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Operation Mechanism of Farmers' Professional Cooperatives from the Point of Low-Carbon Agricultural Products

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Abstract We firstly take a look at internal logic of cluster development of low-carbon agricultural products. In combination with operation features of farmers' professional cooperatives and actual requirements for cluster development of low-carbon agricultural products; we elaborate establishing benefit allocation mechanism, bearing education and training functions, forming low-carbon value, building low-carbon identification system, as well as realizing low-carbon value. According to these situations, we systematically analyze operation mechanism of farmers' professional cooperatives suitable for cluster development of low-carbon agricultural products. To promote cluster development of low-carbon agricultural products, we put forward following suggestions, including government guidance and encouragement, social acceptance and active cooperation, and integration into global low-carbon development system to share benefit of low-carbon development.

Key words Cluster of low-carbon agricultural products, Farmers' professional cooperatives, Low-carbon value

The development of regional agriculture is not only affected by natural climate, but also restrained by natural endowment of inherent agricultural resources. Especially, under the background of acceleration of industrialization, with the single function of agriculture, linear condition of labor division and continuous reduction of derived employment demand, the traditional agriculture takes on an inevitable trend of exchanging the input of many elements for the improvement of unit production efficiency in agriculture and substituting labor with capital to promote the agricultural productivity[1]. Under the current selection of energetic development of low-carbon economy in the world, the element input based on fossil fuel in agriculture still stays at a high level, and the evaluation data of Intergovernmental Panel on Climate Change (IPCC) of the United Nations indicates that emission of greenhouse gas generated from agricultural industry has accounted for 14% of total greenhouse gas emission in the world; during the period of 1991 to 2008, the annual average increase rates for total carbon emission amount and intensity in the agricultural industry of China are respectively 4.08% and 2.38%[2], while during the period of 2006 to 2010, the annual average increase rate of the primary industry is 4.5%, and the contribution rate of the increase amount of agricultural industry for economic growth is less than 4%. The development requirements for low-carbon economy compel the necessity of adjusting the mode of "high-carbon agriculture" on a large scale and seeking a new balance between input and efficiency in agriculture so as to substitute "high-carbon agriculture" with "low-carbon agriculture". This requires that in different regions, not only the advantage in agricultural resources should be brought into play, but also the agricultural benefit should be increased by means of the extension of industrial chain and the effective operating mode of low-carbon agriculture should be explored constantly. We take the mode of "low-carbon agriculture" of low-carbon agricultural industry cluster as a starting point to discuss the issue of exploiting the functions of farmers' professional cooperatives in the organization of production process, selection of low-carbon technology and market connection and combining with the resource characteristics of agricultural industry cluster so as to establish the effective operating mode of farmers' professional cooperatives and find the effective way to make the farmers' professional cooperatives suitable for the cluster development of low-carbon agricultural products under the current conditions of farmer household with low quality and shortage of correct use of "high-carbon" elements such as agricultural machinery, chemical fertilizer, pesticide, *etc.*

1 Summary of inherent logic in the cluster development of low-carbon agricultural products

The development of agricultural products in the form of cluster has its congenital advantages and inevitable trends, and most researches focus on the agricultural industry cluster at present. Hu Ming makes a detailed analysis for the causes of forming agricultural industry cluster and believes that the growth characteristics and natural conditions of crops such as geology, climate, hydrology, *etc.* will directly affect the type and quality of agricultural products[3]. In order to utilize the comparative advantages of agricultural resources sufficiently, the difference

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of agricultural resources in geospatial distribution can attract some industries to a certain regional range fully to form organic industrial clusters and generate agricultural industry cluster around special agricultural products. Zhang Xiaoqing then further analyzes the unique characteristics and restraint factors of agricultural industry cluster and indicates that the agricultural industry cluster plays positive role in the aspects such as the creation of competition advantage, formation of market recognition of agricultural products, creation of "multiplier effect" of growth in regional economy and even the improvement of urbanization level, but possesses different constitutive characteristics when compared with other industrial clusters: farmer household serving as the subject, including not only large ones but also scattered ones; requiring a developed cooperative system; requiring the infrastructures suitable for the great agricultural development and possessing distinctive local characteristics[4]. However, the factors such as the continuity of production process in agriculture, two-sidedness of conduct of farmer household, competition limitation between farmer households and insufficient development of industries associated with agriculture restrain the development of agricultural industry cluster. When taking a broad view of research literature on agricultural industry cluster, it basically centers on the subject that the cluster development of agricultural products is the inevitable requirement for economic development and agricultural development[5], but it is necessary to organize the conduct of farmer household and establish a certain cooperative system.

With the threat of global warming and pressure of environment deterioration, the low-carbon development in the economic society is imperative, and low discharge, low pollution and low energy consumption become the main connotation of "three-low" new economic mode. The vegetalization production in agriculture has carbon fixation characteristic, while the chemical fertilizer dependency, pesticide dependency and agricultural machinery dependency of modern agriculture lead to the obvious characteristic of high-carbon discharge in agriculture. The Intergovernmental Panel on Climate Change (IPCC) of the United Nations points out that the proportion of agricultural industry to total greenhouse gas emission in the world is higher than that of transportation industry, and the emission of greenhouse gas generated from agricultural industry has accounted for 14% of total greenhouse gas emission in the world[6], thus the low-carbon development of agriculture is extremely urgent. Luo Jiwen, *et al.* studies the connotation and development countermeasures of low-carbon agriculture, and believes that the low-carbon agriculture emphasizes the development manner of low consumption, low emission and high output in agriculture as well as the low-carbonization in various links of raw material exploitation, product processing, utilization and consumption and requires that new energy should be used as far as possible, and the strategies of carbon emission reduction, carbon fixation, carbon sequestration and carbon utilization should be implemented[7]. The influence of the implementation of these strategies on the development of existing agriculture is as follows: firstly, increasing the cost of production process in agriculture; secondly, requiring the establishment of efficient popularization routes to low-carbon agricultural technology; thirdly, requiring the economic entity to participate in the process of carbon utilization.

From the literature study, it is shown that the cluster development of agricultural products has its possibility, while the low-carbonization of agriculture is the current requirements. The low-carbon development of agricultural product cluster is the inevitable requirement for complying with low-carbon economic development, the new channel for incorporating into the international carbon trading market and increasing the farmers' income actively and the only way for the sustainable development of agriculture[8]. However, under the current condition of scattered production in the farmer households of China, it is difficult to promote the popularization of low-carbon agricultural mode, which must be realized through establishing the feasible mechanism by means of the effective organization form of farmer household.

2 Operation mechanism of farmers' professional cooperatives suitable for cluster development of low-carbon agricultural products

Low-carbon agriculture includes low-carbon cultivation and aquaculture, processing, circulation and marketing, while cluster development is an important method to solve problem of high cost and also an effective approach to reducing cost through expanding the scale. In this course, it requires effective participation of farmers' professional cooperatives, introduction of concept, technology, method and processing and marketing channels of low-carbon production, to ensure popularization of low-carbon planting model and realization of extension of industrial chain.

2.1 Characteristic analysis of farmers' professional cooperatives suitable for cluster development of low-carbon agricultural products Cluster development of low-carbon agricultural products is an effective act of low carbonization of agriculture. For agricultural production and processing with low pollution, low pesticide and low fertilizer, it not only requires introduction of new technology, new method, but also needs new concept. However, farmers are slow in accepting new ideas, especially like evading risks. They will not take initiative in choosing new technologies and methods, so it requires demonstration of some organization. Farmers' professional cooperatives select farmers that produce same kind of products as major objects. No matter communication or authoritative demonstration, these cooperatives will have better effect than leading by government or company. However, they must carry out relevant activities according to existing farmer, countryside and agricultural characteristics.

2.1.1 Starting the farmer communication model with individual accounting for higher proportion of means of production. Implementation of household contract responsibility system greatly increases farmers' proportion of private property, leading to obvi-

ous of individual decision-making actions. In the beginning of reform and opening up, single market demand determines validity of farmers' independent decision making. Along with increase of residents' income and influence of transnational culture, individualization and regionalization of market demand become more and more obvious. Decisions of single farmer household are hard to suit situations of market demand. In the survey, we find that planting blindly leads to difficult sales, and self-contained attitude lacks improvement awareness after basic living needs are satisfied. Such situation proves that it is necessary to carry out centralized learning and education. Education and training responsibilities after expansion of organization and management scopes of villages and towns should be redistributed according to types of agricultural products. Production of the same type product determines common communication basis, and farmers' professional cooperatives are just organized as per production of the same type product. Although farmers' self-decision awareness is strong, once market risks are aggravated, the psychology of following the crowd will make them become interested in reducing organization forms of risks, so as to bring into play education function of farmers' professional cooperatives[9]. It is required to enrich farmers' leisure activities, transmit effective information, and change decision-making model of farmers' separate information evaluation according to arrangement of farmers' free time from concept and technology to production and sales.

2.1.2 Improving farmers' quality and changing farmers' petty producer nature. Survey data in 2007 indicates that about 80% farmers in China have education level lower than junior middle school. Although farmers' quality in coastal provinces is rising, this situation is not significant in hinterland[10]. Of course, along with popularization of television, convenience of communication and extension of network, channels of farmers' receiving information and education are greatly enriched. Nevertheless, under influence of historic factors, it is hard to completely change farmers' nature of petty producer, and their "Economist" action is obvious, their judgment and selection of benefits often start from personal interests and lack overall awareness. Introduction of low-carbon economy is faced with difficulties in all levels. In rural areas, the task is arduous. Modern agriculture teaches farmers using pesticide, insecticide and fertilizer to increase output, and using agricultural machinery to reduce manpower, so advantages of high-carbon agricultural is obvious. To change such mode, farmers are unwilling to accept. Therefore, it is required to apply existing information transmission channels, create and develop new channel, such as playing science film in rural areas, propagating low-carbon agriculture, and weakening farmers' pursuit of profits through improving their quality. Truly, it is required to actively create economic value of low-carbon agriculture and bring benefits to farmers in the development of low-carbon agriculture.

2.1.3 Raising commodity rate of low-carbon agricultural products and leading farmers to common prosperity. At present, marketization level in China is high, but commodity rate of agricultural products is low, self-sufficient thought makes farmers firstly consider their living needs when making decisions on production, so it lacks exchange to obtain better benefits. This is partly because of farmers' thinking set, and partly because of limited economic benefits brought by commoditization of agricultural products. Consequently, it is impossible for farmers to make correct decision. Farmers' professional cooperatives promote development of low-carbon agriculture. Firstly, it is required to raise commodity rate of agricultural products and create higher value through transaction. Secondly, we should satisfy farmers' clothing, food, lodging and transportation needs through building effective supply channel, for example, actively developing rural supermarkets. Finally, it is proposed to properly distribute farmers' time resource, land resources and human resources, and create multi-channel to obtain income through job opportunities brought by cluster development of agricultural products (Fig.1).

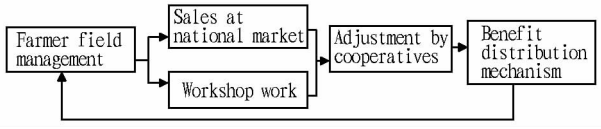

Fig.1 Schematic diagram for adjustment of farmers' time, land and labor forces by cooperatives

2.1.4 Promoting cluster development of low-carbon agricultural products through extension of industrial chain. The key element that attracts farmers is the benefit. Cluster development of agricultural products is an effective way to form benefit chain. Fresh, perishable and seasonable features of agricultural products determine small scale of its development. It is required to have the aid of extension of industrial chain. Besides, build of industrial chain can speed up cluster development, and finally forming more powerful capacity of building benefit chain. Yet, source and start point of industrial chain remain in primary production section of agricultural products. Farmers' professional cooperatives have obligation and ability to participate in extension of industrial chain. Through active propaganda, popularization, research and processing technology, exploring products with high added value, it is able to extend industrial chain and rapidly form the cluster development mode.

2.2 Build effective operation mechanism for farmers' professional cooperatives to promote cluster development of low-carbon agricultural products As an effective development carrier of low-carbon agricultural product, farmers' professional cooperative is favorable to rapid build and popularization of cluster development of low-carbon agricultural products. However, due to phase of agricultural development and difference in farmers' professional cooperatives, there are always some restraint factors during operation. It is required to build effective operation mechanism to speed up cluster development of agricultural products.

2.2.1 Expanding coverage of farmers' professional cooperatives at grass-roots level to build effective benefit distribution mechanism. In areas where cooperatives develop well, problems appear, including centralized stock right, cooperative entry threshold artificially set, buying out to obtain profit, and

leading enterprises making money with the aid of others. These indicate that there are still many imperfections during operation of farmers' professional cooperatives. In line with farmers' characteristics and cluster development of low-carbon agricultural products, we should build cooperatives with farmers at production source as subjects, expand farmer coverage of farmers' professional cooperatives, and change the situation in some areas where leading enterprises of agricultural product processing are leaders of farmers' professional cooperatives. As necessary, we should determine boundary of building farmers' professional cooperatives with land blocks or regionality of cultivation, raise discourse right of farmers at grass-roots level, extend industrial chain through the model of "planting and cultivation cooperatives + production cooperatives + sales cooperatives + research institutions", build interdependent low-carbon agricultural product cluster system, and guide formation of benefit distribution mechanism with symbiosis pattern of ecological system.

2.2.2 Performing education and training functions of low-carbon economy to build effective training mechanism. Farmers' professional cooperatives have congenital function of education. Since promoters are generally experts of agricultural product planting and cultivation, their authority and appealing power are irreplaceable. It is required to provide training for leaders of farmers' professional cooperatives, analyze and propagate advantages and benefits of low-carbon agriculture, set up farmers' awareness of low-carbon agriculture and low cost of cluster development, build Pyramid type training model (Fig.2), disseminate prospects and profits of low-carbon agricultural development, to raise farmers' awareness.

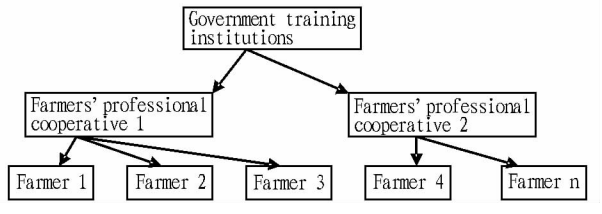

Fig.2 Pyramid type of low-economy training

2.2.3 Building low-carbon industrial chain to set up low-carbon value formation mechanism. Development of low-carbon agriculture is not a problem to be solved by only a section, and its benefit depends on industrial chain or interaction of a system. Therefore, farmers' professional cooperative must actively influence downstream production enterprises, carry out deep processing as per low-carbon requirement, and change production mode of enterprises at industrial chain in the development mode of low-carbon industrial chain, to jointly build low-carbon value. It is required to create value in production and marketing stages of products through "less pesticide, less fertilizer and low pollution"; in deep processing section, it is proposed to improve production section and optimize production process as per requirement of "low emission, low pollution and low energy consumption", to ensure sections of industrial chain extension to low-carbon and form low-carbon value of processing section; for sales section, it is required to seek ways to realize low-carbon value.

2.2.4 Labeling products of different sections and building low-carbon agricultural product identification system. Planting, cultivation and deep processing of low-carbon products need new technology and process support, so costs for low-carbon agriculture are higher than traditional agriculture. If there is no identification channel of low-carbon agricultural products, it will give a heavy blow to suppliers of low-carbon agricultural products. Therefore, agricultural product professional cooperatives should actively call upon and take the lead in preparing low-carbon standard of agricultural products. It is required to build low-carbon identification system through proper packaging of agricultural products; guide consumers to cognize in certain form, to speed up popularization of low-carbon agricultural products; in the beginning of popularization, it requires assistance of government and active guidance with the aid of government purchase.

2.2.5 Intervention in low-carbon sales section to realize and distribute low-carbon value. Farmers' professional cooperatives can intervene in production, sales, and processing sections of agricultural products. On the basis of their organization entity, they can cooperate and negotiate with other organizations[11]. Costs for planting and cultivation of agricultural products are relatively high in short term. If there is no proper compensation mechanism, farmers will lose enthusiasm or even quit. Farmers' professional cooperatives must actively participate in value adding and distribution of value chain, and distribute low-carbon value created in these sections through agricultural product pricing. If subjects of value chain fail to reach an agreement, farmers' professional cooperatives should have the ability of intervening in sales section and leading farmers in realizing value of low-carbon agricultural product planting and cultivation.

3 Suggestions for cluster development of low-carbon agricultural products

Farmers' professional cooperatives are effective economic organizations of promoting development of low-carbon agriculture. However, due to ingrained bad habits of farmers and field of vision of operators, these cooperatives are deficient in information processing ability, negotiation ability and appeal in the beginning of preparation period, and it needs guidance and support of government and society.

3.1 Guidance and effective encouragement of government Low-carbon agriculture is extension of low-carbon economy in agriculture. It needs changing means of agricultural production, developing biological energy, reducing emission of greenhouse gas, and ensuring stable high yield of crops, and not increasing pressure on global warming[11]. Cluster of low-carbon agricultural products is an effective way to realize low-carbon agriculture. This process requires changing farmers' production habit of high-carbon development. Only government propaganda is not enough, government at all levels should also play demonstration role through farmers' professional cooperatives. Therefore, government should energetically support and actively encourage farmers' professional cooperatives, bring into full play their education and training functions, turn direct

propaganda of government into supporting propaganda of farmers' professional cooperatives aided with policy support and preferential tax, to guide farmers' professional cooperatives to actively change agricultural production means and realize energy conservation and carbon reduction targets.

3.2 Social identity and active cooperation Cluster development of low-carbon agricultural products is self requirement of agricultural development and also important measure to respond to low-carbon economy, so there shall be favorable environment of social identity. If the society is unwilling to select low-carbon agricultural products, value of low-carbon agricultural products will not be realized, and front end production will be influenced. Social media and public opinion should have appropriate approaches to propagate low-carbon agricultural products, encourage consumers to select low-carbon agricultural products, and keep circulation of low-carbon agricultural products smooth, to realize reproduction cycle of low-carbon agricultural products. Generally, it is expected to encourage relevant subjects to actively develop cluster of low-carbon agricultural products through social identity.

3.3 Incorporation into global low-carbon development system to share benefits of low-carbon development Development of low-carbon economy has become a global issue. Developed countries have set up various non-government organizations and foundations to promote development of low-carbon economy. Cluster development of low-carbon agricultural products should be incorporated into global low-carbon development system. It also should provide farmers' professional cooperatives with necessary development support and energetically develop low-carbon agricultural products, to benefit such subjects of agricultural product supply as farmers' professional cooperatives sharing achievements of low-carbon development.

4 Conclusions

Agricultural products have innate advantages of cluster development. Cluster development of low-carbon agricultural products is not only internal requirement of agricultural development, but also inevitable requirement of low-carbon economic development. Decentralized production of farmers is hard to promote cluster development of low-carbon agricultural products. Farmers' professional cooperatives take the same kinds of agricultural products as objects on " non-governmental, civil management and voluntary" principles, and will play active role in raising commodity rate, improving farmers' self-decision efficiency, and extending industrial chain. Thus, farmers' professional cooperative is an effective organization form suitable for cluster development of low-carbon agricultural products. In combination with features of agricultural production and present agricultural economic organization ways in China, we should take full advantages of possibility of agricultural product cluster, to promote low-carbon development of agriculture through benefit advantages and low-carbon advantages of cluster development of low-carbon agricultural products. However, there are problems of centralized stock right, cooperative entry threshold artificially set, buying out to obtain profit, and leading enterprises making money with the aid of others[12]. It is required to expand coverage of these cooperatives at grass-roots level, bring into play education and training functions of farmers' professional cooperatives through supervision and guidance of government, build low-carbon value chain to create low-carbon value, participate in preparing standard for low-carbon agricultural products and set up value identification system for low-carbon agricultural products, and directly participate in sales to realize low-carbon value of agricultural products as necessary. What's more, only through constantly forming development motivation of farmers' professional cooperatives and raising disclosure right and benefit distribution right in extension of industrial chain, may we effectively promote formation and development of low-carbon agricultural product cluster.

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