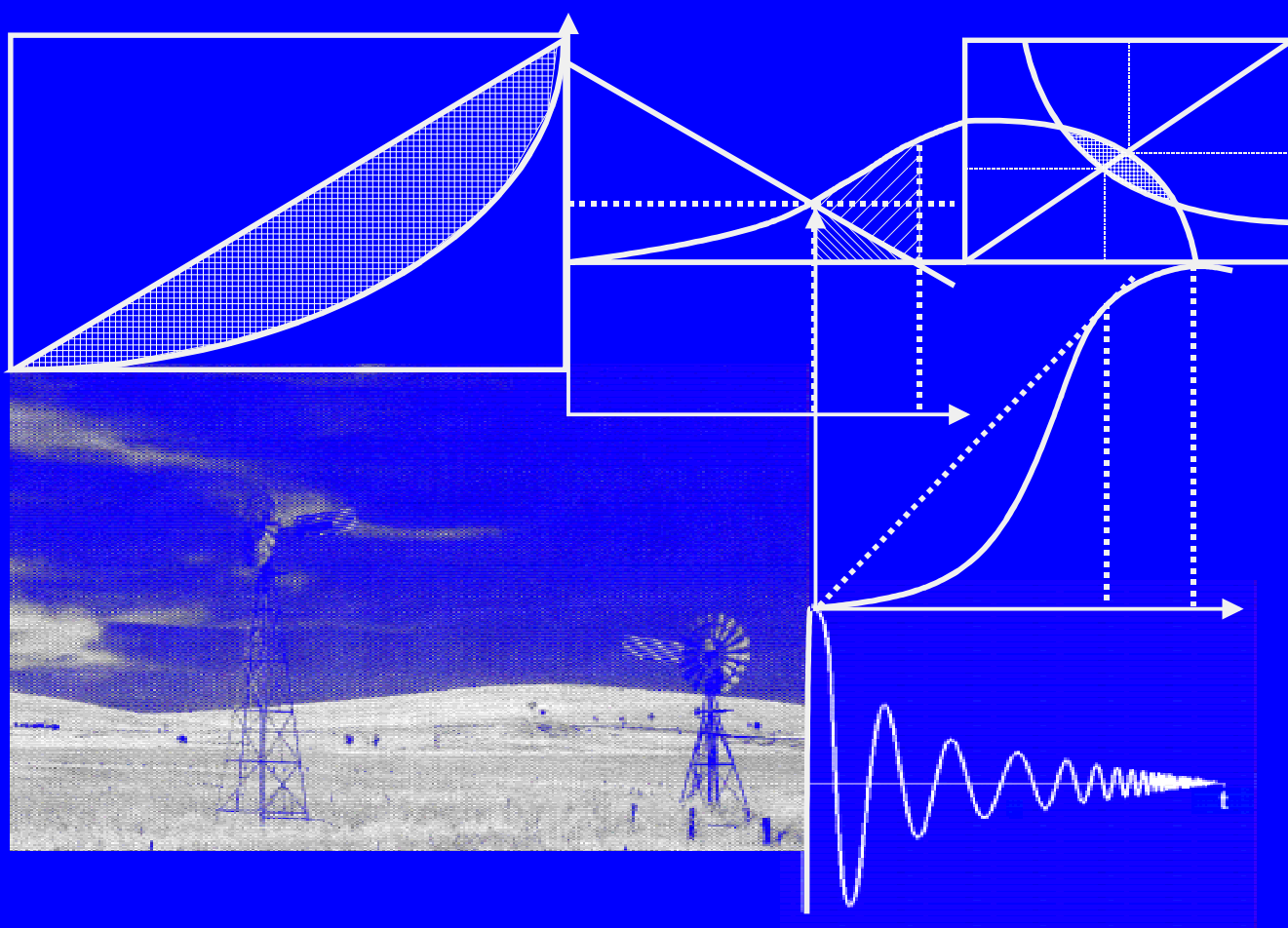


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School of Natural and Rural Systems Management
University of Queensland
St. Lucia 4072 Australia

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Li Suoping Zhang Cungen

Institute of Agricultural Economics, Chinese Academy of Agricultural Sciences

Guo Tingshuang

Department of Livestock Production and Health, Ministry of Agriculture

Scott Waldron

School of Natural and Rural Systems Management

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ABSTRACT

China is a large country with a huge population. How to feed and dress such 22 percent of the world's population by cultivating 7 percent of the global arable land has always been the major concern of the Chinese government. For this reason, China began to reform its agricultural sector in the late 1970's and early 1980's. And much achievements have been made ever since. One of which is the fast growing of livestock production, especially of meat production. Among all meats produced in China, the rate of beef production was the highest. There are, though, many factors contributing to this rapid expansion of Chinese beef and cattle industry, the implementation of “Straw for Ruminants” project is regarded as the most important one and the turning point of the industry development.

The proposal of this project was originally proposed by 14 livestock experts and government officials in 1990. In view of the importance of this project in developing livestock industry and saving grain, it was accepted and put into practice by the central government soon in 1992. Up to the present moment this project has covered 268 counties in 29 provinces, autonomous regions and municipalities, of which 212 are beef cattle project counties and 56 sheep and goat project counties. The total investment made by the state government alone amounted to 253 million yuan. The number of project counties, though, accounts for only about 6 percent of the total counties of the country, the beef produced by these project counties accounts for 32 percent of the national total. With the effective extension of the “Straw for Ruminants” project, historic change in beef production pattern has taken place and vast agricultural area has become the major base in beef production in place of pastoral area. According to FAO, out of the approximately 30 countries FAO has advised, achievements have been most outstanding in China and China is the leading country considering either the number of farmers that apply the technique or the quantity of roughage treated.

Considering the huge straw resources remained to be developed, the “Straw for Ruminants” project will certainly be carried out towards the next century.

China is a large country with a huge population. How to feed and dress such 22 percent of the world's population by cultivating 7 percent of the global arable land has always been the major concern of the Chinese government. For this reason, China began to reform its agricultural sector in the late 1970's and early 1980's. And much achievements have been made ever since. One of which

is the fast growing of livestock production, especially of meat production. In 1996, China produced 27.3 percent of world's total meat, increased from 12.8 million ton in 1980 to 59.2 million ton in 1996, an increase of over three times. Among all meats produced in China, the rate of beef production was the highest, making China the third largest beef producing country on the world only next to the U.S.A. and Brazil. Although there are many factors contributing to this rapid expansion of Chinese beef and cattle industry, the implementation of "Straw for Ruminants" project is regarded as the most important one and the turning point of the industry development. Statistics shows that only in a short time after the implementation of this project, China not only doubled its beef output from 1.5 million ton in 1991 to 4.1 million ton in 1995 and further to 4.9 million ton in 1996, but also increased its annual rate of beef production from 9.9 percent before the implementation of the project to 27 percent afterwards. So in order to get a better understanding of the Chinese beef and cattle industry, it's necessary for us to have a deep look into this project of "Straw for Ruminants".

Background and the Origin of the Project

The proposal of this project was originally submitted to the central government by 14 livestock experts and government officials in 1990. Its primary objective was to resolve the feed problem facing by the rapid expansion of livestock production and reduce the pressure of feed on grain production in China.

Grain is a special commodity of utmost importance for nation's stabilization in China. So Chinese government has always attached much importance to grain production since the founding of New China. With the introduction of household responsibility system in 1978 China's grain output increased by a great margin in the early days of the reform. Between 1978 and 1984 grain output increased by, on an average, 17 million ton each year. But between 1985 and 1994 this number decreased to only 3.8 million ton, a drop of 78 percent of the increase amount. In the meantime, feed consumption kept growing in the past years due to the rapid expansion of livestock production. In 1997, livestock industry in China consumed over one hundred million ton of grain, accounting for about 25 percent of the total grain output. It is estimated that the proportion of feed in total grain output has been increasing by one percentage point each year. In recent years, the per capita grain output stood at 370 to 390 kg and per capita grain consumption at 230 kg. This means that the per capita consumption of grain can be ensured provided there is no severe fluctuation in grain production. The problem is that feed demand can not be guaranteed. So in this sense the crux of the present grain issue is actually a matter of feed issue. Speaking the other way round, if we can find a way out for feed we also find the solution for grain. With the improvement of people's living standard China's per capita meat consumption has been increasing by, on an average, 2 kg while grain consumption decreased by 3 kg each year. This reduction in annual per capita grain consumption would save 3.6 million ton of grain a year, which is enough to meet the demand by newly added 15 million population. The annual per capita grain consumption in China is above that of the world average (170) and much higher than that of the developed countries (130 kg). Based on this fact the per capita grain consumption will continue to decline in the coming 2 or 3 decades. Although population keeps growing every year the total grain consumption volume (about 280 million ton) would not likely to increase. So from the point of view of the development in the future the grain issue is also a matter of feed issue.

How to solve this feed issue? Focused on this subject domestic experts have made strenuous

efforts in the past years. And the fairly unanimous conclusion is to lessen the dependence of livestock production on grain and establish a new grain-saving livestock structure. This conclusion is well supported by international experience in countries like India. India is a country short of grain. The per capita grain output is slightly over 200 kg. But India need not import grain on the whole. Its reason lies in that India has established a grain-saving livestock structure. India's pig population is only 10 million head and chicken a mere 200 million, which are only one thirty-fifth and one eleventh those of China respectively. On the contrary India keeps large quantity of herbivorous animals. Its cattle number was three times that of China and milk output twelve times that of China. Grain consumption by livestock production in India, therefore, is much less than that of China, accounting for only 2 percent of its total grain output.

China now is the world's largest pig raising country and pig number accounts for about 40 percent of the world's total. So in their proposal experts suggest that China control the pork production and encourage the production of herbivorous animals.

Traditionally, herbivorous animals were mainly raised in grassland areas of Inner Mongolia, Xinjiang, Qinghai and Tibet. But because of excessive reclamation and overstocking in the past decades those grassland in north China was severely degraded. According a typical investigation grass output there decreased by 30%--50% compared with that in 1950s while stock number increased by two times. So it's impossible to increase animals on those over-burdened and degraded grassland any more unless huge investment being made. This reality made people think over the other possibilities for livestock production -- to develop non-conventional feed. After years of investigation and discussion crop residues was finally selected as major feed resources to be tapped for three reasons: large in quantity, wide in distribution and some utilization experience already obtained.

Technical Base of the Project

China is a large agricultural and grain producing country. She produces nearly 500 million ton of grain every year and nearly 600 million ton of crop residues at the same time (see table 1). This much of crop residues produced by cropping area is almost as large as 50 times the output of cutting hay by grassland area in northern China. Besides there are also abundant agricultural by-products such as cottonseed cake, rape cake, brewery wastes and bran which can be used as a cheaper feed. So in their proposal experts suggested that top priority for developing herbivorous animals in China be given to the cropping area with crop residues as the main source of feed.

Crop residues is abundantly available in many parts of China and has been used to feed ruminants by farmers for a long history. Of those 570 million ton of crop residues in 1992 about one fourth were used as feed. But they were never treated usually. What farmers did was only to cut them into short pieces. Crop residues is a feed of inferior quality with low nutritive value. This simple way of cutting treatment, though, helps improve the feed intake, palatability and reduce the waste, there is no any help for the improvement of digestibility and the nutritive value. Feeding ruminants with untreated crop residues alone can even hardly meets their maintenance requirement and is, therefore, uneconomical since it had to be supplemented with concentrates in large quantities to achieve sufficient growth rate. So the prerequisite for large scale use of crop residues as feed is to find a way to improve their nutritive value and digestibility.

In order to achieve this goal scientists and experts at home and abroad have made unremitting efforts for the last century to study the way of treatment. The way they found, though very complicated, may be summed up as coming under three categories: physical treatment, biological treatment and chemical treatment. In particular, treatment of straw with ammonia appeared to offer a possibility to achieve great intake of straw and thus to decrease the amount of concentrate required by the ruminants.

Treatment of straw with ammonia was first conducted by Germans in 1933 and many scientists from various countries have been engaging in the improvement of this technology in the past half century ever since. In 1938, Russians explored ways of treating straw with liquid ammonia. In 1950s, Denmark obtained a patent for its research on ammoniation technology. Since 1970s systematic researches and experiments have been carried out in many countries like Norway, Great Britain, Japan, the U.S.A, Canada, Tunis, Nigeria, Egypt, India and Bangladesh etc. in succession. Experiment shows that treatment of straw with ammonia can not only improve the palatability of the straw, but also increase the digestibility and feed intake by about 20 percent and coarse protein content by 1 to 2 times. The total nutritive value can be improved by over one times, reaching to 0.4 to 0.5 feed unit. Because of this ammoniation technology has been extended nationwide in some countries like Norway and attracts attention from more and more countries, especially those developing countries short of feed and grass resources.

To make full use of its crop residue resources China once spread the ensiling technology by the Ministry of Agriculture in 1950s. But because it coincides with the busy farming season and farmers have no time to attend to the matter, its application is limited to some extent. In the mid 1980s, funds was appropriated by the Ministry of Agriculture to support the research project on ammoniation and, at the same time, pilot and demonstration work was conducted in small scale and limited area. In 1987, FAO sent two experts to China for technical advice. Between 1988 and 1992 FAO and UNDP sponsored and funded a series of technical cooperation programs in China, such as "Utilization of Agricultural Residues in Animal Feeding in Hebei and Henan Provinces" and "Beef Production Systems Based on the Use of Crop Residues". During which many outstanding FAO experts and scholars came and worked in China and group of Chinese technicians and officials were sent abroad for training and study tour. By the time implementing the "Straw for Ruminants" project, about 40 thousand technicians were trained and 47 hundred of certificates were issued concerning the treatment of straw with ammoniation. Many local agricultural colleges and universities, institutions and extension departments had also made their own contributions to the research, demonstration and extension of straw treatment. All of this not only contributes to the popularization and perfection of ammoniation knowledge and beef production technology based on crop residues, but also lay a good technical foundation for later implementation of "Straw for Ruminants" project.

According to an experiment jointly conducted by FAO and the Ministry of Agriculture, by feeding cattle with urea-treated straw and a supplemented 0.5kg of concentrates a day the daily gain would reach 345g, over one times increase that of feeding untreated straw. The feed cost per kg liveweight gain would decrease by 29 percent. The consumption of concentrates for one kg liveweight gain was only 1.4 kg. And what they used for concentrates here were only cottonseed cake and wheat bran without any grain. This proves that it is not only feasible but profitable to raise cattle with urea-treated straw as their main feed, supplementing little concentrates without any grain.

Evolution Implementation of the project

In view of the importance of this project in developing livestock industry and saving grain, the proposal won the enthusiastic approval of the central government right after it was proposed. In 1992, Chen Junsheng, state councilor in charge of agricultural affairs within the central government at that time, made an on-the-spot investigation into the pilot and demonstration work in Henan province. In his investigation report he explained the far-reaching significance and the immediate feasibility of the project in developing livestock production with the utilization of crop residues in a systematic way. And his report was praised as “an exciting report” by premier Li Peng then, which marked the recognition of the “Straw for Ruminants” project by the central government. During the same year this project was put into effect on the initiative of Chen Junsheng. In order to give an impetus to the development of this project as soon as possible two nationwide meetings were held within 1992 alone, calling for local governments to pay much attention to the implementation of the “Straw for Ruminants” project and the full utilization of crop residue resources to develop livestock industry in cropping area. In the meantime, the State Council approved the document “Making Great Efforts to Develop Herbivorous Animals in Cropping Area by Using Crop Residues” drafted by the Ministry of Agriculture and sent this document to each province for their implementation. And ever since this project has been gaining momentum and Chinese beef and cattle industry has entered into a new stage of rapid expansion. In April 1994, the Third National Symposium on the Development of Livestock Production in Cropping Area was held by the State Council. At this meeting a strategic plan was worked out to make further efforts to strengthen Zhongyuan Beef Belt, develop Southern China Beef Belt and open up Northeast Beef Belt. Thanks to the joint efforts made by the central and local governments the “Straw for Ruminants” project now has gradually become a national campaign. Up to the present moment this project has covered 268 counties in 29 provinces, autonomous regions and municipalities, of which 212 are beef cattle project counties and 56 sheep and goat project counties. The total investment made by the state government alone amounted to 253 million yuan (see table 2). Furthermore 13 project prefectures were designated beginning from 1995 for the convenience of project management.

The name of this project was initially called “Animal Husbandry Based on Crop Residues” (or simply “Straw for Ruminants”) when it was proposed in 1990. But the name was changed to “Straw for Beef” when it was put into practice in 1992. As we know and envisaged by the initiators, crop residues can not only used to feed beef cattle but can also used to feed other ruminants like sheep and goats, buffalo, dairy cattle and deer. So in order to give full scope to the role of this project and make full use of the resources of crop residues experts suggested that the project be expanded to cover sheep and goats in 1992. In 1994, a decision was made at the Third National Symposium on the Development of Livestock Production in Cropping Area to set up project counties for sheep and goats by reference to the beef cattle model, and, therefore, funds was appropriated. At this time the name was changed to “Straw for Ruminants”. For the same reason the project scope was expanded further to cover buffalo in 1995. But to the present moment, the most successful one is cattle raising by the project. In 1996, the State Council approved the “National Development Outline of the Straw for Ruminants with Manure Returned to Soil Project between 1996 and 2000”. Here “Manure Returned Soil” was added at that time to stress the coordination of farming and animal husbandry and its positive impact on sustainable development of agriculture.

No matter what the project is called the “Straw for Ruminants” project, by now, has become a basic strategy of the state and the largest technical extension project implemented in agricultural sector.

Government Support and Funding

In one of the documents issued by FAO, it is said that the agricultural extension work in developing countries can not be expected to succeed at all without government support. And China is no exception concerning the extension of “Straw for Ruminants” project. Central government supports this project in the following ways:

- **capital input** For each county selected central government would provide, on an average, 1 million yuan, ranging from 0.6 million to 1.2 million yuan dependent on the size of the county selected. Of which 40 percent was a appropriate gratis and 60 percent was a compensable loan. For this part of the loan it would be repaid at the fourth and fifth years of the project period.
- **material input** The main material inputs by central government are urea and plastic film (polyethylene film) with favorable price. The highest amount of urea received within one year in the past reached 200 thousand ton. Now the project is still provided with 80 thousand standard ton of fertilizer and 140 thousand ton of polyethylene at fair price. The price of the project urea is usually lower than that on market by one second to one third. And the polyethylene imported is exempted from tariff and value-added tax.
- **loan granted for policy considerations** Little attention was paid to beef processing and marketing system at first. As the project moves ahead and the cattle industry expands investment is needed to upgrade the existing and backward slaughtering and processing facilities. So beginning from 1996 a loan of 100 million yuan has been granted to the project with low interest, which was provided through the Agricultural Development Bank at first and shifted to Agricultural Bank then.

As required by the state, the local governments, that is, the provincial governments must provided another at least same amount of supporting fund as the central government granted for each county selected in their region. The proportion of the fund is the same as that of the central government. The difference is that the other 60 percent was a interest-free loan before 1996. After that it was turned into a compensable loan and payment for the use of the funds was charged.

The project fund provided by the central government comes from the comprehensive agricultural development funds. So the use of this special fund is strictly controlled according to the management system of the comprehensive agricultural development funds and related rules and regulations. According to the system of funds management the project funds can only be used to develop crop residue resources and improve technical service system. The specific spending items are as follows: purchase of silage and ammoniation equipment such as cutting machines, liquid ammonia tanks and containers, vehicles for the transportation of liquid ammonia, ammonia applicators, gas mask and protective clothing; construction of storehouse for liquid ammonia tanks and containers and vehicles; necessary experimental and monitoring facilities for the use of crop residues; purchase of herd bull (stud ram) or artificial insemination equipment; conducting training courses, printing

technical extension materials and purchasing necessary training equipment; construction of pilot and demonstration cattle farms for scientific purpose, and so on.

According to the system of funds management, the project funds is not allowed to be used for any commercial purpose in principle. Because some of the investment needs to be paid back it is, as a matter of fact, allowed for the project county to run a few profit-oriented enterprises such as feed processing plant and feedlot in a limited way. But the total investment is not allowed to exceed 15 percent of project funds.

As for the breakdown of the investment, we take the fourth batch of 47 project counties accepted in 1998 as an example. In over 600 million yuan used by these 47 counties investment in straw treatment accounted for 20% of the total project funds. Investment in breed improvement accounted for 4.1%. Construction of pilot and demonstration cattle farms accounted for 16.9%. Technical training accounted for 1%. And other investment, including the purchase of cow and feeder cattle and the construction of cattle shed and markets, accounted for 58%.

Compared with the investment made by the state and provincial governments farmer are the main investors in “Straw for Ruminants” project and Chinese beef and cattle industry as well. According to the acceptance report for the first 10 project counties, the planned investment was 65.3 million yuan. But the actual investment reached 732 million yuan. Of which investment raised by farmers themselves accounted 75 percent, 27 times that invested by state and local governments.

In order to increase livestock production and especially beef production in their region many local governments at prefecture, county and township level have also drawn up their own favorable policies. Zhoukou prefecture in Henan province, for example, worked out ten favorable policies to help implement the project and handle affairs which they can not do with the state and provincial project funds. These policies include: a budget of one million yuan and 200 thousand yuan made by prefecture and county governments every year respectively to establish the livestock development fund, aiming to improve service system, develop cattle raising and give awards to advanced staffs; a special fund of 50 million yuan raised by prefectural Agricultural Bank for livestock production focused on beef production; income tax exemption for any company run by the Animal Husbandry Bureau to serve livestock production; and other incentive measures. Caoxian county in Shandong province promises that county government would allocate 600 thousand yuan to establish a yellow cattle development fund and that a special livestock production fund of 5 million yuan focused on cattle production would be raised by county Agricultural Bank every year. The other favorable policies stipulated the supply of 4 thousand ton of urea at fair price every year and the subsidies for straw treatment works such as 100 yuan for each NH₃ pit built and 300 yuan for each straw cutting machine purchased. Xifeng county in Liaoning province and Wanrong county in Shanxi province have also worked out their own ten preferential measures respectively.

Besides all the above mentioned funds resources there have been other channels of investment such as the “Spark Plan” and “Torch Program” initiated by the former State Commission of Science and Technology, “Bumper Harvest Program” and “Poverty Alleviation Project” by the Ministry of Agriculture and the investment for breed improvement by the Animal Husbandry Bureau. But the investment amount is very limited compared with that of the “Straw for Ruminants” project.

Application and Selection Procedures of the Project Counties

when the proposal of “Straw for Ruminants” was accepted by the central government in 1992 it was incorporated into the state comprehensive agricultural development project. So the affairs related to application and selection has been jointly administered by the Ministry of Agriculture and the State Comprehensive Agricultural Development Office under the State Council. Within the Ministry of Agriculture this work has been handled by the Feed Industry Division of the Animal husbandry Bureau.

As for the application procedure, every year in September the Animal Husbandry Bureau of MoA would dispatch a notice to the Animal Husbandry Bureau or Agricultural Bureau in the related provinces, autonomous regions and municipalities asking for the recommendation of project counties for the next year. In this notice the norm of the project counties has been set for each related provinces, regions and municipalities. The notice also stipulates the contents which should be filled by the local departments in their project proposal. These contents can be divided into two parts: basic situation of the county and the present situation of cattle raising. The basic information includes: population, agricultural output value, livestock output value, number of rural households, grain output, meat output, total straw output and the quantity of straw treated. The cattle raising information includes: year-ended cattle number, off take umber, off take rate, per household cattle number, beef output, individual yield, processing and marketing conditions.

The filled proposal must be checked and approved first by the provincial Animal Husbandry Bureau and the Comprehensive Agricultural Development Office and then submitted jointly to the Ministry of Agriculture for further examination and approval. The preliminary examination and selection would be made by the Animal Husbandry Bureau of the MoA while the final decision over the selection made jointly with Planning Bureau of the MoA and the State Comprehensive Agricultural Development Office. Once designated as a project county, the county animal husbandry department is asked to prepare a project design and report it to the higher level for approval jointly with the county Comprehensive Agricultural Development Office. Having examined by the provincial Animal Husbandry Bureau and the Comprehensive Agricultural Development Office it would be then reported to the Animal Husbandry Bureau and Planning Bureau of the MoA and the State Comprehensive Agricultural Development Office for final approval.

As for the essential conditions for application or criterion for selection, there are mainly five stressed by the Ministry of Agriculture:

- abundant crop residue resources;
- extension work having done with respect to the treatment of crop residues (mainly silage and ammoniation);
- large number of ruminants (cattle, sheep and goats);
- relative sound service and marketing system with a certain processing capability;
- the extent of importance attached by the local government officials towards the livestock production based on the crop residues.

All these conditions are, of course, relative and dealt with different situations in different

provinces. A county with 180 thousand head of cattle on hand, for example, may fail to be chosen as a project county in Henan province. But a county with 100 thousand head of cattle on hand may be chosen as a project county in Shanxi province.

In addition, poverty alleviation is not a major concern of the project. So poverty stricken counties, therefore, would not receive a special care in general. On the contrary, whether the local government can raise enough counterpart funds or not is one of the prerequisites for the application. Those poverty stricken counties not up to the conditions set for “Straw for Ruminants” project can apply for poverty alleviation project.

As instructed by state councilor Chen Junsheng, the selection and regional distribution of the project counties has been focused on major beef producing provinces. In China, these provinces are now mainly grouped in Zhongyuan area (including Henan, Hebei, Shandong and Anhui in central China). In the meantime, owing to good climate, abundant crop residue resources and fine cattle breeds in Zhongyuan area these provinces totally meet the conditions or criterion mentioned above. And they are very fit to raise cattle. This is why the Zhongyuan Beef Belt has been heavily targeted by the “Straw for Ruminants” project. Table 3 shows that the number of project counties within these four provinces totaled 105, accounting for 39 percent of the total 268 project counties.

Project Monitoring and Final Assessment

The project has been designed for a term of three years. During this period the project county is asked to take strict measures towards the project management. The project county is obliged to report the project progress and investment conditions to the Animal Husbandry Bureau and Planning Bureau of the MoA and the State Comprehensive Agricultural Development Office every year at the first half of the year and annual work report, funds auditing report and financial report at the end of the year. At the same time the Ministry of Agriculture would make selective examination over the project implementation every year. Those counties failed to fulfill the plan would get a warning of yellow card at first and then would be removed from the project without any progress made ever since. So far three counties had been removed from the project because of either lack of counterpart funds, misappropriation of project funds or failure to attain the planned targets such as cattle number, beef output and ammoniation target.

After the end of the project all the project counties should be checked before acceptance at three different levels beginning from the fourth year;

- **local acceptance** all the project counties should be checked at the local level;
- **ministerial acceptance** one third of the project counties checked at local level would be randomly examined by the Ministry of Agriculture;
- **state acceptance** one third of the project counties checked at ministerial level would be randomly examined by the State Comprehensive Agricultural Development Office. The final decision whether a project county is up to the standard or not would be made after state acceptance. Those qualified would be issued a certificate of inspection and otherwise not. By now three counties have been determined to be unqualified.

According to the Interim Procedures over the Acceptance of Straw for Ruminants Project, the acceptance work should be conducted by the Animal Husbandry Bureau jointly with the

Comprehensive Agricultural Development Office at each level. The main contents examined are as follows:

- **quantity and quality indexes of the project** including the quantity of straw ammoniated and ensilaged, use rate of straw treated, year-end cattle number, off take number, off take rate, beef output and per household cattle number each year during the construction period of the project, individual yield and milk output, etc.;
- **funds raised and its application** including the state comprehensive development funds, special loan made by the Agricultural Bank, local counterpart funds and funds raised by farmers themselves;
- **repayment plan and measures of the compensable funds;**
- **implementation of related measures and policies** including the management measures and related policies after the end of the project, improvement of economic, social and ecological results and the filing of related materials, tables and diagrams.

The goal of the acceptance is to check whether or not those specific targets planned in the project design have been attained and all kinds of funds have been raised and used in conformity with the related rules and regulations.

After the end of the project another compare and appraisal activity would be organized by the Ministry of Agriculture to select “the ten best project counties”. These best ten counties are selected based on the following 10 conditions:

- once commended by the provincial or ministerial level on ensiling, ammoniation and the implementation of “Straw for Beef” project;
- annual cattle number raised must be over 300 thousand head, off take number over 10 thousand head and beef output not less than 12 thousand ton;
- the use rate of straw treated must be over 30 percent;
- the proportion of breeding cows in total cattle number of the county should reach over 45 percent;
- the proportion of beef output in total meat output of the county should be over 20 percent;
- over two head of cattle per household (in terms of cattle number raised);
- having complete facilities for ensilage and ammoniation;
- having worked out the preferential policies and measures to encourage the implementation of “Straw for Beef” project;
- excellent fulfillment of the project as planned and timely reporting of work report and other forms;
- over 20 percent of the per capita cash income of the county should come from the cattle industry.

At the same time those who have been given the title of “the Best Ten Project Counties” would be awarded an additional 200 thousand yuan investment as a prize.

Social and Economic Impact of the Project

according to FAO, out of the approximately 30 countries FAO has advised, achievements have been most outstanding in China. And China is the leading country considering either the number of farmers that apply the technique or the quantity of roughage treated. The achievements have been made in implementing the “Straw for Ruminants” project can be summed up as follows:

- 1. Big increase of beef output and the shift of beef production from pastoral area to cropping area** The “Straw for Ruminants” project was officially incorporated into the state comprehensive agricultural development program in 1992. So far the number of project counties, though, accounts for only about 6 percent of the total counties of the country, the beef produced by these project counties accounts for 32 percent of the national total, nearly one-third of the nation. Between 1992 and 1996 the rate of beef production averaged 27.7 percent, which is the highest among all meats produced in China. In the meantime, the proportion of beef output in total meat output also increased from 5.3 percent in 1992 to 8.4 percent in 1996 while pork decreased from 76.8 percent in 1992 to 68.3 percent in 1996. Due to the effective extension of the “Straw for Ruminants” project, historical change in beef production pattern relied heavily on pastoral area traditionally has taken place. Vast agricultural area has become the major base for beef production in place of pastoral area. Now over 90 percent of beef output comes from agricultural area. In 1995, cattle off take number by Fuyang prefecture alone (Anhui province) reached 980 thousand head, exceeding that of the whole Inner Mongolia (780 thousand head). In 1997, beef output by four provinces in Zhongyuan Beef Belt (Henan, Hebei, Shandong and Anhui accounted for 46.3 percent of China’s national total beef output. Beef output by three provinces in Northeast Beef Belt (Liaoning, Jilin and Heilongjiang) accounted for 15.8 percent of national total (see table 4). This change not only shows the remarkable progress made by the local governments in adjusting their industry structure, but indicates the shift of beef production from pastoral area to agricultural area. At present this shift and change is well under way in China.
- 2. Large amount of feed grain saved and the grain-saving livestock production promoted** Between 1991 and 1996 the straw ensilaged nationwide totaled 331.3 million ton (fresh weight) and straw ammoniated reached 86.2 million ton, which saved over 80 million ton of feed grain (see table 5 and 6). Besides about 100 million ton of straw was directly used to feed ruminants every year, which saved about 20 million ton of feed grain a year. So “Straw for Ruminants” project reduced the feed grain consumption by a big margin and made tremendous contribution to decreasing the contradiction between grain supply and demand.
- 3. Sustainable and coordinated development of agriculture and animal husbandry with large quantity of manure returned to soil** According to an estimation, the whole agricultural area kept over 90 million head of cattle by the end of 1996, which produces near one billion ton of manure every year. And, in terms of the content of nitrogen, it equals to 14.52 million ton of standard fertilizer worth 13 billion yuan. Wide spread of manure contributes not only to the reduction of chemical fertilizer used and production cost, but also to the improvement of soil and soil fertility and to the increase of grain production. Fuyang in Anhui province, for example, is the No. 1 cattle raising prefecture in China. During the project period between 1991 and 1996 content of organic matter in soil increased from 1.54

percent to 1.80 percent. And grain output increased from 3.3 million ton to 7.83 million ton either. The annual rate of grain production averaged 18.3 percent, which is well above the national average level (0.9 percent). The amount of grain increase in other project prefectures such as Zhoukou, Shangqiu and Zhumadian in Henan province has been also well above the national average level in the past decade, turning these prefectures short of grain in the past soon into ones exporting commodity grain.

- 4. Enormous economic benefit achieved** according to an survey, the net income per head of cattle raised would reach 520 yuan (including the income of manure after deduction of the labor cost). The “Straw for Ruminants” project greatly improves the net income of cattle raising by two ways: increasing of off take rate and carcass weight. After the implementation of this project the off take rate increased from 20 percent to 40 percent and carcass weight from 130 kg to 160 kg. Based on these it is estimated that the economic benefit achieved by the “Straw for Ruminants” project between 1993 and 1996 would reach 16.15 billion yuan and another 50.56 billion yuan would be achieved in the following four years between 1997 and 2000. The annual economic benefit achieved by cattle raising would average 8.34 billion yuan. The annual net income ratio of extension cost would be 7.1 yuan to 1 yuan (namely, for every one yuan invested for extension a net income of 7.1 yuan would be achieved). So the economic benefit is very remarkable. What should be mentioned here is that the above economic benefit only refers to that achieved by the cattle raising, excluding the economic benefit achieved by sheep and other indirect benefit achieved by the increase of grain production and the reduction of environment pollution.
- 5. Other beneficial result achieved** Such result includes the reduction of environment pollution, the development of meat and by-product processing industry and pest control. Burning straw in the field now has become an important source of air pollution due to the less use of straw as fuel. During the harvest season every year it has been frequently reported that the air traffic is held up by straw burning. To safeguard the air traffic around the Beijing International Airport 16 townships in Tongxian county, Shuyi county and Chaoyang district have been declared as a suspended straw burning area by the Beijing municipal government. Chaoyang district had appropriated 4 million yuan to subsidize the activity of returning straw into soil. the “Straw for Ruminants” project turns such “waste” into wealth and therefore saves huge investment in environment control. Besides the development of cattle raising the “Straw for Ruminants” project also promoted the development of slaughtering and processing industry related to cattle and created lots of job opportunity for farmers. It is estimated that the output value processing industry related to cattle would reach 2 billion yuan in Henan province. The primary, secondary and tertiary industry related to the “Straw for Ruminants” project in Shandong province would absorb over 6 million employees. And the “Straw for Ruminants” project would furnish employment to more than 20 million hands through the country. Furthermore, it has been confirmed that the ammoniation process of straw would help control the disease such as hemorrhagic fever and weeds

Future of the Project

So far great progress has been achieved by the “Straw for Ruminants” project. But compared with the huge straw resources much potential still remains to be tapped. In the total 600 million ton

of straw only 180 million ton is used to feed ruminants and 50 million ton used for multipurpose including returning to the soil. Much of them, therefore, has not been used effectively and remains to be developed, including 270 million ton used as fuel and 100 million ton burned in the field. So it is introduced that the “Straw for Ruminants” project will certainly be carried out towards the next century not only in the following five years but in a longer time.

At present the proportion of livestock output value in total agricultural output value is only about 30 percent. To build China into a strong agricultural country this proportion should be raised to 50 percent. So in 1996, the State Council approved the “National Development Outline of the Straw for Ruminants with Manure Returned to Soil Project between 1996 and 2000”, calling for the local governments to pay much attention to the implementation of this project.

In this outline, a series of goals has been set for the future of Chinese beef and cattle industry. By the end of this century the “Straw for Ruminants” project will be expanded further to cover 20 project prefectures and 400 project counties, including 250 beef cattle project counties and 150 sheep project counties. Total beef output should reach 7 million ton and the struggling objective is to reach 10 million ton. The quantity of straw ensilaged and ammoniated will come to 120 million ton and 60 million ton respectively. The use rate of straw should reach 40 percent.

As for the focal point of the future work, it would center on the following things:

- **continuous support for those commended project counties** it is introduced that 10 percent of those accepted project counties with better performances will be chosen to be continued;
- **proper shift of the priority** priority will be given to the development of northeast beef belt considering abundant crop residues and feed resources there;
- **strengthening the deep processing sector and market construction** it is suggested that a batch of deep processing projects should be constructed in zhongyuan, northeast and southern China beef belts respectively.

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Table 1 Quantity of Crop Residues by Crop Category

(Unit: 10 thousand ton)

Category	Quantity	Category	Quantity
rice straw	19,791.3	peanut stalk	662.3
wheat straw	10,929.2	rape stalk	2,087.4
corn stalk	15,515.2	sugar cane tip	1,440.5
millet straw	639.0	sesame stalk	29.9
sorghum stalk	1,022.8	sunflower stalk and leaves	80.3
soybean stalk	1,498.5	cotton leaves	270.5
other coarse grain straws	1,958.8	edible stalk of fiber crop	160.0
vine of tuber crop	2,435.9	Total	57,521.5

Table 2 Project Counties and Investment over Time

(Unit: number, million yuan)

Year	1992	1993	1994	1995	1996	1997	1998	Total
Project Counties	10	24	38	47	45	49	55	268
Cattle	10	24	37	40	31	33	37	212
Sheep			1	7	14	16	18	56
Project Prefectures				6	6	1		13
Investment	10	20	35	40	44	50	54	253

Table 3 Number of Project Counties by Province

Province	No. of Project Counties			Province	No. of Project Counties		
	Total	Cattle	Sheep		Total	Cattle	Sheep
Shandong	37	25	12	Guangdong	7	7	
Henan	31	23	8	Xinjiang	7	3	4
Hebei	21	16	5	Jiangxi	6	6	
Anhui	16	14	2	Zhejiang	5	2	3
Jilin	14	13	1	Guizhou	4	4	
Heilongjiang	14	13	1	Gansu	4	4	
Sichuan	13	13		Ningxia	4	2	2
Liaoning	12	11	1	Hainan	3	2	1
Guangxi	12	12		Fujian	2	2	
Inner Mongolia	10	5	5	Yunnan	2	2	
Jiangsu	9	3	6	Chongqing	2	1	1
Shaanxi	9	8	1	Shanghai	1		1
Shanxi	7	7		Beijing	1	1	
Hubei	7	6	1	Tianjin	1	1	
Hunan	7	6	1	Grand total	268	212	56

Table 4 Ten Top Beef Producing Provinces in 1997

province	beef output		province	beef output	
	10,000 t	% of nation		10,000 t	% of nation
Henan	64.6	15.6	Liaoning	21.6	5.2
Hebei	52.6	12.7	In. Mongolia	17.4	4.2
Shandong	44.5	10.7	Jilin	16.6	4.0
Anhui	30.1	7.3	Xinjiang	16.4	4.0
Heilongjiang	27.3	6.6	Hubei	12.8	3.1

Note: beef output has just been adjusted by the State Statistical Bureau by a big margin.

Table 5 Straw Ensilaged and Ammoniated between 1992 and 1996

(Unit: 10 thousand ton)

Year	1992	1993	1994	1995	1996	total
straw ensilaged	5013.3	5885.3	6421.2	7513.4	8521.1	33354.3
straw ammoniated	710.6	1169.2	1590.8	2148.9	3047.9	8667.4

Table 6 Grain Saved by Feeding Ruminants with Straw

(Unit: 10 thousand ton)

year	grain saved		
	by treated straw	by untreated straw	total grain saved
1992	1036	1918	2954
1993	1350	1882	3232
1994	1599	1876	3475
1995	1986	1920	3906
1996	2497	2160	4657
total	8468	9756	18224