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Temporal & Spatial Variation and Benefit Analysis of Farmers Fertilizer at Tarim River Basin

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Abstract
Along with the continuous development of the fertilizer industry, it provides a large extent of impetus to cultivation. This paper analyzes based on the temporal & spatial variation and planting efficiency of farmers fertilizer at Tarim River Basin, it finds that farmers fertilizer provides a large extent of impetus to cultivation. Therefore, using cointegration method to analyze influence of planting efficiency with farmers fertilizer at Tarim River Basin, the model results show that farmers fertilization amount with planting efficiency at Tarim River Basin and prefectures exists a positive correlation, and the influence of the order is same as the fertilization amount with planting efficiency growth. On this basis, it proposes suggestions on farmers reasonable fertilization.

Key words: Tarim River Basin; Fertilization; Plant production value

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INTRODUCTION

Tarim River Basin is the biggest inland river in China and it is located at Southern Xinjiang, including autonomous region like Bayingolin Mongol Autonomous Prefecture, Aksu Prefecture, Kashi Prefecture, Kizilsu Kirghiz Autonomous Prefecture and Hetian Regions of 5 prefectures in total 42 counties. After the reform and opening up, the economy and society of Tarim River Basin is in continuous development and plant production value is continuously improved. Crop structure continuous develops from a grain-based aunitary structure to a diversified development structure of grain, cotton, fruit, etc.. In 2010, the farming area at Tarim River Basin raises up to 1970.11 thousand hectare, in which three crops acreage (grain, cotton and fruit) occupy the total planting area of 93.73% at Tarim River Basin. For the fertilization amount per unit area at Tarim River Basin, from 325.62 kg/hectares in 1998 increases to 393.60kg/hectares in 2010, which is higher than Xinjiang for 118.12kg/hectares, it is 1.43 times more than Xinjiang's and 2.07 times more than Northern Xinjiang. The average annual increases by 1.59%, which is more than twice of developed country such as America (Buck, 2000). After the reform and opening up, along with the rapid increase of agricultural material inputs, especially the rapid increase of fertilizer inputs, Agricultural economy of Tarim River Basin can develop rapidly. The value of agricultural production continued to grow, and the structure is gradually optimized, so that the farmers' income is continuously improved. However, in terms of comparing Tarim River Basin with China's central and eastern regions, The late start of the agricultural economy and the slowly growth makes the stage lag behind. For the current of overall national agricultural economy is already in the right side of EKC curve, the increasing in agricultural material inputs can no longer pushing the increase yield of agricultural products. Thus facing the transformation of this situation, whether the stage of the agricultural economy and increase in agricultural material inputs at Tarim River Basin can continue to ensure the growth of the agricultural economy remains to be seen. For the microeconomic subjects of farmers as the chemical fertilizer behavior, in order to maximize the pursuit of crop production income, such technical means of biochemical agricultural production like chemical fertilizer is used and administering more fertilizer to a certain extent. However, according to the law of diminishing land returns, after chemical fertilizer application amount exceeds the equilibrium point, the excess application amount can cause crops economic benefits gradually decreased, it also causes varying degrees of harm to land, water resources and human. Therefore, studying temporal & spatial variation of farmers fertilizer at Tarim River Basin, investigating the benefit of agricultural materials such as chemical fertilizer both posses important significance. This paper starts from the input intensity and strength of chemical fertilizer at Tarim River Basin, tracing the temporal & spatial variation of farmers fertilizer at Tarim River Basin. Thus, investigating the contribution of fertilizer inputs for planting efficiency growth at Tarim River Basin, and based on this suggests some corresponding countermeasures.

1. FARMERS FERTILIZER AND PLANTING EFFICIENCY CHANGES AT TARIM RIVER BASIN

1.1 Temporal & Spatial Variation of Farmers Fertilizer at Tarim River Basin

In recent years, the total amount of chemical fertilizer used in Tarim River Basin showed a trend of sustained increase, with respect to the Xinjiang, the total amount of chemical fertilizer used in Southern Xinjiang of Tarim River Basin is higher. During 1998-2010, usage net volume of chemical fertilizer in Tarim River Basin increase from 359,200 tons to 666,500 tones (An increase of 1.86 times), its average annual growth is 5.29%, which occupies approx. 60% of the total amount of chemical fertilizer used in Xinjiang. However, with respect to the growth rate of the chemical fertilizer at Xinjiang (6.02%), a slight declined is appeared the occupying proportion of total amount of chemical fertilizer used in Xinjiang drops from 64.08% to 58.97%, its growth rates were also lower than Northern and Eastern Xinjiang. Over the same period, the amount of chemical fertilizer used in Northern Xinjiang increase from 185,900 tons to 432,700 tons (An increase of 2.33 times), its average annual growth is 7.30%; the amount of chemical fertilizer used in Eastern Xinjiang increase from 15,400 tons to 31,000t tons (An increase of 2.01times), its average annual growth is 5.98%. During the period, the amount of chemical fertilizer used in Tarim River Basin appears a trend of decreased and then increased. It is dropped to the lowest point during the period in 2000 which is 303,700 tons, it might be due to the excessive burden on farmers, willingness of engaged in plantation is lowered and it results in the application amount of agricultural materials such as chemical fertilizer is reduced. Later, because of gradual implementation of national agricultural tax waiver policy, willingness of engaged in plantation is increased, application amount of chemical fertilizer is gradually increased.

From the view of applied chemical fertilizer intensity: Chemical fertilizer used in Southern Xinjiang of Tarim River Basin mainly are nitrogen and phosphate fertilizer, in which nitrogen fertilizer usage increase from 1998 (183,300 tons) to 2010 (328,400 tons), its average annual growth is 4.98%, the growth is slow. It occupies approx 50% of the total amount of chemical fertilizer used in Tarim River Basin which 2% higher than Xinjiang; Phosphate fertilizer usage increase from 105,800 tons to 219,500 tons, its average annual growth is 6.27%, the growth is faster. It occupies above 30% of the total amount of chemical fertilizer used in Tarim River Basin; Potassium fertilizer usage is the lowest which displayed a fluctuating of upward trend. Potassium fertilizer usage increase from 18,700 tons to 35,100 tons, its average annual growth is 5.38%. It occupies approx 5% of the total amount of chemical fertilizer used in Tarim River Basin.

Nitrogen, phosphorus, and potassium fertilizer used in Tarim River Basin with respect to Xinjiang also occupies a higher proportion. Among, Nitrogen fertilizer usage in Tarim River Basin occupies above 60% of the total amount of nitrogen fertilizer used in Xinjiang and it has been relatively stable; phosphorus fertilizer usage in Tarim River Basin are larger, which occupies a larger proportion of the total amount of potassium fertilizer used in Xinjiang, but it has been a gradual decrease from 75% to 68%; potassium fertilizer usage in Tarim River Basin has also been a gradual decrease, which occupying proportion of the total amount of phosphorus fertilizer used in Xinjiang reduces from 88.9% to 55.8%, its decline are larger.

In summary, regardless of chemical fertilizer total usage in Southern Xinjiang of Tarim River Basin, or view from chemical fertilizer constitutes (ie. nitrogen, phosphorus and potassium fertilizer total usage), both shows a trend of continued growth; However, view from the proportion of total amount of chemical fertilizer used in Tarim River Basin occupying in Xinjiang, it shows a trend of decreasing. View from chemical fertilizer constitutes in Southern Xinjiang of Tarim River Basin, it mainly is nitrogen and phosphate fertilizer, in which nitrogen fertilizer inputs occupies above 50%, phosphate fertilizer inputs occupies above 30% and potassium fertilizer inputs occupies above 5%; from the view of the proportion trends of total amount of nitrogen, phosphate and potassium fertilizer used in Southern Xinjiang of Tarim River Basin occupying in Xinjiang, nitrogen fertilizer is relatively stable and maintain at 60%, proportion of phosphate and potassium fertilizer shows a decline trend, in which potassium fertilizer decline larger.

Table 1
Application Intensity of Nitrogen, Phosphate and Potassium Fertilizer Used in Tarim River Basin (1998-2010)

Unit: ton, %

Year	Tarim River Basin	Nitrogen fertilizer	Proportion	Phosphate fertilizer	Proportion	potassium fertilizer	Proportion
1998	359163	183357	61.87	105795	74.77	18692	88.92
1999	312190	161810	59.83	91689	71.67	12091	79.71
2000	303731	161200	60.1	86271	71.95	12010	80.59
2001	330561	166228	60.44	112173	72.24	10490	72.88
2002	316712	167792	58.95	101416	68.79	10371	66.7
2003	348092	178732	60.36	118330	71.41	12211	71.23
2004	377716	193522	60.39	124220	71.22	17739	74.36
2005	425539			140379	71.22	20866	71.19
2006	474455	243882	63.26	166148	74.05	20564	67.3
2007	520017	257087	61.87	183998	73.08	25077	67.11
2008	596496	303561	62.53	196502	69.06	29239	59.35
2009	629401	311839	61.71	205364	68.94	34168	59.29
2010	666532	328391	61.47	219515	67.7	35063	55.84

Source: Xinjiang Statistical Yearbook of 1999-2011;
Note: Proportion refers to the proportion of net volume of nitrogen, phosphate and potassium fertilizer used in Southern Xinjiang occupying nitrogen, phosphate and potassium fertilizer used in Xinjiang

Application intensity of chemical fertilizer at prefectures of Tarim River Basin shows a significant spatial differences. From the view of total amount of chemical fertilizers usage: amount of chemical fertilizers usage in Kashi Prefecture is the highest, which occupies above 40% of total amount of chemical fertilizers usage in Tarim River Basin; amount of chemical fertilizers usage in Aksu Prefecture takes the second place, which occupies above 33% of total amount of chemical fertilizers usage in Tarim River Basin; amount of chemical fertilizers usage in Bazhou occupies above 17% of total amount of chemical fertilizers usage in Tarim River Basin; The overall level of amount of chemical fertilizers usage in Hetian and Kezhou are lower, which occupies less than 10% and 2% of total amount of chemical fertilizers usage in Tarim River Basin.

View from time change of amount of chemical fertilizer usage at prefectures of Tarim River Basin: The growth of amount of chemical fertilizer usage in Bazhou is the fastest, increasing from 40,900 tons(1998) to 115,100 tons(2010), which increased of 2.81times and its average annual increase is 8.99%; Followed byAksu Prefecture, chemical fertilizer usage increased volatility from 105,100 tons to 214,800 tons, which increased of 2.04times and its average annual increase is 6.14%; chemical fertilizer usage increased volatility from 149,900 tons to 256,800tons in Kashi Prefecture and its average annual increase is 4.58%

Table 2
Application Intensity of Chemical Fertilizer at Prefectures of Tarim River Basin in 1998-2010

Unit: ton, %

Year	Bazhou		Aksu Prefecture		Kezhou		Kashi Prefecture		Hetian Prefecture	
	Net volume	Proportion	Net volume	Proportion	Net volume	Proportion	Net volume	Proportion	Net volume	Proportion
1998	40967	11.41	105127	29.27	9755	2.72	149880	41.73	53434	14.88
1999	47929	15.35	90294	28.92	11285	3.61	112166	35.93	50516	16.18
2000	43117	14.20	86886	28.61	10599	3.49	110059	36.24	53070	17.47
2001	46970	14.21	104342	31.57	8562	2.59	117265	35.47	53422	16.16
2002	47537	15.01	100489	31.73	8418	2.66	118832	37.52	41436	13.08
2003	57990	16.66	117735	33.82	9017	2.59	118880	34.15	44470	12.78
2004	62736	16.61	125606	33.25	9745	2.58	133546	35.36	46083	12.20
2005	73954	17.38	131610	30.93	9827	2.31	161137	37.87	49011	11.52
2006	82707	17.43	146031	30.78	11310	2.38	185252	39.05	49155	10.36
2007	95169	18.30	152665	29.36	12917	2.48	209260	40.24	50006	9.62
2008	105061	17.61	183971	30.84	13989	2.35	240415	40.30	53060	8.90
2009	109165	17.34	202633	32.19	15283	2.43	244332	38.82	57988	9.21
2010	115139	17.27	214831	32.23	16274	2.44	256809	38.53	63479	9.52

Source: Xinjiang Statistical Yearbook of 1999-2011.
Note: (1) Proportion refers to the proportion of net volume of nitrogen, phosphate and potassium fertilizer used in Southern Xinjiang occupying nitrogen, phosphate and potassium fertilizer used in Xinjiang
(2) The full name of Bazhou is Bayan Guo Lemeng ancient Autonomous Prefecture; The full name of Kezhou is Kizilsu Kirgiz Autonomous Prefecture.

From the view of spatial variation of nitrogen, phosphate and potassium fertilizer at prefectures, the amount of nitrogen, phosphate and potassium fertilizer used in Kashi Prefecture and Aksu Prefecture are higher, followed by Bazhou and Hetian regions, and Kezhou is lesser. The nitrogen, phosphate and potassium fertilizer of Kashi Prefecture in 1998-2010 accounted for an average of 37.34%, 40.35% and 39.23% of Tarim River Basin. The nitrogen, phosphate and potassium fertilizer usage in Bazhou accounted for 16.69%, 14.26% and 16.29%, Hetian regions accounted for an average of 14.11%, 10.10% and 11.3%. Various elements of chemical fertilizer in Kezhou accounted for less than 3.6%.

From the view of time change of amount of nitrogen, phosphate and potassium fertilizer used at prefectures, the growth rate of chemical fertilizer in Bazhou is the fastest, followed by Aksu Prefecture. Amount of potassium fertilizer used in Bazhou increase from 605 tons (1998) to 7127 tons (2010) and its annual average increase is 22.82%, which higher than Tarim River Basin for 17.44%. Amount of phosphate fertilizer used increase from 8344 tons to 32313 tons and its annual average increase is 11.94%, which is higher than Tarim River Basin for 5.67%. Amount of potassium fertilizer used increase from 22744 tons to 60489 tons and its annual average increase is 4.49%, which higher than Tarim River Basin for 3.52%. Amount of phosphate fertilizer used in Aksu Prefecture increase from 28770 tons to 78422 tons and its annual average increase is 9.72%, which higher than Tarim River Basin for 2.44%. Amount of nitrogen fertilizer used increase from 49860 tons to 100998 tons and its annual average increase is 6.06%, which higher than Tarim River Basin for 1.08%. Potassium fertilizer increases from 4166 tons to 8404 tons and its annual average increase is 6.02%, which higher than Tarim River Basin for 0.64%.; Amount of potassium fertilizer used in Kezhou increase from 451 tons to 943 tons and its annual average increase is 6.34%. Nitrogen fertilizer increases from 4277 tons to 8566 tons and its annual average increase is 5.96%. Annual average increase of phosphate fertilizer is 0.81%.

Overall, the total amount of chemical fertilizer used in Tarim River Basin occupies a larger proportion of the total amount of chemical fertilizer used in Xinjiang, the Average annual growth rate of application intensity of chemical fertilizer are very fast too. From the view of the trend of the total amount of chemical fertilizer used in Tarim River Basin, nitrogen fertilizer used in southern Xinjiang regions occupies the highest proportion of the amount of chemical fertilizer usage, but it is in decline trend; Growth rate of potassium and phosphate fertilizer is faster. From the view of chemical fertilizer usage in sub-regional, Kashi Prefecture and Aksu Prefecture occupies a higher proportion in Tarim River Basin. The growth rate of Bazhou is the fastest and it is higher than the average level of Xinjiang.

1.2 Efficiency Change of Farmers Planting at Tarim River Basin

During 1998-2010, planting efficiency of farmers at Tarim River Basin appears a trend of sustained growth, continued to grow from 17009831.1 thousand dollars(1998) to 45726910 thousand dollars(2010) and its average annual increase is 8.59%, and the average annual account for 55.53% of Xinjiang which provides a large contribution to planting efficiency of Xinjiang. Among, the growth rate of Bazhou regions are fastest, increase from 2204186.1 thousand dollars to 12793830 thousand dollars and its average annual increase is 15.8%,which more than Xinjiang for 6.52%; Kashi Prefecture and Aksu Prefecture occupy a larger proportion, Kashi Prefecture increase from 6389328.1 thousand dollars to 15354690 thousand dollars and its average annual increase is 7.58%; Aksu Prefecture increase from 5373336.5 thousand dollars to 12080140 thousand dollars and its average annual increase is 6.98%, in which both occupy 35.04% and 29.01% at Tarim River Basin respectively.

2. BENEFIT ANALYSIS OF FARMERS FERTILIZER AT TARIM RIVER BASIN

From temporal and spatial variation analysis of farmers fertilizer at Tarim River Basin, it shows that farmers fertilizer at Tarim River Basin is continued to increase and the planting efficiency is also continued to increase. To do this, writers take the cointegration analysis to investigate the specific influence of farmers fertilizer with planting efficiency, which the amount of chemical fertilizer increase 1% will bring how much increase in planting efficiency.

Let plant production value (Y) be the explained variable which represents the planting efficiency, and let total amount of chemical fertilizer used in prefectures of Tarim River Basin (X) be the explanatory variable which represents farmers fertilizer changes, the basic formula of regression model is:

$$Y = C+\alpha X \qquad (3\text{-}1)$$

In which: C is the constant and α is the contribution of farmers fertilizer with planting efficiency.

After the data standardization processing(logarithmic and differential), and via the unit root test, Johansen cointegration test and T-test of the model, as shown in table 3, 4, 5:

Table 3
The Result of Unit Root Test

Variable		Differential Numbers	(C,T,K)	DW Value	ADF Value	1% Critical Value	5% Critical Value	10% Threshold
Tarim River	LNY	1	（C,0,1)	1.379464	-8.000226*	-4.200056	-3.175352	-2.728985
Basin	LNX	0	（C,T,1）	2.452634	-4.603666**	-4.992279	-3.875302	-3.38833
Bazhou	LNY1	2	（0,0,1）	1.998307	-5.333055*	-2.81674	-1.982344	-1.601144
	DLNX1	2	（0,0,1）	2.007679	-19.60155*	-2.84725	-1.988198	-1.60014
Aksu	LNY2	0	（C,T,1）	1.036881	-6.71722*	-4.992279	-3.875302	-3.38833
Prefecture	LNX2	1	（C,0,1)	2.762329	-4.495476*	-4.200056	-3.175352	-2.728985
Kezhou	LNY3	2	（0,0,1）	1.808418	-3.005756*	-2.81674	-1.982344	-1.601144
	LNX3	2	（0,0,1）	2.321013	-3.404966*	-2.81674	-1.982344	-1.601144
Kashi	LNY4	2	（0,0,1）	1.219173	-6.954263*	-2.81674	-1.982344	-1.601144
Prefecture	LNX4	1	（C,0,1)	1.593245	-4.846661*	-4.200056	-3.175352	-2.728985
Hetian	LNY5	0	（C,T,1）	1.863841	-4.778331**	-4.992279	-3.875302	-3.38833
Prefecture	LNX5	2	（0,0,1）	2.442581	-5.16691*	-2.81674	-1.982344	-1.601144

Source: Statistics is calculated and collated from Xinjiang Statistical Yearbook.
Note: (1) (C, T, K) represents whether the ADF test contains constants, time trend or lagged Variable;
(2) *, **, *** represents significance level of 1%, 5% and 10% respectively.

Table 4
Results of Johansen Cointegration Test

			Trace Statistic	0.05 Critical Value	Prob.**	Max-Eigen Statistic	0.05 Critical Value	Prob.**
Tarim River Basin	LNY	LNX	24.39318	12.3209	0.0003	23.96698	11.2248	0.0002
Bazhou	LNY1	DLNX1	28.07777	20.26184	0.0034	22.31672	15.8921	0.0042
Aksu Prefecture	LNY2	LNX2	28.48028	12.3209	0.0001	27.95749	11.2248	0.0000
Kezhou	LNY3	LNX3	31.03624	12.3209	0.0000	26.23464	11.2248	0.0001
Kashi Prefecture	LNY4	LNX4	22.85522	12.3209	0.0006	20.82504	11.2248	0.0008
Hetian Prefecture	LNY5	LNX5	23.28765	12.3209	0.0005	17.88376	11.2248	0.0030

Source: Statistics is calculated and collated from Xinjiang Statistical Yearbook.
Note: T-statistics and λ-max statistics are both larger than the critical value of 1% significance level, and the probability are both less than 0.01, which indicates that it exist cointegration relationship.

Table 5
Results of T-test

	R^2	Adjusted R2	F value	Prob.	DW value
Tarim River Basin	0.985557	0.982668	341.1790	0.000000	1.674686
Bazhou	0.960588	0.957005	268.1044	0.000000	1.513530
Aksu Prefecture	0.995659	0.993489	458.7518	0.000000	2.660811
Kezhou	0.998345	0.996690	603.2323	0.000114	1.155741
Kashi Prefecture	0.985245	0.982294	333.8665	0.000000	1.204554
Hetian Prefecture	0.984132	0.978182	165.3867	0.000000	2.805841

Source: Statistics is calculated and collated from Xinjiang Statistical Yearbook.
Note: Adjusted R^2 value is less than the original value, and the probability is less than 0.01, which indicates that is passes the T-test and exist correlation.

In order to eliminate the autocorrelation of the model data sequence, the formula should be introduced AR and MA. The equation items pass the T-test, and its probability value are both less than 0.01. Model has no autocorrelation and heteroscedasticity, which indicates that this model passess the test.

The results of model as follows:

LNY=-4.10965*1.444645LNX+[MA(2)=0.802539] (3-2)

LNY1=-4.35771*1.555803DLNX1 (3-3)

LNY2=-1.78541*1.283205LNX2+[MA(1)=-1.36693;MA(2)=0.886359;MA(4)=-0.51192] (3-4)

LNY3=-5.96031*0.813852LNX3+[AR(6)=-1.75535;MA(4)=0.990009] (3-5)

LNY4=-2.21524*1.317271LNX4+[MA(2)=-0.97269] (3-6)

LNY5=7.77456*0.485766+[AR(1)=0.866546;MA(2)=1.014631] (3-7)

The above results show that rising 1% of amount of farmers fertilizers at Tarim River Basin, which leads to an increase of planting efficiency for 1.4446%. And the order of contribution degree of fertilization amount with planting efficiency in prefectures of Tarim River Basin is Bazhou(1.5558) > Kashi Prefecture (1.3173) > Aksu Prefecture (1.2832) > Kezhou (0.8139) > Hetian Prefecture (0.4858), which exactly matches the growth rate of farmers fertilizers with planting efficiency at Tarim River Basin. It indicates that farmers fertilizers produce a positive influence to planting efficiency at Tarim River Basin. At the same time, it indicates that Tarim River Basin is undergoing the early stage of planting efficiency growth, and the growth of plant production value can be promoted to some extent. However, domestic and foreign research shows that (HE & ZHANG, 2006; MA *et al*, 2001; ZHAO *et al*, 2009; DENG *et al*, 2001; Mander, 2000) continued increase in the amount of farmers fertilization amount, marginal benefit of planting will undergo growth first, and after reaching the equilibrium point it will be gradually decreased. This shows that Tarim River Basin is still fall behind most of the developed world for a very long period, and it is still at the stage of fertilization to promote the planting effective.

CONCLUSION AND SUGGESTIONS

This paper analyzes via the influence of farmers fertilizers with farming gains at Tarim River Basin, and obtained a results of an increase in chemical fertilizer usage of farmers at Tarim River Basin, with contribution degree of farming efficiency appears regional differences. Fertilizer efficiency of farmers at Tarim River Basin is still at the "law of diminishing land returns" which is at the left side of inverted U-shaped curve. Within a period of time in the future, sustained increase in chemical fertilizers inputs will still bring an increase of planting efficiency, but this quantity rather than quality, efficiency rather than environment, expansion outward rather than connotative development, this development mode of one-sided pursuit of planting efficiency growth must be unsustainable. Therefore, according the analysis results of temporal & spatial variation and model calculation of farmers fertilizer, we can give that the following three recommendations: (1) Tarim River Basin is a minority residential areas, education level of farmers is not high. Therefore, farmers fertilizer technology needs to be strengthened and equipped with more agricultural extension workers. Achieving growth in planting efficiency should mainly depend on the extensive mode of growth of agricultural resources inputs such as chemical fertilizers and transforms to mainly rely on intensive growth of scientific and technological progress, this is the main way of upgrade the competitiveness of the agricultural economy at Tarim River Basin. (2) Change the concept of unreasonable fertilization of farmers at Tarim River Basin. Part of fertilizing farmers are compared unidirectional and exists some ideas like "short-term benefits, path dependence". According to an estimation from the U.S. National Institute, the fertilizer absorption degree of crops with growth conditions of crops, method of fertilization has close relationship. Therefore, it should grasp the best timing and method of fertilization to obtain the best efficient of chemical fertilizer, and achieve the raised in planting efficiency. (3) Increase the farmers environmental awareness. For a long time, depending on the sustained inputs of agricultural resources like chemical fertilizers to drive the growth of planting efficiency, which causes excessive consumption of natural environment and serious damage of agro-ecological environment. Also, it also exists a certain degree of market price risk and the quality and safety problems of the agricultural products. Only mitigating the excessive reliance on fertilizers can improve the planting efficiency, environmental protection and the organic unity of the ecological construction.

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