farmers (Acharya, 2006). They experienced problems when profits were lower than expected due to unfavorable climate or market conditions. The high dependence on external inputs was one of the main causes of the increasing indebtedness of many farmers, resulting in agrarian distress.

Karnataka is a state in the south-western part of India (Fig. 1a). It represents the agricultural situation of India, with high economic growth (from 5.5% in 1999 to 10.4% in 2010), but poor agricultural growth rates (agricultural share in GDP decreased from 28% in 1995 to 17% in 2008) and agrarian distress culminating in farmer suicides (30,552 farmers' suicides between 1997 and 2010).

As a response to the agrarian crisis, both national as well as state governments introduced measures like loan waivers, subsidies and policies favoring sustainable agricultural practices including organic farming. In Karnataka, the Karnataka State Policy on Organic Farming (KSPoOF) (GoK, 2004) was introduced in March 2004 (implemented in 2006). This policy promotes organic farming as an alternative to conventional farming. The policy has an aim to reduce the dependence on external inputs, optimize the use of natural resources, increase crop diversity and maintain or enhance yields, and thereby increase the sustainability of agriculture in the state. Though organic farming practices are traditional in India, little comprehensive research has been done on the advantages and limitations of this practice.

However, evident from many studies in similar regions of the world (Rasul and Thapa, 2004; Bengtsson et al., 2005; Altieri, 2002; Pretty, 1995; Singh, 2000), advantages of organic agriculture range from conserving soil and water resources, improving soil and water quality, enhancing diversity, sustaining yield, producing quality products, natural pest control with less environmental pollution. On the other hand, the disadvantages of organic agriculture also are well documented. It is labor intensive, needs constant attention and skills, needs abundance of natural input material, and in transition periods (usually 2–3 years) often yield reductions occur (Ramesh et al., 2005; Prasad, 2005).

Therefore, the main aim of this study is to compare the economic and environmental sustainability of conventional agricultural activities with organic agricultural activities, both for the current situation and towards 2015. The effects of organic farming will be different in different regions as soil, climate, crops and inputs are different. We therefore selected a relatively dry district, Chitradurga, and a more humid district, Mysore, of Karnataka state for the assessment. Firstly, the impact of conventional and organic management on economic (i.e. yields, input costs, net returns, financial risk) and environmental (i.e. nutrient loss, nutrient balance, water use, biocide index) indicators were assessed for major crop rotations in the current situation (2009). Secondly, projections were made towards 2015. For both, conventional and organic management, it was assumed that trends would continue from 2009 and impacts on economic and environmental indicators were assessed for both. In addition, we investigated the optimal nutrient management to maintain currently obtained yields. Data were collected at household level in the year 2009, and complemented with literature and expert knowledge. The tool that was used in this paper is the technical coefficient generator, TechnoGIN (Ponsioen et al., 2006), which will be further explained in the methodology section. The results lead to recommendations to farmers and policy makers, on the consequences of change to organic farming from prevailing conventional practices.

Methodology

Study area

In the state of Karnataka, agriculture occupies around 63% of the total geographical area, of which 30% is irrigated. The state is divided into 10 agro-climatic zones (Ramachandra and Kamakashi, 2005), with average annual rainfall ranging from 354 to 4173 mm, which results in diverse cropping patterns. From 1966 to 2009, the total agricultural land area has not changed much, but type of crops and the intensity has changed considerably. The cultivation of commercial crops like maize, sugarcane and coconut show consistently increasing trends, while cultivation of subsistence crops including sorghum and pearl millet are declining (Purushothaman and Kashyap, 2010). Acreages have been stable for rice and finger millet, but have been volatile for oilseeds and cotton. Such changes in cropping patterns have impacts on food security in rural Karnataka (Suryanarayana, 1997).

The KSPoOF has been introduced in selected villages (GoK, 2004). In each taluk (sub-district), one village was selected to serve as a model for organic farming practice. In each village, a local Non-Governmental Organisation (NGO) was responsible for training and guiding the farmers in the process of converting from conventional to organic farming. For this study, we chose two districts, differing in agro-environmental conditions and cropping patterns. Chitradurga is located in the Central dry zone, receiving average annual rainfall of 656 mm, and Mysore is located in the Southern transition zone with an average annual rainfall of 815 mm (Fig. 1b). Both districts have experienced major land use changes in the past decade and agrarian distress as well, but the reasons behind the distress are different. In Chitradurga, the main reasons for crop failures resulting in debts and consequent distress are pest and crop disease attacks, while in Mysore the main problems are price volatility of commercial products and wildlife destroying the crops (Madhusudan, 2003; Purushothaman, 2010). Secondary data were obtained from the NGOs, who performed farm surveys in 2006 before the policy was implemented, and primary data were collected in 2009 after the implementation of the policy including information on soil and climate. Table 1 presents characteristics of the selected study area.

Modeling approach: TechnoGIN

In order to compare the economic and environmental sustainability of conventional and organic agricultural activities, a model is needed which describes inputs and outputs of agricultural activities. An agricultural activity is defined by the crop rotation and the production technique in a particular land unit, where the production technique consists of agronomic inputs such as seeds, fertilizers, labor and animals to realize a target production level (van Ittersum and Rabbinge, 1997). The land unit is the physical environment in which production takes place. The main difference between organic and conventional farming is the production technique adopted.

In this study, we used TechnoGIN (Ponsioen et al., 2006), a technical coefficient generator (TCG) developed for South-East Asia. A TCG estimates input–output relationships of all relevant combinations of land units, crop rotations and production techniques (Ponsioen et al., 2003). TechnoGIN calculates technical coefficients