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CULTIVATED LAND RESOURCES AND ITS DEVELOPMENT IN THE TROPIC AND SUBTROPIC MOUNTAIN AREAS OF SOUTH CHINA
——A Case Study in Deqing County

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ABSTRACT: Deqing County of Guangdong Province is located in the tropic and subtropic mountain areas of China. Its area of cultivated land from landuse survey is 40% larger than the statistical data. Of all cultivated land, owing to flood, waterlogging, drought and barren soil, the high yield land occupies only 30% and the mid-low yield land 70%, which is far more than the percent by statistics. Because the statistic area of cultivated land is less than the actual, the per unit area yield by statistics is higher than the actual. These situations generally exist in the tropic and subtropic mountain area of South China. So the measures to protect the high yield cultivated land strictly, to improve parts of the mid-low yield selectively, to adjust agricultural structure further, and to control soil erosion, are necessary to make best use of its advantages and bypass the disadvantages.
KEY WORDS: cultivated land, landuse survey, land development

Since "the Land Control Law" was proclaimed in 1978, landuse surveys have been done in every administrative division. It is found that the areas of cultivated land in most mountainous counties are larger than the statistics and in some counties are 50% larger. These situations generally exist in tropic and subtropic mountain areas of China, to the south of the Qinling Mountains and the Huaihe River is known as Southern Tropic and Subtropic Mountain Areas, it has an area of 2.2×10^7 km^2, its cultivated land area of landuse survey and statistics respectively are 6×10^8 ha (Department of Landuse Plan, State Bureau of Land Administration, 1994) and 4×10^8 ha(State Statistical Bureau, 1993), the former is 50% larger than the latter. The aim of landuse survey is to know the basic situation of landuse, especially the types and structure of cultivated land, and promote the land utilization from now on to the rationality. Now, there are 1.2×10^9 people in china. Occupied by the construction, the cultivated land continues to diminish and the food supply has caused wide attention in the internal and even in the world, through landuse survey, the existing state such as actual area, quality and utilization of cultivated land can be known clearly so as to make the policy correct to meet the

needs of the development of population and economy. The landuse survey this time in work steps and way is more accurate than any before in China, so according to the mentioned above, it is necessary to recognize the conditions and productive forces of the cultivated land again in order to make out the correct measures of protection and development.

Deqing County, located in the west of Guangdong Province, the north bank of the Xijiang River, 111°30′19″ – 112°15′43″E and 23°43′15″ – 23°31′13″N, has an area of 2001.8 km^2. It is a mountainous county, hills and mountains occupy 82%, and plains only 10%.

I. COMPARISON OF LANDUSE SURVEY AND STATISTICS

1. Landuse Survey

The way of landuse survey in Deqing is: first to select the aerial photographs for the base map; then, through field survey, classify the land into cultivated land (it can be further divided into terraced field, field at the foot of valley, plain field, low waterlogging field, field on hill tops, nonirrigated land and vegetable land), garden plot, forest area, resident and industrial land, water district and unused land on the base map, and at last to measure and sum up their areas with computer and convert the area of cultivated land into net area according to the slope rate.

The result of landuse survey shows that Deqing County has a gross area of cultivated land of 2.32×10^4 ha, of which the area of irrigated land is 2×10^4 ha and nonirrigated land 0.32×10^4 ha. Among the irrigated land, the area of terraced field is 0.4×10^4 ha, field at the foot of valley 0.61×10^4 ha, and field in the little plain 0.99×10^4 ha. By converting with the slope rate, the area of cultivated land in Deqing is still 2.10×10^4 ha, of which, the area of irrigated land is 1.85×10^4 ha and nonirrigated land 0.25×10^4 ha. Among the terraced field, the area of terraced field is 0.33×10^4 ha, field at the foot of valley 0.55×10^4 ha, and field at the little plain 0.97×10^4 ha. The technological error rate in this survey is less than 2‰.

2. Comparison of Land Area by Landuse Survey and Statistics

The area of cultivated land in the annual statistic report in 1992 is 1.48×10^4 ha, only 70% of net area, and 63.8% of gross area of the landuse survey, the areas of the irrigated land and nonirrigated land are 1.26×10^4 ha and 0.22×10^4 ha respectively, occupying only 68% and 81.8%, so the difference in irrigated land area by the landuse survey and the statistic is great and that in the nonirrigated land is small.

3. Main Causes for the Difference in Land Area by Landuse Survey and Statistics

First, the statistic data is from the Land Reform in the early 1950s, of which the measure

technology and equipment was very backward. Second, in the period of learning from Dazhen in the 1960s, slopeland was largely exploited into the cultivated land, which was not all added to the statistics. Third, with the improvement of water conservancy facilities and reduction of natural disaster, much damaged cultivated land was recultivated. Before 1949, the erosion of water and soil is so serious in Deqing that more than 0.13×10^4 ha of cultivated land was buried and 0.33×10^4 ha was harmed by yellow mud-water, after 1949, through large-scale renovation, some soil erosion was controlled, some cultivated land covered by sand was recultivated again and large area of sandy land was made into cultivated land. By 1992, the increase of cultivated land only by this way had been over 0.13×10^4 ha.

II. QUALITY AND PRODUCTIVE FORCESI OF CULTIVATED LAND

By the comparison of land area by the landuse survey and the statistics, the quality and productive forces of the cultivated land can be known clearly.

1. The Total Amount of Cultivated Land Resources

The landuse survey shows that Deqing County has 2.10×10^4 ha of cultivated land, which is 0.62×10^4 ha more than the statistics. There were 32.9×10^4 persons in Deqing County in 1992. The amount of cultivated land per person under the statistics is only 0.045 ha, 0.08 ha less than the average of China, but under the landuse survey the cultivated land per person is near 0.07 ha, 0.02 ha more than the statistics and close to the average of China.

2. The Quality of Cultivated Land Resources

Based on the landuse survey, of all cultivated land, the fertile fields in plains, with an area of 0.99×10^4 ha, occupy only 42.5% and terraced fields, fields in the foot of valley and on the hill tops which depend on rains for water supply, with poor soil 1.01×10^4 ha and nonirrigated land, 0.3×10^4 ha, respectively occupy 43.7% and 12.9%. Otherwise, the latter is in bad condition of water conservancy to harvest for drought and excessive rain fall. Of the fields in plains, more than 30% are in the condition of low lying waterlogging. Actually, the cultivated land with high-stable yield is 0.69×10^4 ha, occupies only 29.8%. So the quality and environment condition of cultivated land in Deqing are bad.

3. The Productive Forces of Cultivated Land Resources

The productive forces is shown by yield per unit area. Because the statistic area of cultivated land is less than the actual, the per unit area yield by statistics is higher than the actual. Of all cultivated land, greater part was used for grain crops planting, of which most was for rice

planting, the total grain yield in 1992 was 13.2×10^4 t. Based on the statistic area of cultivated land, the per unit area yield for grain crops and rice was respectively 5040 kg / ha and 5220 kg/ha. Actually, based on the landuse survey, the per unit area yield was only 3450 kg/ha and 3555 kg/ha. This shows that the productive forces were much low and make us know the seriousness of vast planting and less harvesting.

In fact, from our survey, we know that the yield per unit area in the rather part of paddy fields is only 2250– 3000 kg/ha and the low-lying and waterlogging paddy fields usually have no harvest. According to the standard of 4000 kg/ha, the mid-low yield fields occupy 80% of all paddy fields and more than the statistics. This phenomenon is common in the tropic and subtropic mountainous area of South China. Deqing is located in the southern edge of the Tropic of Cancer, and climatically in the subtropical zone with rich light, heat and rainfall. Based on the computing, the theoretic productivity is 43 455 kg/ha, the greatest output of rice in a year has been over 15 000 kg/ha, so the total productive level now is much lower and has the great potentialities. This problem exists generally in the tropic and subtropic mountainous area.

III. MAIN FACTORS TO CAUSE LOW YIELD OF CULTIVATED LAND

The main factors which cause the low yield of cultivated land in Deqing County are low terrain to waterlogging, high terrain to drought and poor soil. These are also the common problems in hill and mountainous areas in South China.

1. Calamity of Waterlogging Caused by Low Terrain

There are 83 km of the Xijiang River in Deqing County. The Maxu River and the Yuecheng River, the first class tributaries of the Xijiang River, run through the whole of Deqing. The cultivated land along the Xijiang River and the lower reaches of the Maxu River and the Yuecheng River is low and waterlogging. The Xijiang River flood is relatively frequent. In the 41 years from 1949 to 1990, the flood levels (Deqing level) in 31 year-times are above 14 m, 5 year-times 19 m. When flood level is at 13.5 m, the waterlogging area along the Xijiang River and the lower reaches of the Maxu River and the Yuecheng River would be 900 ha, which cause the output of cultivated land low and unstable. As for the cultivated land of the middle reaches of the Maxu River and the Yuecheng River, the severe soil erosion of the hills in the upper reaches caused much silt deposited in the river bed and make it higher than the cultivated land along the river. The river water is in poor drainage and the cultivated land along the river is waterlogging all the year round, which severely affect the crop's regular growing and make the yield low, this kind of cultivated land is about 800 ha. To the upper reaches, water flow in the river is rapid, mountain torrents happen frequently, the cultivated land at the foot of hills or at the bed of valleys gets little sunshine and has a high underground water level, the underground water temperature is low, waterlogging all the year round and the output is low.

2. Water Shortage Caused by High Terrain and Irrigation Condition

Of the irrigated land in Deqing County, more than 50% is terraced field, most of the irrigation water is supplied by the small ponds with very little stored water among mountain area. In dry seasons, the ponds would dry up, which make the yield of field lower and unstable. This kind of farmland is over several thousand hectares.

3. Poor Soil

Of the large area of the terraced field in Deqing, the ratio of sand to soil is imbalance, with too much soil or too much sand, lack of organic matter, short of nutrition, the soil is poor.

Moreover, soil erosion in the past is serious in Deqing, much of the irrigated land is affected by the "yellow-mud water" from soil erosion. Besides, after the soil erosion is under control, much of the sandlogged land is transferred to cultivated land, which is over 1300 ha and there is similar problem.

IV. SUITABILITY AND FEASIBILITY OF THE SUPERIORITY DEVELOPMENT OF CULTIVATED LAND IN DEQING COUNTY

There is much mid-low-yield cultivated land but a little good-quality and high-yield cultivated land. The basic task of agriculture is mainly to fulfill the inner requirement. The 6700 ha of high-quality plain fields must be strictly protected in order to stablize the crop production and guarantee the essential self requirement. On the principle of suitability and feasibility, the main task is the superiority development of mid-low yield cultivated land.

There are many factors causing the low yield of cultivated land, the main factors must be grasped in the process of development and utilization to select the renovation measures. Meanwhile, based on the objective economic conditions, low cost, high benefit and suitable measures to local conditions are the goal to make best use of advantage and bypass the disadvantage.

1. Lowlying Waterlogging Cultivated Land

The main hindrance of this kind of cultivated land is the higher river bed, which makes the water in the cultivated land can not be self-drainage but flow backwards and lead to waterlogging all the year round. The only way is to lower the river bed of the Maxu River and the Yuecheng River if this management mode is not changed. Now there are more than 800 ha of this kind of cultivated land. To reduce the river bed to the same altitude of the cultivated land along the river, several million cubic metres of earth and stone are needed and the investment would be several ten million yuan (RMB). Moreover, if the soil erosion can not be controlled

without delay, the river bed would be at the same altitude in 3 to 5 years. At present, it is impossible for the soil erosion to be controlled in 3 to 5 years, so obviously this method will not do.

This kind of cultivated land has been waterlogging for a long time and the output is low but there is no flooding. So if the management mode is changed from planting rice to breeding fish, the water can be used and the output would be stable, meantime, the input would be not much. According to the statistics, the project cost of transforming to fish pond is several hundred yuan for one mu(1 ha= 15 mu). The annual value of output of the fishpond can be 3000 yuan and can compensate the project investment in one year. At the same time, shortage of fish supplying in Deqing will be resolved and farmer's income will be increased. So, it is suitable and feasible. Moreover, if the soil erosion is controlled in the future, the river bed lowers and water does not flow backwards to cultivated land, the fish pond can be changed to cultivated land easily.

2. Easy Waterlogged Cultivated Land Along Rivers

The damage caused by waterlogging in the lower reaches of the Maxu and the Yuecheng River and along the Xijiang River is obviously lightened in pace with the dyke construction.

Dyke construction standard is relatively low, usually happened once in 20 years, when stronger flood comes, the waterlogging is still very serious. The government has planned to heighten the dyke standard from once in 20 years to once in 100 years to protect large area of farmland. This part of cultivated land would be no more waterlogging then. To construct dyke to protect scattered scrappy cultivated land along the Xijiang River is not economically reasonable. To these cultivated land, planting mode should be changed. Because waterlogging is temporary, vegetable and other short-term crops or mulberry could be considered to plant, which can not be affected by temporary waterlogging and the output would be stable.

3. High Irrigated Land

The county government has planned to build some reservoirs in order to irrigate the large area of cultivated land in the east part. Much of these cultivated land, scattered with an area of about 1000 ha, should be changed for dry farming. These areas such as high altitude area of Shapang Town, parts of granite area in Maxu, Guanxu and Xinxu areas should be changed from crop to forest based on the consideration of environment protection.

4. Barren Cultivated Land

This kind of cultivated land in Deqing is over muddy or sandy with little organic matter. Soil type including Super-muddy field, Sandy field and muddy field. Sand or soil must be pro-

portionally added to these cultivated land in order to adjust their sand-soil ratio. Meanwhile, cultivated system should be changed to popularize vigorously rotation of legume and grass, for example, the rotation of peanut and rice, to plant green manure crop in large area, not to take stem of crop away from field, to add organic manure, in order to enhance the fertility.

Part of the cultivated land is high-iron-bearing field, deep-soaked field and serious water-logging field. We should do well in the water and soil conservation, and at the same time renovate irrigation and drainage system energetically, especially the mountain surrounding channel, lower the underground water level for getting rid of "five poison" water, in addition to add sand and soil and add organic manure.

V. MEASURES TO PROTECT AND UTILIZE CULTIVATED LAND

The problems in Deqing are common in southern mountainous area, so the measures to protect and utilize cultivated land should be directed against.

1. Realistically Protecting the High-Yield Cultivated Land

The cultivated lands in little plains, with low proportion and high yield, are the granary of mountainous area. Now with the development of economic construction, readjustment for agricultural structure such as fruit planting, fish pond digging have objective needs for cultivated lands. But the problems are that the occupied lands are always the high-yield parts in little plains and the total quality of cultivated land is lowered. So the protections to these parts are very important and urgent.

2. Enhancing the Capital Construction of Mid-Low Yield Field

Before the 1980s, the capital construction of farmland in China had been paid attention to, but after the 1980s, especially in mountainous area that have been lessened. Of all cultivated lands in hilly and mountainous areas, the percent of mid-low-yield land is higher than the statistics and the lowest yield is lower than the statistics. The mid-low-yield fields have great potentialities to be exploited, so remaking these lands should become the basic policy of governments. Now the hilly and mountainous areas are still rather backward and have not enough money to improve the conditions of farmland. So the funds should be amassed to transform part of land selectively. Different levels of governments should work out the special-purpose plan for the transformation of cultivated lands in stretches and carry out stage by stage.

3. Adjusting Agricultural Structure Further to Local Conditions

After reform, agricultural structure has been adjusted in large scale in mountainous areas,

but the most of adjustments regard the total cultivated lands as the prerequisite and lack of thoughts on suitable measures to local conditions.

The cultivated lands in mountainous areas are scattered and small. It is unpractical and unsuitable to the maximum economic benefits to make overall or large scale capital construction of farmland, but adjusting agricultural structure, not only simple and easy to do, but also less invests and more harvests, should be carried out in large scale and can solve the low yield of rice planting and improve the farm products supply, to meet the needs of people for raising their living levels day by day.

4. Controlling Soil Erosion, Improving Eco-Environment and Promoting Agricultural System

Soil erosion is the main factor for the low yield of cultivated land. Cultivated land is only in a good environment to get a stable harvest, forest is the foundation to protect water and soil. The area of soil erosion in the southern mountain area, up to 17×10^6 ha, occupies 16% of the total land. The soil erosion results in the loss of vast amount of soil and sand and brings about the reservoirs and rivers silting, increases frequency and severity of drought and waterlogging and soil degradation. So it is necessary to control soil erosion and turn the fields on hill tops back for afforesting to improve the quality of eco-environment and promote the agricultural system to sustainable development.

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