

AGRICULTURAL DEVELOPMENT BASED ON APPLICATION OF BIOLOGICAL HIGH TECHS IN CHINA AND LESSONS AND SUGGESTIONS FOR VIETNAM

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Abstract:

During more than two decades of application of policies for bio-technological development, China has used and exploited successfully achievements of high techs in this new scientific field and China has become one of the leading countries in fields of development of bio-technologies. These achievements are fruits of policies applied by the Chinese Government for development of high techs based agriculture including the improvement of research system as well as institutional mechanisms to encourage the development of bio-technologies for commercialization ends. It is possible to see the development policies for high techs based agriculture in China is close to the one which are being formed and developed in Vietnam. Experience in organization, administration and coordination between ministries/branches as well as involvement of enterprises in China are good lessons for forming, propagating and developing bio-technologies in Vietnam in the coming time.

Keywords: *High techs based agriculture; Bio-technologies; Policies for bio-technological development.*

1. Introduction

During the early reform periods (1979 - 1984), Chinese agricultural production was extended and gained impressive achievements for productivity and crop volume. The important factors deciding the success of Chinese agriculture came from institutional changes, extensive investment and application of intensive cultivation and S&T progresses [6]. Since 1984, however, the annual growth rate of China lowered to 3 - 4% in comparison to 7% of the previous years. The slow-down of agricultural growth of China in general or the one of crop plants in particular showed that the Chinese agriculture would face huge challenges if still being based on traditional technologies and available resources such as cultivating lands and low labor to meet domestic increasing demands of foods. The application of bio-technologies was considered as one of the main solutions defined by the Chinese Government to develop a modern agriculture.

The objectives of bio-technological development were well-indicated in numerous policies for agricultural development of China. Starting from concepts of applied research, China had defined the objectives of bio-

technological development for food security, sustainable agricultural development, increased incomes for farmers, reduced use of insecticides, environment protection, human health and higher prices of Chinese agricultural products on international markets [1, 2]. A global view of Chinese objectives of bio-technological development shows that China is realizing the objectives of agricultural modernization and upgrading of bio-technological R&D system to international standards.

In order to achieve the above objectives, the Chinese Government implemented development programs of high techs based agriculture in bio-technological sector including reforms of research system, institutional changes and incentive mechanisms for bio-technological development for commercialization ends [2]. Investment budgets of China in field of bio-technologies for plants and animals has doubled for every 3-4 years during the last decade [8]. Through programs of application of bio-technologies for agriculture development, the cultivation area of bio-technologies based plants in China comes up to 3.9 million hectares by 2011 which made China the 6-th ranked position in the world in this field [5].

Because of similar geographical conditions, socio-economic particularities and production practice between China and Vietnam, the experiences of about 30 years of agricultural development based on high techs of China surely would be useful for Vietnam.

2. Roles of the Chinese Government in agricultural development based on high techs

Financial sources for agricultural research and development organizations and individuals mainly were provided by the Chinese Government. Private financial sources for research were minor. Strategies for bio-technological development, key research programs and policies for bio security administration were set up by line ministries such as Ministry of Agriculture (MOA), Ministry of Science-Technology (MOST), National Development and Reform Committee (NDRC), Ministry of Health (MOH) and some other concerned ministries. MOA takes the overall hosting responsibilities and coordinates with other ministries to set up strategies for bio-technological R&D programs, to define research programs and topics and objectives of research projects, and concrete administration works for every stage. When research institutes finished their research for genetically modified (GM) varieties the National Bio Safety Committee (NBC) of MOA would issue license for field tests. Finally, NBC provided environment safety certificates and then permission for mass production. MOH is competent to provide food safety certificates.

At national level, Ministry of Agriculture, Chinese Academy of Sciences (CAS) and Ministry of Education (MOE) are mainly in charge for agricultural bio-technological R&D activities. Under management of MOA there are three large research institutes which are Chinese Academy of Agricultural Sciences (CAAS), Chinese Academy of Tropical Agriculture (CATA) and Chinese Aquatic-Fishing Institute (CAFi). CAAS has 37 member research institutes of which 12 research institutes, 2 key laboratories and 5 ministerial laboratories carry out research programs for application of bio-technologies in agricultural production. CAFi and CATA also set up their laboratories and research programs for bio-technological research where every research institutes has one key laboratory.

In addition, some non-MOA research institutes have their own bio-technological research programs for agricultural development. Among them 7 research institutes and 4 national key laboratories are from the Chinese Academy of Sciences, some research institutes are from Chinese Academy of Forestry (CAFo) and some universities of MOE. In 2001 there were 7 national key laboratories, which were built up in 7 leading universities of China, for agricultural bio-technological research and other agricultural problems related to fundamental research in bio-technological fields.

At provincial level there are also R&D programs for agricultural bio-technologies and they were implemented similarly to the ones of national level. Accordingly, every province has an agricultural science institute and, at least, an agricultural university. Every agricultural science institute and agricultural university has 1 or 2 research institutes or laboratories for agricultural bio-technologies. Financial funds for research activities of local research institutes and universities are provided from local sources (key research and investment projects) or State budgets (research projects) [7].

3. Roles of enterprises in high tech agricultural development in China

A series of research facilities in field of application of bio-technologies for agricultural development were set up by the Chinese Government. The cooperation between State owned research institutes and enterprises contributes to push up high tech agricultural development for commodity production. For example, Bio-technology Institute cooperates with Pioneer Company for research of NM maize, Ricetech cooperates with Research Center of Crossed Rices for research of GM rice, Delta and Pineland cooperate with CAAS for research of bio safety management for Bt-cotton, Monsanto cooperates with Syngenta for GM varieties of plants.

In fact enterprises contribute an important role for market objectives and commercialization of important plants of China where there are three notable sectors. *First*, seed producing industries have implemented commercial

liberation of seed production which was based on market reforms of seed production sector since 1990. Seed producing companies have their own integrated production system in provincial and district level. Gaps between research and practical production get shortened thanks to results of cooperation between research institutes and seed producing companies or to enhanced research capacities of seed producing companies.

Second, links between research institutes and markets have passed changes. Some research institutes and even some individual researchers set up research-production companies to commercialize of high tech applied products. In this type of companies, science-technical human resources come from scientists which are working in research institutes. However, these companies operate on basis of market demands. Actually some companies developed and participate in securities markets. For example, BWK (<http://www.bwkcrop.com>) was set up through cooperation between Beijing University and Institute of Development Biology and Genetics of CAS, Bio-technology Institute of CAS and Beijing Agriculture-Forestry Institute. The above said cooperation form between universities and research institutes was approved by MOST and actually BWK is considered as national center for molecular biology of plants in China [3].

Third, public-private partnership (PPP) activities are increasingly extended in field of bio-technologies. The typical example is the case of Monsanto which developed PPP links in field of GM seed production in China. Monsanto together with Delta and Pineland starts their activities in Ha Bac Province since 1997 and then developed a JV company with a seed producing company of the province known as Jidai JV Company. Similar JV companies were developed with seed producing companies of An Hui and Son Dong Provinces.

4. Organization and management of high tech agricultural development in China

Various ministries such as MOA, MOST, NDRC, MOE and other concerned ministries are assigned of duties to set up research strategies, research orientations and to decide research budgets. The same structure is implemented at provincial level where provincial Departments of Science-Technology are in charge of global management of S&T programs of provinces.

At national level, a council of experts from MOA and MOST sets up R&D plans for agricultural bio-technologies for middle-term plans (5 years) and long-term plans. Plans include the set up of R&D and regulations for implementation of laws and policies. MOA is in charge of guiding, coordinating and assessing R&D plans and large State invested projects (MOST used to be charge of them). Ministry of Environment Protection (MEP) is in charge of negotiating and implementing Bio Safety Protocol China had

ratified in 2005. MOST and NDRC set up 4 large programs for development of bio-technologies and high techs including “863 Plan”, “973 Plan”, “Special Funds for GM plants” and “Key Science-Technology Programs”. “863 Plan” is the development plan of high techs which was set up since 1986 to give financial supports to applied research and fundamental research to develop high techs in China including bio-technologies as one of the 7 priority technological sectors.

National Key Science-Technology Program is a large program initiated since 1990. This program was put under hosting management of MOST and NDRC to enhance equipment and infrastructure investment for development of high techs. Similarly to “863 Plan”, “973 Plan” was initiated since 1997 and implemented since 1998 to support fundamental scientific research (life sciences and bio-technologies are priorities for supports from this program).

In China, NDRC is in charge to approve budgets of various terms: annual, five years and long-term allocated for ministries. NDRC assigns Ministry of Finance (MOF) to allocate funds to ministries and CAS. NDRC has Department of High Techs (DHI) which is in charge also for bio-technologies. DHI has various services in charge of concrete fields of high techs. Agricultural Service, particularly its Division of Agricultural Bio-technologies, together with MOST, controls Key Science-Technology Programs (KSTP) including a large program for agricultural bio-technologies. In 2001, NDRC set up Service of Industrialization to push up commercialization and to extend applications of agricultural bio-technologies in and out of agricultural fields through a large program entitled “High Techs Applied Industrialization Program”.

MOA with its Science-Technology Department and Education Department are in charge to control bio-technological programs in research systems of the Ministry and to coordinate R&D programs at national and local level. Research activities of research non-MOA controlled institutes, as rules, are independent from R&D activities of MOA. Also, the control by MOA of research activities of provincial research institutes, in practice, is limited.

Before, MOA gets involved into research programs of agricultural bio-technologies through processes of setting up of frameworks for master plans for research and development of bio-technologies (e.g. five year plans, long-term plans and R&D laws) and implementation of policies for bio-technologies. However, MOST is directly in charge of the total activities in field of bio-technologies. There was the only fund for agricultural science training which was set up in 1990 was under management of MOA but the fund volume was very minor compared to the ones controlled by MOST and NDRC. Similarly to Vietnam, in China there were disputes about who, MOA or MOST, is most suitable to control agricultural research programs in general

and agricultural bio-technologies in particular. However, actually MOA was chosen to be in charge of management of research programs.

On basis of guidelines by NDRC, MOST and MOA, development plans of provinces and consultancies of other functional institutions, Provincial Departments of Science-Technology set up a global strategy for research and development of bio-technologies through five year plans and long-term plans and decision of provincial budget allocations for research units. Provincial Departments of Science-Technology are also competent to issue guidelines, management and assessment of effectiveness of R&D plans, projects and use of funds at local level.

2010 year was the final year of implementation of “the XI-th Five year plan of development of bio-technologies” of China. Though China had developed successfully GM cotton plants (70% of cotton cultivating land of China) [9], other plants are not fully commercialized. China does not yet export high techs applied plants abroad. China does not have large companies in field of bio-technologies. Almost all activities of research and development of bio-technologies remain within research institutes/universities [4]. Actually China prepares a draft of “the XII-th Five year plan of development of bio-technologies” with the some focused priorities, namely focused technological transfer from research institutes/universities to leading bio-technological companies, financial supports for setting up bio-technological companies and incentive measures for foreign or private investment to set up research institutes and joint research programs, establishment of Government level transaction systems to support local products applied with bio-technologies, 50 % reduction of taxes for bio-technology applied R&D activities at all the administrative levels, 15% reduction of income tax for bio-technological companies listed as high techs based companies.

5. Conclusion

During about 39 years of implementing policies for development of bio-technologies China has maximized the effective application of achievement of high techs in this new fields of sciences and then become one of the world’s leading nations in this field. Experiences from this development process in China show that, in order to secure the effectiveness and to mitigate risks in applying science-technology achievements in practical production, it is necessary, first, to set up a unified organizational mechanism from central level to local level. At central level, NDRC, MOA and MOST were assigned to host and to coordinate activities with concerned ministries to set up research and development strategies for bio-technologies, to identify research programs, to approve and to assess research results. Similarly, for provincial level, the works

are assigned to Provincial Planning and Development Committee and Provincial Department of Science-Technology.

Procedures to set up development policies for bio-technologies need to provide participation chances to many groups of actors including scientists, government agencies, multinational companies, food processing enterprises, trading organizations, farmer organizations, consumers and NGOs. In this case, the issued policies would fit the context of the country and international regulations.

The implementation of socialization of R&D activities for high techs in field of bio-technologies can be conducted through incentive mechanisms which would let research institutes and researchers set up companies for direct application of bio-technologies in production process and then shorten the gaps between research and practice. It is necessary also to push up the diversified development of PPP forms, e.g. setting up of JV companies including FDI enterprises, for application of high techs in field of bio-technologies. They would contribute important part to realize the market objectives and commercialization of high techs applied products.

It is also possible to note that high techs agricultural development policies in China are close to the ones actually applied for the field of bio-technologies which are being formed and developed in Vietnam. Experiences in organization, management and coordination between ministries/branches as well as the involvement of enterprises are good lessons for forming, propagating and developing bio-technologies in close future.

High techs agricultural development in general and development of bio-technologies in particular were implemented in China and the process is highly diversified. Lessons of success and limitation taken from this process of China are precious for setting up policies and mechanisms to push up the high techs agricultural development in effective manner in Vietnam./.

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