A review of research on influencing factors and risk managements for farmers’ adoption of organic farming

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ABSTRACT

Influencing factors of farmers’ adoption of organic farming and risk managements to promote the growth of organic sector have attracted many scientists’ attention and a lot of studies have been carried out. However, there is no systematic review on this subject. The article reviews these studies in order to provide useful knowledge for the explanation of farmers’ adoption or refusal of organic farming and the public sector to make policies for organic farming. We argue that there are many factors affecting farmers’ adoption of organic farming, among which, financial risk is the most important factor; farmer’s demographic characteristics, farm characteristics and farmer’s attitudes are also important factors. However, the conclusions of literatures are mixed and promoting organic farming requires supports from public sectors. Organic farmers mainly reduce the risks of yield and cost by the premiums of organic products. Improving varieties, rational rotation and diversified production will help to reduce the risk of yield. Changing traditional marketing methods and establishing cooperative organizations are also common strategies for farmers to resist risk. Agricultural environmental policies and public funding can promote the development of organic farming, in which, the public subsidy is the most common incentive.

Key words: organic farming, farmers’ decision making, influencing factor, risk management, public policy.

INTRODUCTION

Farmland use activities are the major drivers of global environmental changes and of farming system resilience (Barbieri et al., 2017). Although agriculture provides growing supplies of food and other products, it is a major contributor to greenhouse gas emissions, biodiversity loss, agrochemical pollution, and soil degradation, public health problems, non-point source pollution and natural resource degradation (Rockström et al., 2009; Godfray et al., 2010; Reganold et al., 2011; Crowder and Reganold, 2015; Muller et al., 2017).

The disadvantages of conventional farming compel farming activities to move in the direction of meeting the requirements of sustainable development. Organic farming has obvious advantages in ensuring food quality and health, protecting ecosystems, improving farmers’ adaptability to environmental changes, increasing employment opportunities and reducing external investment (Reganold et al., 1990; Lampkin and Measures, 2001; Mäder et al., 2002; Willer and Lernoud, 2016; Liu et al., 2016; Jouziet al., 2017); it is also a popular strategy for poverty alleviation (Qiao et al., 2016), and has become a hot spot for policymakers, environmentalists, consumers and producers (Stolze and Lampkin, 2009; Beltrán-Esteve et al., 2012), and regarded as an important substitute for conventional farming (Seufert and Ramankutty, 2017).

However, in both developed and developing countries, the risks of conventional farming move to organic farming still exist (Läpple, 2013; Reganold and Wachter, 2016), and not all conventional farmers’ conversion will be continuous (LlorensAbando and Rohner-Thielen, 2007). Many scientists...
interested in the factors influencing farmers' adoption of organic farming and risk managements, and have done a lot of research. So far, however, there is no systematic review on this subject. In view of this, the article reviews the studies' conclusions on the influencing factors and risk managements of farmers' adoption of organic farming, in order to provide useful knowledge for farmers to adopt or refuse organic farming and for the government to formulate organic agricultural policies.

**ORGANIC SECTOR FACING CHALLENGES**

Although organic farming as a concept has existed for over 90 years, only since the mid-1980s has it become the focus of significant attention from policy-makers, consumers, environmentalists and farmers around the world. This turning point coincided with the increasing concerns about the negative environmental and other impacts of post-war agricultural development and the introduction of policies to support agri-environmental initiatives (Stolze and Lampkin, 2009).

Organic farming, sometimes called biological or ecological farming, combines traditional conservation-minded farming methods with modern farming technologies. It emphasizes on rotating crops, managing pests naturally, diversifying crops and livestock, and improving the soil with compost additions and animal and green manures (Reganold and Wachter, 2016). It avoids the use of genetically modified organisms and the production elements of chemical synthesis; it is a production system that improves the health of the agricultural ecosystem including biodiversity, biological cycles and soil biological activities (Codex Alimentarius Commission, 1995, 2007). Organic farming without the use of chemical pesticides and fertilizers, reducing the risk of water pollution from agricultural production and the impact of pesticides on people's healthy (Pussemier et al., 2006).

Nitrogen and phosphorus leaching and greenhouse gas emissions per unit organic production area are less than conventional farming (Lynch et al., 2012; Skinner et al., 2014; Lee et al., 2015). Compared with conventional farming, scientists generally believe organic farming has stronger carbon sequestration capacity, higher soil quality, less soil erosion, more animals and plants and landscape diversity, more habitats, and more use of natural energy (Reganold et al., 1990; Lampkin and Measures, 2001; Mäder et al., 2002; Gättinger et al., 2012; Tuomisto et al., 2012; Lynch et al., 2012; Tuck et al., 2014; Skinner et al., 2014; Lee et al., 2015; Willer and Lernoud, 2016). In terms of three ecosystem services such as pest biological control, soil formation and plant nutrient mineralization, the value of such services of organic farming provision is $86 \text{hm}^{-2}\text{yr}^{-1}$ (Sandhu, 2010).

Zeng et al. (2013) evaluated and compared organic and conventional tea production systems by emery analysis in Anxi, China. The results showed that the inclusion of a nursery had no significant influence on the sustainability of the tea plantation system, and the cultivation phase's energy sustainability index (ESI) increased 2.10 times, while the ESI would increase 5.48 times and the energy index for sustainable development (EISD) would increase 11.05 times in the processing phase. Although the social benefits of organic farming are not precise enough, they should be taken seriously. If there are many organic farmers in a community, the economic and social contacts of such community may change in a positive direction. The reason may be promoting the development of the community economy, enhancing the social relations between the farmers and consumers, providing more employment and enhancing the cooperation among farmers (Mendoza, 2004; MacRae et al., 2007; Gruère et al., 2009; Prihtanti et al., 2014). It can improve food security, income diversification and improve food varieties through diversification of crops and livestock (Reganold and Wachter, 2016).

Organic farming not only provides more ecosystem services and social benefits than conventional farming (Smith-Spangler, 2012; Forman, 2012; Reganold and Wachter, 2016), but is also considered to be a useful choice to reduce the cost of investment and to gain a high premium and improve farmers' income (Greene et al., 2009). The main reason why organic farming is more profitable than conventional farming is the combination of yield changes, lower input costs and premiums (MacRae et al., 2007). Although the yield of organic farming is usually lower than that of conventional farming, with certain crops, growing conditions and management practices, organic systems come closer to matching conventional systems in terms of yields (Reganold and Wachter, 2016). Under severe drought conditions, organically managed farms have frequently been shown to produce higher yields than their conventional counterparts, due to the higher water-holding capacity of organically farmed soils (Lockeretz, 1981; Lotter et al., 2003; MacRae et al., 2007).

Without using chemically synthesized fertilizers, pesticides and fodder organic farming reduces the cost of non-renewable resources investment (Morris, 2001). Mäder et al. (2002) found that the fertilizer and energy input of organic farming in 21 European countries was 34 to 53% lower than that of conventional farming and the input of pesticides was 97% lower than that of conventional farming. Although yield of organic farm is generally inferior to that of conventional farming (Badgley et al., 2007; Seufert et al., 2012; Ponisio et al., 2015), the premium of organic products makes organic farm profit.

Crowder and Reganold (2015) analyzed the financial performance of organic and conventional farming by using meta-analysis and combines findings from 40 years of studies covering 55 crops grown on five continents. The results showed that when actual price premiums (higher prices awarded to organic foods) were included, organic farming proved significantly more profitable (22 to 35%...
greater net present values) and had higher benefit/cost ratios (20 to 24%) than conventional farming. Organic farming is becoming a worldwide sport, and more and more conventional farmers are converting to certified organic farming system (Lampkin and Padel, 1994; Willer and Lernoud, 2018).

Developing organic farming has increasingly become an agricultural policy tool in many countries (Stolze and Lampkin, 2009; Reganold et al., 2011). There have been 178 countries in the world to develop organic farming, which has increased from 11 million hectares in 1999 to 57 million 800 thousand hectares in 2016, accounting for 1.2% of the total area of the world's farmland (Willer and Lernoud, 2018). Organic farming will bring positive solutions to a range of global problems (Certification and Accreditation Administration of the People's Republic of China and China Agricultural University, 2017). By 2030, organic farming is expected to contribute to dealing with the future challenges of global farming, to become the first choice of farmland use, to strengthen and ensure the safety of food and ecosystem through enhancing ecological functions and to provide healthy food for all people in a fair way (Barabanov et al., 2015).

The safety, health and environment-friendly properties of organic products have won the favor of consumers and also have high premium, which shows higher benefit/cost ratio than conventional products (Crowder and Reganold, 2015). Moreover, if the positive externality values of organic production are taken into account, organic farming will be more profitable (Tuomisto et al., 2012). However, the conversion from conventional farming to organic farming is not as smooth as expected, and is a challenging process (Läpple, 2013). Although the area of organic farming is increasing, but conventional farming convert slowly to organic farming, and the share of organic farmland in total farmland is still very small (Willer and Lernoud, 2018). Moreover, in the process of conventional farming converting to organic farming, not all conventional farmers’ conversion will continue. In 2005, more than 7% of organic farmers quitted in the European Union (LlorensAbando and Rohner-Thielen, 2007), and the organic plant area in China decreased by 28% in 2015 (Certification and Accreditation Administration of the People's Republic of China and China Agricultural University, 2016, 2017), some organic farmers have withdrawn from organic farming. To meet the challenges of organic agricultural growth, the key is to understand the influencing factors for farmers to adopt organic farming and take appropriate measures to deal with risks.

INFLUENCING FACTS OF ORGANIC FARMING ADOPTION

What determines whether farmers convert to organic farming or not? The answer to this question is complex (Henning, 1991). Scientists believe that the influencing factors of organic farming adoption include financial risks, farmer demographic characteristics, farm characteristics and farmer attitudes (Padel, 2001; Anderson et al., 2005; Knowler and Bradshaw, 2007; Kallas et al., 2009; Karki et al., 2011, 2017), policy, information and knowledge, and foundation facilities etc (Reganold and Wacheter, 2016).

Financial risk

The bases of farm sustainable management are to maintain at least a complete ecosystem and the ability to achieve sustainable income (Majewski, 2008). Financial performance determines the material living conditions of the farmers’ families; it is the basis for choosing life style, and thus determines the economic and social sustainability of the rural areas. Financial considerations have a significant impact on farmers’ organic farming adoption (Duram, 2000; Padel, 2001; Karali et al., 2014). Yield, price and cost are important financial factors (Harwood et al., 1999; Meuwissen et al., 2001; Kallas et al., 2009; Crowder and Reganold, 2015), because they are directly related to profit, which is the primary consideration for farmers’ decision-making.

The significant differences between organic farming and conventional farming are that organic farming relies on the natural process of the ecosystem and does not use the most important risk management tools of the conventional farming such as chemical synthetic pesticides and fertilizers. However, the huge difference and immature production technology system will cause the yield gap between organic and conventional farming. Most organic farms are less productive than conventional ones (MacRae et al., 1989; Lockeretz, 1989; Stanhill, 1990; Henning et al., 1991; De Ponti et al., 2012; Seufert et al., 2012; Ponisio et al., 2015; Crowder and Reganold, 2015), especially with horticultural crops and animals, where the yield of organic systems is significantly lower than that of conventional systems (MacRae et al., 2007; Berentsen et al., 2012; Reganold and Wacheter, 2016).

In general, yield averages are 8 to 25% lower in organic farming. This will prevent farmers from adopting organic farming. With the improvement of technology, the yield gap between organic and conventional farming will be reduced (Wrigley, 2006), and the profit will increase (Sunding and Zilberman, 2001). However, with the popularization and application of organic farming and the increase in the amount of organic products, the profit margins of organic products will be cut down. In addition, the yield of the organic conversion period may be reduced, while the product in the conversion period cannot get the same premium as the certified organic product, and many farmers call it the period of “thinking risks” (Norman et al., 2000), which may prevent the adoption of organic farming by risk aversion farmers.

The premium of organic products induces farmers to
adopt organic farming. When organic premiums were taken away, net present values (-27 to -23%) and benefit/cost ratios (-8 to -7%) of organic farming became significantly lower than conventional farming (Crowder and Reganold, 2015). In addition, although the premium of organic products is beneficial to organic farmers, it is beyond the purchasing capacity of ordinary consumers, which may seriously hamper the expansion of organic product market and hinder potential organic producers entry (Torjesen et al., 2004; Hughner et al., 2007; Thøgersen, 2010; Lagos et al., 2010; Schlenbecker and Hamm, 2013; Xie et al., 2015; Li and Xiang, 2016).

Organic farming reduces the cost of purchasing inputs and the mechanical depreciation costs associated with spraying technology application when chemically synthesized inputs are not used; however, these cost reductions may be offset by additional costs such as mechanical weeding, land tillage and higher feed and seed prices (Offermann and Nieberg, 2000; Morris, 2001). The labor cost of organic farming is obviously higher than that of conventional farming (Adhkari, 2011; Crowder and Reganold, 2015), which has a negative impact on the development of organic farming in areas with tight labor supply.

It may be non-profitable to produce crops with only narrow harvest period and high local labor demand (Fisher, 1951; Binswanger and Rosenzweig, 1986). The price fluctuation of inputs and inputs required for economies of scale also affect farmers’ decision-making (Zilberman et al., 2012). The certification cost of organic products is also an important factor to prevent small area farms from entry into organic farming (Lagos et al., 2010). The marketing channels and performance of organic products are also important factors affecting farmers’ adoption of organic farming (Khaledi et al., 2010; Panneerselvam et al., 2011; Liu et al., 2016; Veisi et al., 2017). Although the price of organic products is generally higher than that of conventional products, the global organic farmers receive only 9% consumer payments, and the input sector obtains 24%, distribution, transport and retail sectors gain 67% (Vorley et al., 1995).

The premium for an organic producer depends partly on the ability of the producer to obtain a marketing channel for premium and the ability to meet the quality requirements of such channel (Offerman and Nieberg, 2000). Product research and development, popularization, distribution chain length and small volume have also contributed to marketing costs and prices, especially for the immature organic product market (Winson, 1992; MacRae et al., 1993; Pretty et al., 2005). In addition, customer satisfaction and the development of own brands are important determinants of organic food sales (Lukić, 2011).

**Farmer’s demographic characteristics**

A considerable number of literatures argued that farmers’ demographic characteristics have an impact on organic farming adoption, but the conclusions of scientists are mixed (Kalka et al., 2010). Burton et al. (1999) believed that gender had great influence on farmers’ decision-making and women were more likely to engage in organic farming. Egri (1999), Anderson et al. (2005) and Wang (2012) believed that gender had no significant influence, while Midmore (2001) found that the proportion of female organic farmers was very small. Genius et al. (2006), Koesling et al. (2008), Beltrán-Esteve et al. (2012) and Shams and Fard (2017) found that farmers educational level had a significant positive impact on their adoption of organic farming, but Burton et al. (1999), Anderson et al. (2005), Panneerselvam et al. (2011) and Wang (2012) argued that the influence of education level is not remarkable. Chen et al. (2013), Xu et al. (2014), Fard et al. (2014) and Shams and Fard (2017) found that young farmers were more likely to convert to organic farming, but Anderson et al. (2005) and Panneerselvam et al. (2011) found that age had no significant influence on farmers’ adoption of organic farming.

Most studies argued that farmers’ experience, income and their organic farming knowledge have a significant impact on their organic farming adoption (Shams and Fard, 2017), and agricultural vocational training increases the probability of conventional farmers converted into organic farming (Beltrán-Esteve et al., 2012). Chavas et al. (2010) and Chavas and Kim (2010) found that farmers lack of knowledge and information about the cost and benefit of organic farming, or lack of knowledge of how to apply may not be able to produce a preference for organic farming. However, scientists also believe that even if farmers have complete information, effective application of new technologies and low cost, differences in cross term preference or credit constraints may also make farmers reluctant to sacrifice current profit or income for long-term soil fertility improvement, risk reduction, or increase in yield (Shively, 2001; Sunding and Zilberman, 2001; Coxhead and Shively, 2002).

**Farm characteristics**

Anderson et al. (2005), Koesling (2008), Karki et al. (2011), Mann and Gairing (2012) and Xu et al. (2014) argued that larger farms are good for organic farming adoption; large farms with low yields are more likely to be converted to organic farming (Pietola and Lansink, 2001), but Best (2009), Beltrán-Esteve et al. (2012) and Qiao et al. (2016) argued that small farms easily adopt organic farming, while Wang et al. (2012) believed that farm area has no significant impact. Farmers engaged in crop production are more willing to transform into organic production (Koesling, 2008), while farmers engaged in intensive cultivation are less willing to convert (Pietola and Lansink, 2001). Communities near the city center may adopt new technologies more quickly (Rogers, 2003), and organic
farmers are closer to the city than conventional farmers (Koesling, 2008), but there are also studies that found out that farmers far away from the market are more willing to adopt organic farming (Karki et al, 2011).

Farmers' attitudes

In terms of changing cropping systems or engaging in new agricultural activities, farmers may be risk aversion and attitudes toward technology or concerns about natural environment may be very conservative (McCann, 1997; Hanson et al., 2004; Musshoff and Hirschauer, 2008; Serra et al., 2008). Generally speaking, the degree of risk aversion of organic farmers is lower than that of conventional farmers (Flaten et al, 2005; Kallas, 2010). The comparative analysis of Berentsen and van Assebøen (2016) on the conventional and organic farms in Holland showed that the risk of crop yield, price and variable input cost was higher in organic farms. There is also a significant difference in production risk and risk aversion between the organic and conventional farms in Spain (Serra et al., 2008). Cooperative organizations may be an effective way to reduce the cost of organic farming. However, there are also violations of cooperative agreements in practice (Liu, 2010).

Past irregularities play an important role in predicting future irregularities. There is an increase in the probability of defaults in livestock production (Zanolí et al., 2014), default risk increases with farm size and operational complexity, and it is difficult to establish effective risk-based regulatory measures (Gambelli et al., 2014). Risk aversion farmers may not be willing to use organic farming and in the long run risk may be reduced or productivity or income increased (Nerlove, 1996; Hanson et al., 2004).

Farmers have no incentive to engage in organic farming when risk exceeds circumvention range (Liontakis and Tzouramani, 2016). The positive influence of farmers' concern for environment on the adoption of organic farming has been supported by most researches (Burton, 1999; Midmore et al., 2001; Best, 2009; Xu et al., 2014). Organic farmers showed higher awareness of environmental protection (Lockeart et al, 1995; Egri, 1999; Flaten et al, 2006), and the economic motivation is less than conventional farmers (Padel, 2001), but there are also studies that argued that environmental awareness does not have significant influence (Wang et al., 2012). In addition, organic farmers prefer more diversified sources of information than conventional farmers (Burton et al., 1999).

Policy

Organic farming can improve environmental quality, but environmental quality is a kind of (quasi-) public goods, and the market mechanism often fails and is inequitable. If we want organic farming to become a profitable choice for farmers and the main system of global farming in the future, public funding is necessary (Bowman and Zilberman, 2013). Governments should focus on creating an enabling environment for the development and adoption of organic farming and provide diversity knowledge. These efforts must be targeted at improving agricultural performance and will require a diversity of knowledge-based, legal and financial policy instruments (Stolze and Lampkin, 2009), including policy instruments needed to create an enabling environment for organic farming innovation, education and promotion; legal instruments are needed to create an enabling environment for ensuring open and competitive markets, limiting government influence in market and increasing transparency in the food production system; financial instruments are required to give monetary value to the externalities that arise from organic practices and to empower farmers through access to capital, infrastructure and competitive markets (Reganold and Wacheter, 2016). However, the 2010 report of the National Research Commission of the United States pointed out that new agricultural systems (including organic farming system) that could help achieve multiple sustainability goals were not common (National Research Council, 2010).

Reganold et al. (2011) argued that in addition to the science and technology barriers, there are also policy barriers. Agribusiness corporations, agrochemical industries, commodity groups and food companies have a strong vested interest in the conventional agro-industrial model, command ever-greater market power in the food system and have heavily influenced public policy to favor organic agriculture (Jackson, 2008). These led to the government’s lack of specific support for organic production or organic enterprises (Lagos et al., 2010). Some farmers face infrastructure and economic barriers, which include access to markets, loans and insurances (Stolze and Lampkin, 2009; Reganold and Wacheter, 2016). There is also lack of the platform to discuss contracts between organic producers and marketers (Lagos et al., 2010). Solution to these problems may require assistance from the government. In less developed countries, targeted inputs subsidy and investment in rural infrastructure are the key tools (Sanchez, 2010).

The risk aversion farmers are willing to convert to organic farming, if the incentive policies that contribute to the development of organic agriculture are implemented (Acs et al., 2009). There is a positive correlation between government subsidies and farm efficiency improvement, technological progress and the reduced possibility of withdrawal from organic market (Sauer and Park, 2009). Subsidies are powerful incentives for farmers to adopt organic farming (Serra et al, 2008; Panneerselvam et al, 2011), but it does not mean direct support for agricultural income, but an award on environmental protection.
Policy incentives based on subsidies may not be sufficient to promote organic agriculture with technical barriers (Lhппle and Kelley, 2013), but increasing farmers’ access to information may help them to adopt organic farming (Ma et al, 2017). Promoting farmers to adopt organic farming requires more technical training and education (Beltrán-Esteve et al, 2012; Liu, 2016). Considerably, less public and private funding has been put towards research and development for organic systems and this has resulted in a dearth of knowledge and information resources supporting organic farmers, especially in less developed countries (Khakeli et al, 2010; Reganold et al, 2011; Tuck et al, 2014; Ponisio et al, 2015).

ANALYSIS METHOD OF INFLUENCING FACTORS

In order to clarify the determinants of farmers’ adoption of organic farming, different approaches have been implemented. These include: (i) Analyze the determinants of farmers adoption of organic farming by multiple regression and linear programming methods based on cross section data (Burton, 1999; Anderson et al, 2005; Genius et al, 2006; Yuan, 2009; Kallas et al, 2010; Doris, 2011; Wang et al, 2012; Gao et al., 2016); (ii) Examine cumulative adoption rates at the aggregate level using time-series data (Feder and Umali, 1993; Gardebroek and Jongeneel, 2004); (iii) Measure the outcomes arising from conversion through mathematical programming and simulation methods in terms of the physical and financial performance of farms (Acs et al, 2007; Kersemaers et al, 2007; Musshoff and Hirschauer, 2008); and (iv) compare organic and conventional farming along various management criteria such as input use, efficiency, productivity, as well as, financial results, using basic statistics or profit maximization models (Klepper et al, 1977; OECD, 2000; Tzouvelekas et al, 2001; Oude and Jansma, 2003; Cisilinoa Madau, 2007; Serra et al, 2008).

However, most researches have been rather descriptive instead of being guided by a decision theory. According to Aristotle, “the origin of action is choice, and that of choice is desire and reasoning...” “The origin of...choice is desire and reasoning with a view to an end — this is why the choice cannot exist...reason (Aristotle, 1998). Rational choice theory offers a micro theory that proposes how humans behave on average. Human behavior is conceptualized as the result of decision making, before acting, the actor has to choose between several alternatives. The decision to adopt or not to adopt organic farming is also a choice. From a sociological point of view, although the constraints have significant influence on farmers’ organic farming adoption, the subjective perception and evaluation of organic farming may be more important (Best, 2009).

Best (2009) showed that the decision for or against an adoption of organic farming was a rational choice of farmers. The higher the farmers’ subjective expected utility difference between the organic and conventional farming, the more likely the organic farming is adopted, the characteristic development of the farm operation and the expectation of daily work are the core of farmers’ decision-making. Although Best argued that the subjective expected utility difference is the first factor to explain the farmer’s adoption of organic farming (the model explains 25% of pseudo-variance), his model only explains 55% of pseudo variance and 45% is not explained. Then, whether the subjective expected utility difference is the primary factor of farmers’ decision-making remains to be tested.

FARMERS’ DEMANDS FOR INCENTIVE POLICY

Although scholars generally believed that the development of organic farming needs public policy support, there are little literatures on farmers’ subjective demands for incentive policies. The focus groups were facilitated by Hanson et al (2004) to explore the risks faced by organic farmers, how they are managed, and needs for risk management assistance. The organic farmers who participated in the discussion expressed strong interest in the wider change of policy — for example, public expenditure has shifted to organic farming research and popularization and consumer education showed strong interest, this will enhance public support for organic farmers. It is believed that organic farmers need more promotion projects and supports, and new organic farmers need help while converting from conventional to organic production and federal subsidized crop insurance is likely to be particularly important for the transition period. Some participants suggested helping farmers learn organic farming through providing education and training programs, providing subsidies for the transition period, subsidizing organic certification and providing low interest loans to organic farmers. Organic farmers at the discussion sessions especially farmers engaged in the organic production of grain, soybean and cotton expressed considerable concern about risks from the use of genetically modified organisms (GMOS) by conventional farmers.

Governments should ask the regular agricultural enterprises to strengthen their responsibilities, especially for the loss of organic farmers caused by the pollution of genetically modified crops. Federal multiple-peril crop insurance, a major USDA program to assist farmers with yield and revenue risk was discussed by all discussion groups. Participants argued that federal crop insurance as a risk-management tool is workable but needs improvement. Several of them said that the problem with crop insurance is that the coverage does not reflect higher prices received for organically produced crops. They noted that the insurance ‘price election’ (the insurance value of a crop) is the same whether the crop is produced organically or conventionally, and is too low for organic farmers.

Organic farmers in most of the discussion groups...
mentioned that federal crop insurance does not cover what they think is a major risk — the loss of sales and markets due to accidental contamination of crops from GMOs. Organic farmers expressed interest in having crop insurance available for a wider variety of crops. They suggest a number of changes to crop insurance, including a reflection on the premium of organic products, broadening the coverage of crop insurance and crop insurance for genetically modified pollution, which will improve the effectiveness of insurance.

**Risk management**

Scientists are not only interested in the influencing factors of farmers' adoption of organic farming, but have also carried out a lot of research on how to reduce the farmers' financial risk and the incentives to promote the development of organic agriculture.

**Farmer's strategies**

As long as the gain is greater than the opportunity cost, farmers will have the motivation to engage in organic farming. Farmers may cope with risks in many ways, preventing them in advance and reducing losses as much as possible afterwards. In most cases, organic farmers rely on premiums to offset risk and increased production costs (Klonsky and Greene, 2005). Following the principles of agroeconomics, the improvement of organic crop varieties, rational rotation and diversified production may make up or narrow the yield gap between organic and conventional farming (Badgley et al, 2007; Murphy et al, 2007; Seufert et al, 2012; De Ponti et al, 2012; Ponisio et al 2015). Crop diversification can also help farmers cope with price risk, production risk, input market risk and product market risk (Bowman and Zilberman, 2013). If the price risk of the two crops is not related, the farmers can choose the optimal crop combinations by diversifying production, which helps to protect the total profit when the price of a crop is lower than the average (Bromley and Chavas, 1989).

Change in the traditional sale ways of organic products through online stores, home delivery service and exclusive shop and other forms of direct sales reduce transaction costs (Lagos et al, 2010; Wang et al, 2014). Moreover, the direct selling price of organic products is sometimes lower, and consumers also benefit from it. For example, the price of organic cabbages (green leafy vegetables) supermarkets sold is $2.70 per pound in Guangdong, China, but the online price was $0.88 to $1 per pound. The direct selling price of organic vegetable farms was only 60% of the supermarkets' retail price (Lagos et al, 2010). Through different market channels such as Community-Supported Agriculture (CSA), consumers can promise to buy bundled products in advance rather than a single fruit or vegetable; this model can help producers cope with potential market risks (Brown and Miller, 2008). Analysis of the impacts of contractual arrangements, direct sales and spot marketing on the income of farmers producing "safe vegetable" in northern Vietnam shows that direct sales and contractual arrangements have a significant positive impact on earnings compared with spot marketing (Wang et al, 2014).

The analysis of organic product processing and retailers in different regions of the EU Mediterranean shows that the promotion of the supply contract makes the agricultural and processing enterprises in the organic product supply chain coordinate vertically, and the main distribution channels of the processing enterprises are organic product stores, direct selling and supermarkets (Cavaliere et al, 2016). Green marketing strategy can stimulate consumption of organic products and promote organic production (Acekeanu, 2016). Organic product consumers have a strong sense of quality, which in turn affects their willingness to pay and price sensitivity to the types of store they choose. The daily cost of shopping, the distance between the home and the store, and the size of the home shopping basket are important for consumers to choose between a specialty store and a one-stop shopping mall. Families with high income, married families and families with children are more likely to go to high-end shopping malls. Larger families and older people preferred stores with lower prices and wider range variety (Hsieh and Stieget, 2011). Information and popularization activities can promote organic vegetables and organic food and enable consumers to improve their knowledge and experience in these organic products (Pieniak et al, 2010).

The study of organic vegetable consumption in Indonesia argued that organic food can be vigorously promoted from the implementation of appropriate pricing strategies, encouraging organic labeling and certification, motivation of consumers and their attention to health, safety and environmental sustainability (Slamet al, 2016). The supply, marketing and distribution of organic products require the trust of producers and consumers, which may benefit from the vision of moral and social responsibility (Chang et al, 2011).

Some dilemmas for high price can be solved through the support of the scientific research institute, when there is more investment on research, production, distribution and processing strategies with lower cost may emerge. When more participants are involved, the increase in competition leads to lower prices. There was evidence that the costs of production, distribution, processing and retail are declining over time (Moran, 2001; Jones, 2003). The more profitable the new technology, the more applications will appear faster, and reach a higher level of application (Griliches, 1963). As time goes on, producers gain knowledge or "learn by doing" and more farmers begin to apply this technology or "learn by using"; this make technical measures popularized. When the fixed cost of technology application decreases with time, more farmers will adopt this technology. For some technologies, income increases over time as the number of producers using these technologies expands (Sunding and
Without the support of cooperative forces on production, marketing and certification, individual farmers cannot cope with the risks, difficulties and dangers of engaging in organic production. For labor-intensive and small-scale farms, any form of cooperation provides at least some economies of scale for management, trade and risk bearing (Sanders, 2006). Cooperation with the enterprise or establishing the farmer’s cooperative organization is an effective way to reduce transaction costs and production costs (Setboonsarng et al, 2006; Oelofse et al, 2010; Mahdi, 2012; Wang et al, 2014; Girma and Gardebroek, 2015). Contract agriculture is an effective system to reduce the transaction costs of small-scale poor farmers to improve profitability and reduce rural poverty (Setboonsarng et al, 2006). "Company + farmers", "cooperatives + farmers", "company + base + farmers" and "company + farmer cooperative organization + farmers" are important modes of Chinese organic farming operation and management, which can reduce transaction costs, reduce risk and improve financial performance (Liu, 2010; Yang, 2011; Certification and Accreditation Administration of the People’s Republic of China and China Agricultural University, 2017). Farmers obtain technical guidance, provision of agricultural inputs with quality guarantee from the contract and purchase such inputs at a favorable price, while consumers get organic certified products at a reasonable price (Gahukar, 2007). The analysis of organic rice farmers in Thailand showed that the contract agriculture is an effective system to reduce the transaction costs of small poor farmers and improve profitability and reduce rural poverty (Setboonsarng, 2006).

The conclusions of the survey on the organic vegetable farmers in northern Vietnam (Wang et al, 2014), the coffee producers in the Kilimanjaro area of Tanzania (Mahdi, 2012) and the beekeepers in the southwest of Ethiopia also showed that the contract arrangement had a positive impact on the income (Girma and Gardebroek, 2015). However, the case study in China and Brazil found that the scope of the contract agriculture is narrow, and the farmer cooperatives are the most important external support (Oelofse et al, 2010). The analysis of the impact of village level contractual arrangements (spot contracts, contingent contracts with product grading and contingent contracts without product grading) on producers’ income and quality improvement in the Kilimanjaro region of Tanzania showed that coffee contracts, including village-based product grading have a significant positive effect on the income of producers, and the grading effect is related to the quality enhancement of production, and cooperative membership has no significant impact on the producer’s income (Mahdi, 2012).

Free-riding may hamper the establishment of farmers’ cooperative organizations and violations of cooperative agreements might reduce. Research on Ezenvelo farmer’s organization (an organic crop grower group) in South Africa showed that free-riding poses a serious threat to collective marketing; to remove the root of concealment of low quality products in grading process, cooperation with the processing packaging plant is necessary; in the long run, to deal with free-riding needs property rights transactions, achieving a contract compatible with the buyer’s incentive through transparent intermediary negotiations may also help to build trust and reduce free-riding (Gadzikwa et al, 2007). Other coping strategies include non-farm employment, savings or credit using, private lending, use of risk reduction technology, order contract and diversified production (Feder et al, 1985; Goodhue and Hoffmann, 2006; Ito and Kurosaki, 2009).

Public policy

Governments should create an enabling environment for the adoption of organic farming and provide laws, economic policies and diversified knowledge to improve the performance of organic farming (Stolze and Lampkin, 2009; Bowman and Zilberman, 2013), including policy instruments needed to create an enabling environment for agricultural innovation, education and popularization; legal instruments are needed to create an enabling environment for ensuring open and competitive markets, limiting government influences in market and increasing transparency in the food production system; financial instruments are needed to give monetary value to the externalities that arise from agricultural practices and to empower farmers through access to capital, infrastructure and competitive markets (Reganold and Wacheter, 2016).

The focus of policies to improve the performance of organic farming include: 1) support for the research of new organic crop varieties and organic pesticides; 2) to strengthen the research and popularization of the best technical measures of organic farming; 3) to develop domestic organic markets and organic certification, especially in low-income countries; 4) to provide subsidies to organic farmers for reducing production and labor costs during the transition period; 5) to develop fair trade labels with organic certification; 6) to improve low-income consumers' access to organic food by subsidizing farmers or consumers to reduce the premium on organic products (Seufert and Ramankutty, 2017). These public payments can help improve the welfare of farmers and society as a whole (Just and Antle, 1990; Smith, 2006; Swinton, 2006; Bowman and Zilberman, 2013). Policy makers should also consider supporting farmers’ institutions, providing farmer’s training and raising farmers’ awareness of the environmental, financial and health benefits of organic agriculture (Karki et al, 2011).

In order to promote the development of organic farming, some countries have formulated and implemented incentive policies. Public sector intervention in the context of organic farming in the European Union addresses correction of previous government intervention, imperfect competition, lack of information and transparency as well as, market
failure with respect to public goods (Stolze and Lampkin, 2009). EU organic farming policy employed three types of instruments — legal, financial and communicative instruments (Stolze and Lampkin, 2009). In Europe, the most important public policies fostering organic farming development were the introduction of organic farming area support and the provision of the EU-wide legal basis for organic farming (Lampkin and Stolze, 2006; Daugbjerg et al., 2008). Financial payment in the framework of agri-environmental policy has become the main form of European organic agriculture support policy (Stolze and Lampkin, 2009; Crisostomo et al., 2012; Zofia, 2015).

Subsidies by production area have effectively reduced the income difference between conventional and organic farms (Offermann, 2003; Serra et al., 2008). In the income of organic farms in the EU, the proportion of subsidies reached 10 to 30% and after some eastern European countries joined the EU, the proportion was up to 3/4. In the view of farmers, subsidies for the adoption of organic farming is considered to have an important impact on the survival of the farms in new EU members (Zander et al., 2008; Offerman et al., 2009).

Many international, federal, state, and local agricultural, credit, energy, risk-management, and environmental policies influence farmer decisions in U.S., a major policy driver for U.S. agriculture is the Farm Bill traditionally renewed by the U.S. Congress every 4 to 5 years (Reganold et al., 2011). The new 2014 Farm Bill continued to support the national organic plan of the United States Department of agriculture, increased support for the research, promotion and education of organic farming, supported the operation of organic farming, enhanced government support for the allocation of organic certification costs, increased the proportion of government payment for organic crop insurance, and provided organic production and market data to reduce costs (Chite, 2014).

In order to encourage risk aversion farmers to convert to organic farming, Australia has established an Australian Organic Grower Alliance to provide training and payment of organic certification costs for small farmers, and expand the overseas market actively to improve the income of organic producers and operators (Xie and Pu, 2014). Although Australia is already the largest organic farming country in the world, Wheeler (2011) believed that government supports are not enough; government should directly influence farmer adoption of organic farming through establishing clearer property right, increasing information provision about organics through research and extension, other market-based policies and address institutional bias against organic farming. South Korea began to implement a system of direct payment for sustainable agriculture in 1999, mainly for farmers lost in adopting organic farming (Qiang, 2009).

Facing the growing demand for organic products, China’s organic farming has a bright future. As long as appropriate institutional arrangements are established and strengthened, there is a possibility of a win-win situation between economic and environmental benefits (Sanders, 2006). Lv and He (2011) argued that organized farmers engaged in ecological activities are the key to promote the development of organic farming, and the relevant government policy, especially financial support, is the fundamental guarantee. China should introduce policies to support organic production, processing and certification, make full use of the green box policy to implement direct subsidies and certification subsidies for organic farmers, reduce production costs and transaction costs, and improve the competitiveness of organic farming. Compared with developed countries, China’s organic farms are generally small, production costs are high and the organic product markets are imperfect and subsidies are more necessary for organic farmers.

In order to promote the development of organic farming, Chinese government has promulgated the policies of the construction of organic farming demonstration areas and the poverty alleviation policy through organic industry (Certification and Accreditation Administration of the People’s Republic of China and China Agricultural University, 2017), but there is no national support policy specifically for farmers’ adoption of organic farming. Although a few places in China have begun subsidizing enterprises and farmers engaged in organic farming, the scope and intensity of subsidies are relatively small (Yu, 2016). Most of the subsidies were given to enterprises, and farmers only got a small part and needed to increase their subsidies to farmers (Ding, 2012).

There exists evidence that some of the policies enacted had their desired impacts. For example, Daugbjerg et al. (2011) found out that six of the 14 organic policy measures in the UK and Denmark had statistically significant impacts on the growth of organic farmers and the organic farming area, of which 5 are direct supply side measures, and subsidies are fundamental measures to change the number of organic producers and the area of organic production. However, systematic analysis of the extent to which organic food and agricultural policies affect the ‘growth’ of organic sectors is rare, with little theoretical understanding of which policy instruments or policy portfolios contribute most to growth (Daugbjerg and Halpin, 2008). It is also unclear how specific policy instruments can promote organic sectors (Daugbjerg et al., 2011).

CONCLUSION

The remarkable ecological benefits of organic farming have been confirmed by a large number of literatures, moreover with certain crops, growing conditions and management practices, organic systems come closer to matching conventional systems in terms of yields. Under severe drought conditions, organically managed farms have frequently been shown to produce higher yields than their
conventional counterparts. Organic products are safer, healthier and more pro-environmentally, which win the favor of the vast majority of consumers, and have a broad market prospect. Organic farming is considered to be an important alternative for conventional farming. However, the development of organic farming is not as fast as people expected. At present, organic farming area accounts for only 1.2% of the world's agricultural land area. This phenomenon has attracted wide attention from scientists of different disciplines.

Many scientists have discussed the influencing factors of farmers' adoption of organic farming, and generally believe that farmers' adoption of organic farming faces market risks. The production, price and (production and marketing) cost of organic products are the important risk factors that farmers consider, because it is related to the opportunity cost of organic farming adoption. Although there are literatures that argue that with certain crops, growing conditions and management practices, organic systems come closer to matching conventional systems in terms of yields. Under severe drought conditions, organically managed farms have frequently been shown to produce higher yields than their conventional counterparts. But the fact that the yield of organic farming is lower than that of conventional farming in general hinders farmers from adopting organic farming. In spite of the premium for safe and environmentally friendly organic products, the high price of organic products exceeds the purchasing power of ordinary consumers, limiting the expansion of the consumer market and hindering the transformation of potential organic farmers. Products in transition stage cannot be sold at the price of organic products, which also affect the choice of farmers. Organic farming avoids using chemical synthetic inputs, which can reduce the cost of some inputs, but the labor cost is significantly higher than that of the conventional farming, which is not conducive to the choice of farmers in the areas of tension labor supply in choosing to engage in organic farming. For the immature market of organic products, high marketing costs also impede farmers' adoption of organic farming.

The demographic characteristics, farm characteristics and attitudes of farmers are also important factors affecting their adoption of organic farming. Most studies believed that young farmers are more likely to shift from conventional production to organic production, and the gender of farmers has no significant impact on the adoption of organic farming. The farmers' experience and income have significant influences. The education degree of farmers has a significant positive impact and agricultural vocational training increased the probability of conventional farmers converting to organic farmers.

According to some literatures, the type, scale and distance from the market of the farm affect conventional farming move to organic farming. Farmers with environmental protection attitude have a positive impact on farmers' adoption of organic farming as supported by most literatures. Farmers who prefer a variety of information sources are more likely to adopt organic farming. The comparison of the characteristics of organic and conventional farmers has attracted considerable attention in the literature, but there is a lack of research on the former organic farmers. In addition to Läpple (2013), who compared the demographics and farm characteristics of organic, former organic and conventional farmers with the study of farmers engaged in the production of cattle and sheep in Ireland, few literatures have analyzed the reasons why former organic farmers quit organic production, and the characteristics differences among organic, former organic and conventional farmers.

Most of the literatures believed that public sector support is conducive to converting to organic farming. Governments should create an enabling environment for farmers' adoption of organic farming and such instruments are needed to create an enabling environment for ensuring open and competitive markets, limiting government influence in market and increasing transparency in the food production system; financial instruments are needed to give monetary value to the externalities that arise from agricultural practices and to empower farmers through access to capital, infrastructure and competitive markets. However, the incentive policies that contribute to the development of organic agriculture are not common. A few public funds are invested in the research and infrastructure of organic farming, which leads to the lack of knowledge and information of organic production and the weakness of farmers to deal with risks, especially in underdeveloped countries and regions. Although scientists generally believed that public sector policies affect farmers' decisions, there are few scientific literatures about farmers' demand for incentives to adopt organic farming. Little is known about farmers' preferences for incentives.

Although literatures on the influencing factors of farmers' adoption of organic farming are rich, their conclusions are not completely consistent, and some are even contradictory (Wilson and Hart, 2000; DeFrancesco et al, 2008), then, there may be limitations in the use of farmers' decision-making knowledge in different places, and specific circumstances need to be emphasized (Karali et al, 2014). Quantitative analysis has been widely used to explore the determinants about farmers' adoption or rejection of organic farming. However, most studies were not based on rational choice theory.

How to deal with risks for organic farmers has attracted scientists' attention. Most literatures believed that premium is the main way for organic farmers to counteract market risks. Improving crop varieties, reasonable rotation and diversifying production can reduce the yield gap between organic farming and conventional farming. Changing the traditional sales way can reduce the marketing cost through direct selling. Many literatures suggested that cooperative contract can reduce transaction costs, production costs and provide access to technical guidance; it is more effective...
especially for small-scale farms to deal with production risks.

Most literatures believed that agri-environmental policies and public funding will help organic farms cope with market risks. Among them, subsidy measures, such as subsidy according to production area and certification subsidy, can help organic farmers reduce production and price risks, and are most widely used. Supporting infrastructure and public exchange platforms, helping farmers to establish cooperative organizations and providing technical training are also important incentives adopted by governments. Although a large number of literatures believe that policies have promoted the development of organic farming, the systematic analysis of the policy influence on organic farming growth is rarely. The contribution of specific policy instruments to farmers’ adoption of organic farming is not so clear, and it is necessary to be further tested. Scientific literatures on financial risk and risk management of organic farming mainly comes from developed countries, and the developed and less developed countries, including China, are still quite short of research.

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REFERENCES


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