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Changes of the Scale and Structure of Agricultural Laborer and Their Impacts on Food Production

—Empirical study on YinshanPo Village, Suizhou City

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Abstract On the strength of expounding the general situation of study area and the status quo of agricultural laborers in China, the changes of the scale and structure of agricultural laborer from 1985 to 2009 are analyzed by relying on the survey from farmers and statistical data from the government. The causes of these changes are analyzed from the aspects of rural farmland policy, birth-control policy, farmland marginalization and industrialization. Based on the study on the causes, the impacts of the changes on food production are analyzed from operation scale of household, the grain cropping area, the multi-cropping index and land productivity. The results show that the quality of agricultural laborers is decreasing from 1985 to 2009, which is characterized by the lack of middle-aged agricultural laborers and the aging of agricultural laborers. The causes of the changes include farmland policy, birth-control policy, farmland marginalization and urbanization. The shrinkage of agricultural laborers has grave impact on the multiple-cropping index. In addition, the land productivity is comprehensively affected by the scale and structure of agricultural laborers.

Key words Agricultural laborers, Peasant household, Food production, Yinshanpo Village, China

The transfer of agricultural laborers is a process of redistributing social productive forces^[1]. With the shift of economic development strategy and the economic growth pattern, the reform of household registration system and urban employment system, the advancement of rural economy and agricultural technologies, and the increasingly improved agricultural labor efficiency, the laborers needed in the agricultural business drop gradually and a horde of agricultural laborers have been changed to non-agricultural laborers through transferring to the secondary and tertiary industries by the gradient mode or cross gradient transfer mode. The increase of productivity is gradual, so the change of the laborer distribution structure is a long historic process and the change does not transfer with human' subjective will^[2-3]. In some underdeveloped rural areas, the opportunity costs for undertaking agriculture are higher and higher, but the preferential policies can not weaken agricultural laborers' enthusiasm for going to towns and cities, so the trend of excessive transfer of agricultural laborers unveiled^[4]. With the further advancement of rural economy, the problems of rural surplus laborers are prominent day by day. How to achieve the order transfer of rural surplus laborers has become a hot topic^[5].

The rapid transfer of agricultural laborers can expand the income source of farmers and tap the agricultural growth potential, however, the small scale family-based agricultural production has existed for such a long time in China and the production mode featured by labor input has been formed, so the

transfer of agricultural laborers may lead to the farmland abandon and the decrease of agricultural productivity, which will have a bad effect on the stability of food production^[6-7]. The food production is affected by both the nature and human activities, but in a relatively short period, the effect of human activities is far greater than natural factors^[8-10]. The study on the changes of agricultural labors and their impacts on food production is of theoretical and practical significance for stabilizing food production, promoting the orderly transfer of agricultural laborers and preventing the excessive transfer of agricultural laborers. Besides, the study can be referenced, when stipulating the policies concerning rural areas in China.

1 Overview of Yinshanpo Village and the description of its representative

Yinshanpo Village is located in the southeastern Suizhou City and western of Fuhe Town. It lies against Junzi Mountain in the north; borders the Gongqiao Village of Fuhe Town on the east; neighbors Wusiju of Fuhe Town in the south and lies to Hongxing Country, Luohe Town of Suizhou City on the west. Yinshanpo Village lies between 113°29'11" E to 113°30'50" E and 31°28'55" N to 31°31'07" N^[11], with 15 kilometers away from Fuhe Town and 25 kilometers from Luohe Town, is a marginal area of the urban development. Long being affected by the closed natural and economic environment and the unitary agricultural management method, the economy of Yinshanpo Village is still backward and the agriculture plays a dominant role in GDP. From the village's resources and external situations, the poor situation will continue.

With the rapid development of China's urbanization, the productivity, quality of agricultural laborers and farming conditions in the urban and rural connecting areas have obtained great improvement. However, in most remote rural areas, the

Received: August 3, 2010 Accepted: September 3, 2010

Supported by the Humanity and Social Science Programs of Hubei Provincial Department of Education (2009Y149) and the Project of Excellent Middle-aged People and Young People Team in Colleges and Universities of Hubei Province (T200708).

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productivity and the quality of agricultural laborers are still low. In order to survive well, most laborers abandon their lands and go to cities to seek jobs. Yinshanpo Village is the very representative, which represents most remote and underdeveloped rural areas in central and western China.

2 The features of the changes of the scale and the structure of agricultural laborers

2.1 The status quo of agricultural laborers According to the 122 valid questionnaires in the spring of 2010, among the aggregate 537 rural residents, the laborers account for 86.78%, non-agricultural laborers account for 13.22%. But among the 466 agricultural laborers, 191 of them are agricultural laborers, which account for 35.57% of the total rural laborers. Among the 191 agricultural laborers, 93 of them are male laborers and 98 of them are female laborers, which account for 43.81% and 56.19% of the total agricultural laborers respectively. It can be seen from Table 1.

Table 1 The population structure of survey household

Job of the survey household		Population people	Proportion %
Laborers	Agricultural laborers	191	35.57
	Non-agricultural laborers	275	51.21
	In total	466	86.78
Non-agricultural laborers		71	13.22
In total		537	100.00

Note: Source is from 122 valid questionnaires of Yinshanpo Village.

In terms of age structure, among the 191 agricultural laborers, 83 people are between 41 and 50 years old; 63 people are between 51 and 60 years old; 22 people are over 60 years old; 87.96% of them are over 40 years old; only 8 people are between 18 and 30 years old, which indicate that the agricultural laborers have shown the ageing trend. In terms of education, 16 and 51 are the illiterate and semi-illiterate people respectively; 63 people of them have accepted the primary school education; 48 people have accepted junior high school education and only 14 people have gotten the education above technical secondary school, the figures show that the overall educational degree of agricultural laborers is low. By the end of 2008, there are 950 migrant workers in the aggregate in Yinshanpo Village, 750 of them work out of Hubei Province, 200 people works outside the Zengdu District, which account for 87.96% of the migrant workers in the whole village^[12]. In the near future, more and more agricultural laborers would be transferred to non-agricultural industries and cities and towns. The drop of the quantity and quality of agricultural employees would do great harm to the food production, so the analysis of the changes of scale and structure of agricultural laborers are of great practical significance.

2.2 The changes of the overall scale of agricultural laborers It can be seen from Fig. 1 that from 1985 to 2009, the quantity of agricultural laborers shows three different phases. Firstly, growth period: from 1985 to 1996, with the newly appeared laborers, the agricultural laborers show the growth trend. Secondly, adjustment period: from 1996 to 1999, with

the transfer of agricultural laborers and the decline of birth rate, the change of the quantity of agricultural laborers is modest. Thirdly, reduction period, from 1999 to 2009, due to the increase of agricultural management costs and the growth of the job opportunities for migrant workers, the changes of the relevant national policies concerning migrant workers, newly appeared migrant workers and some other reasons, the agricultural laborers have decreased from 219 to 191, the agricultural laborers have been further shrunken.

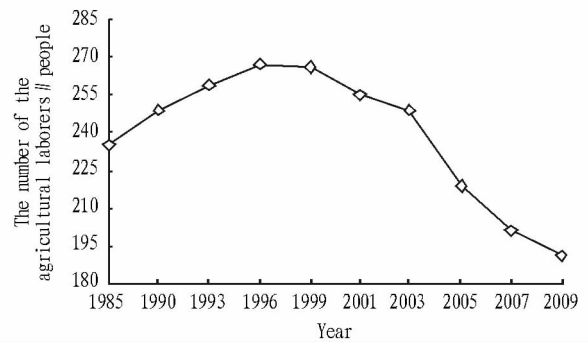


Fig. 1 Changes of the agriculture employees quantities of survey farmers from 1985 to 2009

2.3 The changes of the structure of agricultural laborers

2.3.1 Fracture in the age structure. Relying on the survey of peasant households in the spring of 2010, the age structure of agricultural laborers in 1985, 1993, 2001 and 2009 can be shown on Fig. 2. In the figure, from 1985 to 2009, the proportion of agricultural laborers who are 60 or over 60 years old to agricultural laborers is increasing gradually and the aging trend of agricultural laborers can be detected. In 2001 and 2009, the proportion of agricultural laborers of the years from 18 to 30 is relatively small, but in 1986, the proportion is the largest one among the three years. Between the ages from 31 to 40, the proportion in 2009 is far lower than the other three years. Briefly, from 2001, the quantity of young agricultural laborers has decreased obviously but the aging laborers have increased, the fracture of agricultural laborers becomes more and more serious.

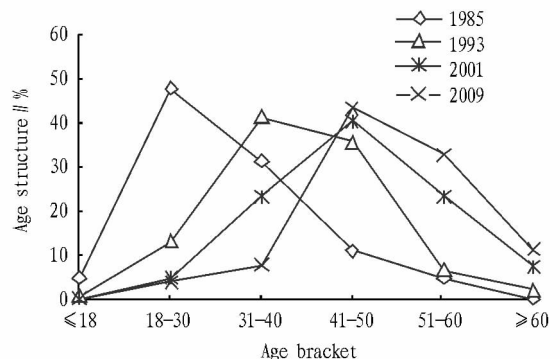


Fig. 2 The age structure of agricultural laborers in 1985, 1993, 2001 and 2009

2.3.2 The change of cultural structure is modest. It can be seen from Fig. 3 that the overall cultural quality of the survey households is low. From 1985 to 2009, the overwhelming majority of agricultural laborers have only accepted the primary school

education or below (including illiteracy or semi-illiteracy, primary school). In summary, the change of education of agricultural laborers is modest in the 24 years and there are no significant improvement. In 2009, 25% of the laborers have accepted junior high school education; 5% of them have gotten the technical secondary education; 2% of them have accepted high school education and 1% of them have junior college degree. There are no laborers with the undergraduate education or above. In the 25 years, the education level of agricultural laborers do not have great change.

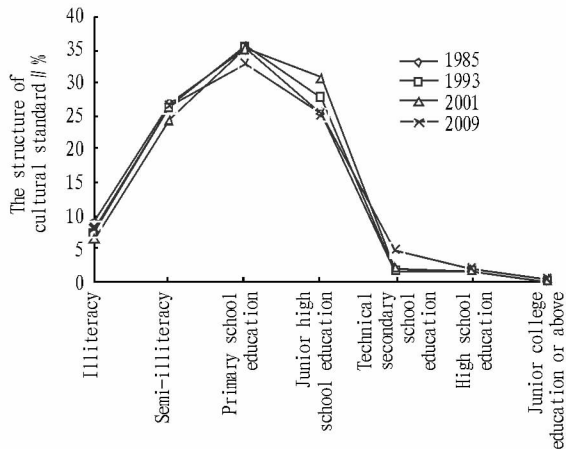


Fig. 3 The cultural structure of agricultural laborers in 1985, 1993, 2001 and 2009

The overall education level of agricultural laborers has obtained great improvement in the near two decades, especially since the implementation of the nine-year compulsory education, the new appeared laborers all have accepted the junior high school education. According to the incomplete statistics, after 2000, there are two people every year on average can be enrolled by universities, four people can be enrolled by vocational colleges, seven or eight people enter technical secondary school and tens of people can get junior high school education, but most of these students stay in cities rather than undertaking agricultural production, so the education level of agricultural laborers does not have great improvement.

2.3.3 The changes of sex structure. It can be seen from Fig. 4 that, the male agricultural laborers have decreased from 133 in 1985 to 93 in 2009; the female agricultural laborers have increased from 102 in 1985 to 130 in 1996, and then decreased to 98 in 2009. The proportion of the female laborers has increased from 43.40% in 1985 to 51.31% in 2009. With the industrialization of China, there will be more and more young male laborers will work in cities and the number of female workers will continue to increase.

3 Causes of the changes of the scale and structure of agricultural laborers

Many reasons can explain the changes of scale and structure of agricultural laborers. In the paper, four aspects, including farmland system, birth-control policies, farmland marginalization and urbanization are chosen to analyze.

3.1 The influences of farmland system The rural land

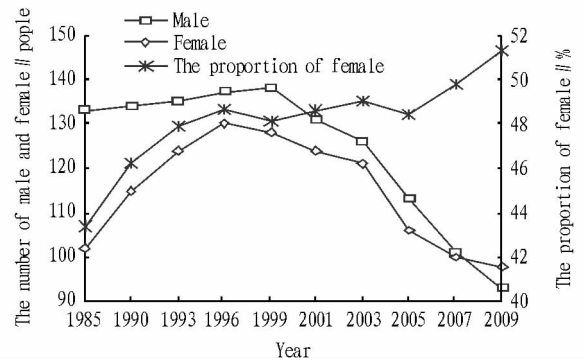


Fig. 4 Changes of the proportion of male to female in agricultural laborers from 1985 to 2009

system, which takes household contract responsibility as the core, has attained great achievements in more than two decades since its implementation. However, relative to the problems of current rural laborer transfer, the existing rural land system still has certain defects. And the defects have increasingly limited the transfer of rural labor forces and the sustainable development of rural economy^[13]. In China, the scanty arable land and low comparative interests of agriculture lead to the transfer of agricultural laborers. Limited by the existing household contract system of land, the land use right of the transferred land can not be reasonably arranged; the land resources can not be effectively distributed and the input on land is short seriously. Besides, the decentralized management and low efficiency of land use make it difficult to realize the scale operation of rural land. At the same time, the over average of land enslaves many agricultural laborers and lands, and the peasant households with non-agricultural production are widespread. In addition, like migratory birds, many migrant workers rush between urban and rural areas according to the seasons, so the agricultural laborers can not be transferred completely. Under the current land system, the laborers transferred are mainly middle-aged men and the laborers left are mainly aged people and women, thus the quality structure of agricultural laborers will be changed obviously. Therefore, the current land system has negative impact on agricultural laborers.

3.2 The influences of birth control policy The birth control policy has direct influence on the development of population. In view of the problems arising from the implementation of birth-control policy, there are great changes in the near 24 years. Generally speaking, from the 1980s to the present, the birth control has experienced the process of "tolerable-severe-appropriate relaxation", which has great effect on the newly born people and directly affected the newly appeared laborers. Under the tolerable policy, the newly born population will increase and the proportion of male and female is rational. But under the severe policy, the newly-born people will decrease and the proportion of sex will lose its balance. So the birth control policy directly affects the quantity and quality of newly-emerged laborers.

3.3 The influences of arable land marginalization Arable land marginalization is a process driven by the comprehensive factors of society, economy, politics and environment, and it is

a process in which the arable land loses its economic productivity under the existing situation of land use and society-economy structure. During the process of arable land marginalization, the peasant households hold different attitudes toward it, which leads to the great change in terms of intensity of land use, sown acreage, transfer of land functions and land management system^[14]. With the up of the prices of agricultural materials and the increase of the opportunity costs of undertaking agriculture, the net income of land goes down or even goes to zero. Driven by the maximum of profits, farmers allocate their laborers by themselves reasonably in different regions and different industries, so as to seek the maximum of interest^[15-16]. It can be seen that arable land marginalization has positive effects on pushing forward the transfer of agricultural laborers, but in general, the male labors with high quality will be transferred priorly.

3.4 The influences of urbanization and industrialization

The pace of urbanization and industrialization has close relations to the transfer of agricultural laborers. The development of industrialization and urbanization has certain effects on the scale and speed of the agricultural laborers transfer, which including transferring from agricultural laborers to non-agricultural laborers and from rural areas to urban areas^[17]. Due to the unbalanced regional economy, the speed of urbanization and industrialization varies hugely. In eastern China and the littoral regions, the proportion of the secondary and tertiary industries is large, and the urbanization and industrialization are fast, so they need a large number of workers and farmers, which provides job opportunities and survival space for agricultural laborers. At the same time, the orderly transfer of agricultural laborers provides engine for the rural system reform and intensive development of agriculture. However, in the central and western regions of China, the irrational economic structure and low level of industrialization and urbanization lead to the distant migration of numerous rural surplus labor forces. But the urbanization is unstable, for the low comparative interests of agriculture will force farmers to leave the land and the high comparative interests will attract them back. Farmers do not have high input on land use and long term plan for it and they will change their jobs at any time.

4 The influences of scale and structure of agricultural laborers on food production

Under the fixed area of arable land, multiple-cropping index and the per unit area yield of grain are the two indicators, which directly determine the grain yield. In the paper, the management scale of peasant households, multiple-cropping index of grain, and sown area of grain, land productivity and labor productivity are chosen to indirectly study the influences of the changes of scale and structure of agricultural labors on food production.

4.1 The impacts on the scale of household management

It can be known from the questionnaires that, in 2009, 25 households have land with the area over 0.667 hm² and the aggregate contract area is 16.675 hm². In 1985, there is no household with the sown area over 0.667 hm², and most of the contracted land of big grain-cropping households comes from

the secondarily contracted land of the individual household, and that of the small grain-cropping households comes from the collective land.

Fig. 5 indicates that from 2003 to 2009, the area of the average farmland and the paddy fields of the survey peasant households increases rapidly. The area of farmland increases from 0.200 hm² per capita to 0.265 hm² per capita; the area of paddy fields increases from 0.155 hm² per capita to 0.227 hm² per capita.

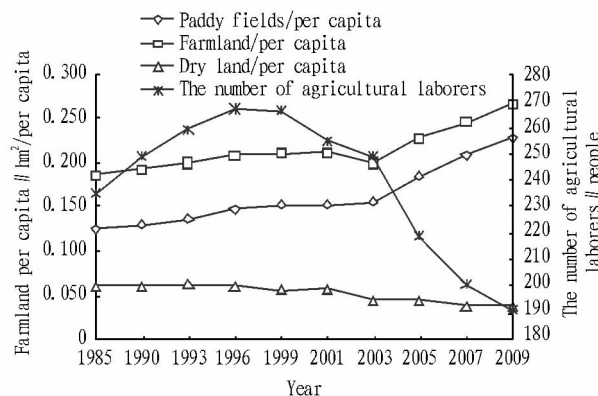


Fig. 5 The changes of Agricultural laborers and their impacts on agricultural land area of every farmer

Relying on the survey, the main reasons of the increase areas follows. Firstly the survey areas has implemented the preferential policies concerning agriculture since 2004, which eliminated the agricultural tax, thus peasant households' enthusiasm of cropping was improved. Secondly the manual work has been replaced by machine and tools, and the agricultural efficiency is lifted. Thirdly with the development of urbanization and industrialization, some agricultural laborers go to work in cities, which leads to the increase of the per capita sown area. The causes that limit the management scale of peasant households are backward water conservancy projects and the small pieces of fields.

4.2 The impacts on sown area and multiple-cropping index

4.2.1 The impacts on sown area. It can be known from Fig. 6 that in the recent two decades, the sown area of the survey peasant households has varied hugely and the changes in each period vary greatly as well. During the years from 1985 to 1996, the growth of sown area is relatively great, from the 72.93 hectare to 89.33 hectare; from 1996 to 2003, the sown area drops greatly, from 89.33 hectare to 63.76 hectare; from 2003 to 2009, the shrinkage of sown area is modest, from 63.76 hectare to 61.46 hectare. It is obvious that the study area has experienced the process from sharp growth to sharp down and to slight drop, and the drop is greater than the growth. Although China has launched the preferential policies concerning farmers, the drop of sown area of food production has not been controlled.

During this period, the quantity of agricultural laborers still experience the process of "sharp growth and sharp drop", but the changing rate is smaller than the sown areas of food production. It indicates that the changes of agricultural laborers

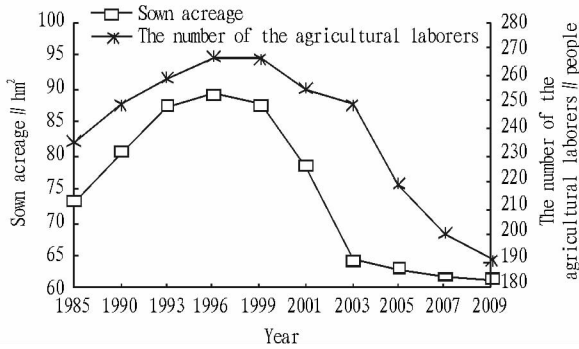


Fig. 6 The changes of Agricultural laborers in household and their impacts on sown acreage of grain

have great impacts on the changes of sown area.

4.2.2 The impacts on multiple-cropping index. The multiple-cropping index is the proportion of the sown area of grain in the whole year to the agricultural area and it is represented by percentage to show the degree of arable land use. The overall multiple-cropping index of the survey households shows the downward trend. During the years from 1985 to 2009, the multiple-cropping index decreases from 167.01% to 121.47%. The time can be divided into two periods: (1) From 1985 to 1993, the multiple-cropping index increases from 167.01% to 168.59%; (2) From 1993 to 2009, the multiple-cropping index drops from 168.59% to 121.47%.

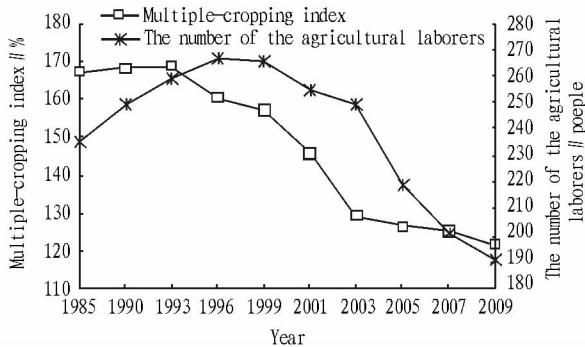


Fig. 7 The changes of Agricultural laborers in household and its impacts on the grain multi-cropping index

The changes of multiple-cropping index are affected by many factors. Through surveying and analyzing, the following main reasons can be concluded. The first one is the seasonal abandon of land caused by the decrease of agricultural laborers, which directly leads to the decrease of sown acreage of grain, and then resulting in the drop of multiple-cropping index. The second one is the decrease of the quantity of agricultural laborers, for example, the increase of aged and women laborers has decreased the labor productivity. The third one is the changes of farming pattern, for example the changes from traditional rice-the shift from wheat to rice-economic crops-vegetables and so on. The fourth one is the up of the prices of fertilizer, pesticide, weeds and labor forces lead to the high cost of planting wheat and minor cereals. It can be seen that the changes of the quantity and quality of agricultural laborers have great impact on multiple-cropping index of grain and directly affects the output of food.

4.3 The impact on land productivity The per unit area yield of grain shows the situation of land productivity. The per unit area yield of grain refers to the amount of food produced per hectare in the actual farming acreage of grain. The per unit area yield of the survey peasant households can be seen on Fig. 8.

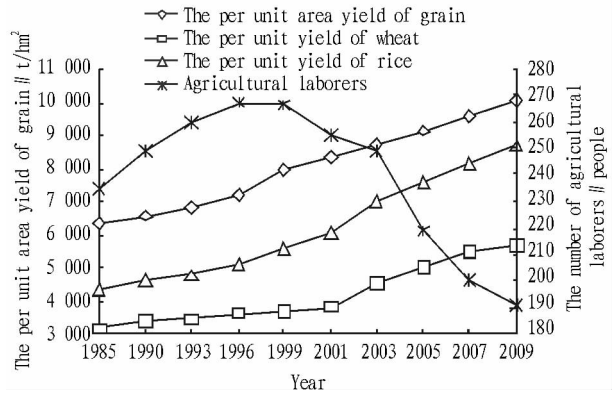


Fig. 8 The changes of Agricultural laborers in household and their impacts on Land productivity

From 1985 to 2009, the per unit area yield of the survey peasant households, per unit area yield of rice and the overall per unit area yield of wheat increase continuously. The change has positive effect on increasing food production under the decrease of multiple-cropping index. In the following parts, the per unit area yield level of peasant households with the different number of family members, age structures and education background is analyzed, then the impacts of the changes of agricultural laborers on land productivity can be obtained.

4.3.1 The impacts of the number of laborers on land productivity. Table 2 shows the per unit area yield of grain in peasant households with different number of agricultural laborers. It can be seen from the table that the per unit area yield of peasant household with four members is slightly higher than peasant household with three members and the same phenomenon appears in 2005, 2007 and 2009. The more the number of agricultural laborers, the better the management of farmlands and the less loses of grain. In the peasant household with only one labor, the management on farmland is insufficient and the per unit area yield is relatively small. Briefly, the changes of the quantity of agricultural laborers have certain impact on the per unit area yield of grain.

Table 2 The average level of grain yield in different number of agricultural labour rural households in 2005, 2007 and 2009

	t/hm ²			
Year	One	Two	Three	Four
2005	7 225.35	7 518.25	7 559.55	7 621.03
2007	7 729.68	8 153.31	8 219.99	8 333.68
2009	7 935.83	8 624.19	8 753.79	8 813.32

4.3.2 The impacts of the age of agricultural laborers on land productivity. From Table 3, it can be seen that the per unit area yield in peasant households with the labors aged among 41 – 50 years old is higher than that in other age bracket, for in this

bracket, the agricultural laborers have rich experience of farming and rich physical energy; per unit area yield of grain in the age bracket of 31 to 40 is higher than that in the age bracket of 51 to 60 years old; households with labors older than 69 years old have the lowest per unit area yield of grain, for they are too old to accept the new technology. Therefore, the agricultural laborers have great impacts on the per unit area yield of grain, and the phenomenon of "aging" and "fracture" of agricultural laborers should not be neglected.

4.3.3 The impacts of the cultural quality of agricultural laborers on land productivity. From Table 4, it can be seen that, the household owners who are illiterate have low per unit area yield; owners who have accepted high school education and technical secondary education have high per unit area yield; the

Table 4 The average level of grain yield in different education level of rural households in 2005, 2007 and 2009 t/hm²

Year	Illiterate	Semi-illiterate	Primary school	Junior high school education	Technical secondary education	High school education	Junior college
2005	5 843.57	6 855.67	7 485.83	7 754.09	7 496.63	8 321.95	8 515.36
2007	5 845.43	7 825.77	8 033.39	8 393.08	7 827.01	9 125.68	8 978.29
2009	6 191.92	8 272.41	8 510.14	8 904.91	8 297.30	9 402.36	9 452.11

In summary, the per unit area yield of grain of different rural households is affected comprehensively by the quantity and quality of agricultural laborers, among which the age of them has the greater impacts on it.

The small scale of agricultural laborers and the decrease of the quality of them will lead to the neglecting of management and the phenomena of selecting the crops and the farming pattern without large amount of labor forces, which will cause the sown acreage of grain crops and the multiple-cropping index and then indirectly affect the yield of grain. Although the total output of grain has increased under the decrease of agricultural laborers, the increase is achieved by increasing the per unit area yield through agricultural technology. However, the per unit area yield of grain will not increase lastingly, and the appropriate scale and high quality of agricultural laborers will further increase the per unit area yield of grain, so keeping appropriate agricultural laborers and rational structure of age, sex and education degree are important factors for stabilizing the output of grain.

5 Conclusions and enlightenments

5.1 Conclusions In the paper, the impacts of the changes of scale and structure of agricultural laborers on food production, the results are as follows. Firstly, in the years from 1985 to 2009, the quality of agricultural laborers shows the downward trend, which is mainly presented by the "fracture" and "aging" of agricultural laborers; most agricultural laborers do not have high level of education and many of them only accept the primary school education or even below; the agricultural technology is backward. Secondly, the main reasons that cause the changes of the scale and structure of agricultural laborers cover the rural land system, birth control policy, rural land marginalization and urbanization. Thirdly, the excessive small scale of agricultural laborers in rural households has relatively greater negative impacts on multiple-cropping index. Besides, the per unit area yield of grain is affected comprehensively by the quantity and quality of agricultural laborers. Fourthly, with the ad-

per unit area yield of owners who have accepted junior high school education is higher than that of owners who have accepted the technical secondary school education, for the owners or family members with technical secondary school education is slightly older. Briefly, the cultural quality has certain impacts on the per unit area yield of grain.

Table 3 The average level of grain yield in different age groups of rural households in 2005, 2007 and 2009 t/hm²

Year	18-30 years old	31-40 years old	41-50 years old	51-60 years old	Over 60 years old
2005	6 692.83	7 797.67	7 954.58	7 193.63	6 637.26
2007	-	8 211.97	8 583.06	7 727.00	7 302.73
2009	-	8 668.10	9 061.99	8 186.46	7 589.00

vancement of agricultural technology, the per unit area yield of grain and the overall level of grain have been enhanced. However, from the lateral comparison of grain yield of different rural households, it is still important for keeping appropriate scale and sex, age and cultural structure of agricultural laborers so as to ensure the stability of food production.

5.2 Enlightenments Firstly, the agricultural laborers have been transferred excessively. As a result of the excessive transfer of laborers, the shortage of labors emerges in rural areas which originally have abundant labors. The survey shows that about 10% of rural households abandon the contracted land due to the lack of labors. The scantiness of rural labors has directly led to the abandon of land and the neglecting of managing the water conservancy facilities, which do great harm to agricultural production.

Secondly, the current preferential policies concerning agriculture still need further reforming. The current preferential policies concerning agriculture have not improved the decrease of sown acreage and the over decrease of multiple-cropping index, as well as the excessive decrease of agricultural laborers. It indicates that there is still a long way to go for the preferential policies concerning agriculture.

Thirdly, the rural land transference requires marketization. The marketization of rural land transfer is helpful for reducing the costs of it and for speeding up the rural land transference. In addition, the effective allocation of farmland can be guaranteed, which is beneficial to ensuring the sown acreage of grain, lifting the multiple-cropping index of grain and stabilizing the production of grain.

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