CHAPTER 6

POLICY ANALYSIS AND IMPLICATION

6.1 Increasing Chemical Fertilizer Use Is the Strategy to Increase Crop Production.

The easier and faster way to promote crop production, obviously is increasing input use. As mentioned earlier, population growth, and the industrialization processes definitely are deriving higher demand for agricultural products, and the increasing demand trend is going to continue. How to meet the increasing demand is an urgent issue in Chinese society, this problem is even more severe in the mountainous Guizhou province. Based upon the results of the research, material input use has been a much greater contributor to crop production growth in comparison with productivity. From 1952 to 1990, input use was the dominant factor affecting crop production, in several periods of different institutional reform, most of crop production increases were also explained by the increased input use.

It is estimated that a shift of dependence upon input use to dependence upon both input use and productivity increase for boosting crop production, possibly will take a long time, and even much more time is needed for productivity to become a major contributor to crop production growth. Increasing input use, therefore, seems still to be the solution to the supply shortage problem of agricultural products in the coming future.

However, what kind of inputs use can be increased in crop production processes, in order to be effective and economically feasible, deserves careful considerations. Marginal product of input can be employed as a criterion for such a purpose. Presented in Tables 18 and 19 are average productivity and marginal value product of inputs in different years (calculation procedures are presented in appendix).

Table 18. Average productivity of inputs in 1952-1990

Year	Labor (Yuan/year)	Land (Yuan/mu)	Chemical fert. (Yuan/kg)	Manure fert. (Yuan/kg)
1952-1960 average	290.11	39.58	9.36	5.14
1961-1970 average	170.15	43.38	7.27	5.40
1971-1980 average	264.03	50.19	6.52	6.28
1981	274.85	60.90	5.23	7.42
1982	311.62	66.73	5.79	8.26
1983	298.32	69.16	5.48	7.83
1984	304.26	75.78	6.16	8.33
1985	267.86	66.98	5.67	7.16
1986	286.87	70.65	5.63	8.88
1987	282.40	69.85	5.29	9.10
1988	267.61	80.54	5.55	7.06
1989	265.27	80.05	5.41	7.17
1990	212.45	89.29	5.46	8.22

Table 19. Marginal value product of inputs in selected years

Year	Labor* (Yuan/year)	Land (Yuan/mu)	Chemical Fert. (Yuan/kg)	Manure Fert. (Yuan/kg)
1952-1960 average	151.07	21.53	1.84	1.44
1961-1970 average	133.52	24.73	2.11	1.09
1971-1980 average	121.90	30.27	2.63	0.59
1981	122.03	37.79	2.45	0.32
1982	137.34	41.63	2.78	0.27
1983	130.50	43.37	2.69	0.18
1984	132.11	47.77	3.10	0.10
1985	115.43	42.45	2.91	0.01

* Value of marginal product of labor was calculated for one more adult labor added to crop production for the whole production year.

If Marginal value product (MVP) of labor is counted on man-day basis, and the average work-day for rural labor is assumed 205 full days per year[8], then the marginal value product of labor is as follows:

Table 20. Marginal value product (MVP in yuan/man.day) of labor

Year	MVP	Year	MVP
1952-1960	0.74	1982	0.67
1961-1970	0.65	1983	0.64
1971-1980	0.59	1984	0.64 (1.38)*
1981	0.60	1985	0.56 (1.65)

* Number in parentheses is the average wage rage.

[8]Guizhou Association of Agricultural Economics: *Studies on Rural Economic Reform and Development*. Guiyang: Guizhou Publishing House, 1988.

It should note that, marginal value product of labor has long been small with values close to zero. It has been well below the wage rate in the corresponding time period. This low MVP values indicate that, in the crop production system of Guizhou province, labor resource has long been over-utilized. Thus labor productivity can be improved by reducing labor use in crop production processes.

Further land resource use or cropped area expansion can increase crop production. This can be accomplished in the following two ways: through opening new land, and through increasing land use intensity. The former however, theoretically possible, but in Guizhou province, with the very limited arable land resource, it is unlikely that much new agricultural land could be developed. The practical way left seems to be the second alternative, which is intensification of land use in the regions in which required physical conditions for increasing land use intensity are existing.

However, increasing chemical fertilizer use is the proper solution to raising crop production under the current circumstances in crop production systems of Guizhou province. In a short passage of time, a substantial increase in land use intensity further is, also unlikely. Increasing chemical fertilizer, with its MVP at 2.9 yuan per kg in 1985 and 3.04 yuan in two consecutive years of 1988 and 1989, 3.12 yuan in 1990, all well above its price[8] (the average prices of chemical fertilizer were 0.175 yuan/kg in 1975, 0.219 yuan in 1978, 0.276 yuan

[8] Based on *Guizhou Economic Manual, 1984*, and *Guizhou Annual Report, 1985, 1990.*

in 1980, 0.343 yuan in 1984, 0.503 yuan in 1989), can directly increase crop production for the time being. Increasing manure fertilizer use in the present crop production processes, however, can lead to little increase in crop production, according to the almost zero marginal value product of manure fertilizer estimated. But it will show its importance for the further crop production growth. That is, with the growing utilization of chemical fertilizer, soil fertility normally tends to decline unless appropriate soil fertility restoring measures are to be taken. Manure fertilization practice has a long history in Guizhou's crop production, it can be an effective method, in combination with chemical fertilizer, to increase land productivity, furthermore, to increase crop production.

Based upon the analysis above, the specific strategy for increasing crop production in 1990s can be figured out. With a large population at reproductive age, annual growth rate of population during 1990s will continue to be high. As a result of population growth together with industrial development, demand for agricultural products was estimated to grow rapidly (Table 21). To meet the required output growth, workable solutions are increasing use of chemical fertilizer, labor, in addition to more intensified land use. However, with fast growing opportunities created by urban-industrial development and low prevailing marginal value product of labor, a substantial growth in labor use in crop production are unlikely both technically and economically. Land use intensity is expected to increase in the first half of 1990s with an average 2.1% of sown area growth rate annually. After 1996, most of the increase in land use intensity will be

discounted by the decrease in the total agricultural land area, which will probably bring the total sown area growth rate down to 0.03%. Chemical fertilizer use has a great potential for crop production growth. Inputs use strategy for achieving the required output in corresponding year, considering the possible expansion of various inputs, were presented in Table 21, assuming that the contribution by technological change to crop production will keep at the same level of 1952-1990, 17.8% in every coming year.

Nevertheless, the undergoing price reform policy for agricultural products is expected to exert a strong impact on prices of both fertilizer and agricultural produces. The policy at this moment is critical and policy formulation should be very much cautious. Incentives to use more fertilizer can be created by either a reduction in fertilizer price, an increase in output price, or the elimination of constraints on fertilizer credit access. The price effect on crop production however, is beyond the scope of this study.

Table 21. Expected growth rate of inputs use to meet the population-induced demand for crop production, 1991-2000

Year	Est. popu. grow rate %*	Req. output growth %*	Possible Lb growth %	Exp. sown area growth %**	Est. Cfert. growth %
1991	1.78	3.90	0.0	2.10	3.66
			0.1		3.58
			0.2		3.56
			0.3		3.40
			0.4		3.33
			0.5		3.23
1992	1.77	3.80	0.0	2.10	3.48
			0.1		3.40
			0.2		3.31
			0.3		3.23
			0.4		3.15
			0.5		3.05
1993	1.75	3.70	0.0	2.10	3.33
			0.1		3.25
			0.2		3.15
			0.3		3.10
			0.4		2.99
			0.5		2.90
1994	1.73	3.60	0.0	2.10	3.17
			0.1		3.09
			0.2		3.05
			0.3		2.92
			0.4		2.84
			0.5		2.74
1995	1.69	3.50	0.0	2.10	2.99
			0.1		2.92
			0.2		2.82
			0.3		2.74
			0.4		2.67
			0.5		2.59

Table 21. (Continued)

Year	Est. popu. grow rate %*	Req. output growth %*	Possible Lb growth %	Exp. sown area growth %**	Est. Cfert. growth %
1996	1.64	3.50	0.0	2.10	2.99
			0.1		2.92
			0.2		2.82
			0.3		2.74
			0.4		2.67
			0.5		2.59
1997	1.59	3.40	0.0	0.03	5.39
			0.1		5.31
			0.2		5.21
			0.3		5.14
			0.4		5.06
			0.5		4.98
1998	1.57	3.30	0.0	0.03	5.23
			0.1		5.16
			0.2		5.06
			0.3		4.98
			0.4		4.90
			0.5		4.82
1999	1.56	3.20	0.0	0.03	5.08
			0.1		5.00
			0.2		4.92
			0.3		4.82
			0.4		4.75
			0.5		4.67
2000	1.55	3.20	0.0	0.03	5.08
			0.1		5.00
			0.2		4.92
			0.3		4.82
			0.4		4.75
			0.5		4.67

Note: *Est. popu. growth rate* for estimated population growth rate; *Req. output* for required output; *Lb* for labor in crop production; *exp.* for expected; *Cfert.* for chemical fertilizer.

* Estimated by Kang. *Problems and countermeasures in Guizhou province*, Monograph of GAAS, 1990

** Computed based on the expected sown area data by Sho. "*Problems and countermeasures in Guizhou province*" Monograph of GAAS, 1990.

6.2 Technology Development Is a Solution to Solve the Increasing Demand for Agricultural Produces in the Long Run.

It has become evident that development programs emphasizing on the increased use of traditional inputs in agriculture have contributed only modestly to agricultural output gains. Economists have increasingly turned to technical change as their major "engine of growth." (Peterson, and Hayami, 1977). The future sustainable growth of crop production in Guizhou province has to depend on technological change. The great potential in crop production seems to be in the area of technology. In the past four decades, contribution of technological progress to the crop production growth amounts to 17.77% of the total. After initiating the radical economic reform in 1980s, contribution by technological change was decreased to 9% of the total crop production increase. The smaller contributions by technological change to the crop production than that to the entire agriculture estimated by Fan (1991) at the national level indicates that, technological advancement in crop production system has been slower than the average level in agriculture for the whole nation as well as other provinces and regions. The underinvestment in agriculture has resulted in insufficient agricultural research which is the direct cause of slower technological change (Liao 1990). An increase in agricultural research and development can stimulate technological change (Fan 1991).

In the near future, the emphasis should be on developing and diffusing of neutral technology, e.g. cultivation practices, crop management skills, timing and amount of chemical fertilizer use, optimal resource use patterns and allocation, cropping system analysis, etc..

Those technologies can facilitate resource use efficiency, moreover, to increase resource productivity.

Biased technology, the increased quality of input used in production processes, can contribute more to crop production increase. In the past, biased technology explained only a small fraction of production change. For the crop production systems, among the biased technology, land and chemical fertilizer biased technology improvements have to be placed on the top schedule. Soil conservation techniques, construction of irrigation facilities, apart from research on improving effectiveness of chemical fertilizer, among others, are those areas which can contribute to the crop production growth.

6.3 Institutional Modifications Need to Be Made For a Sustained Crop Production Growth

Further institutional adjustments are seen as another effective solution to increase crop production besides input use increase. Institutional reform has been an important factor to the crop production in the past forty years. China has experienced three major institutional changes, the effects of each change on crop production are significantly different. Compared with other regions in China, the impacts of institutions in Guizhou are less (Fan 1991), the less effect suggests that institution in Guizhou province is less favorable for crop production and more has to be adjusted. The slower change in institution hampers crop production from moving ahead. In this study the effects of institution were reflected by the improvement of production efficiency. Judge from the estimated results, maximum production efficiency of crop

production during 1952 to 1990 period was 80.01% in the year of 1984. The average production efficiency in the last five year period of 1985 to 1990 was 75.94%. In 1990, it was 75.92%. Suppose crop production efficiency in 1990 was increased to the production efficiency (89.1%, Fan, 1991) for the whole agricultural sector of southwest China in 1984, the total value of crop production would be as much as 4265 million yuan, in stead of 3638 million yuan. This increase alone can bring the total value of crop production up by 17.3%.

Some aspects of institutions in the present crop production systems need to be modified in order to have an increase in production efficiency, which is a precondition for further promotion of crop production.

As the results of village survey indicate: highly fragmented farmland, widely scattered plots, lack of proper contract systems, are the top issues in the current crop production systems. A clear-cut policy on land tenure, transfer of land use rights, together with policy encouraging the development of rural industry and other activities to absorb surplus labor, can gradually alleviate the problems. In addition, a focus on greater specialization in crop production will be a workable strategy. In the mean time, resource distribution and the growing uneven income distribution issues, should not be ignored.

Resource immobility will still be the source of inefficiency in crop production. The introduction of factor and output markets have contributed to more efficient allocation of resources, but a lot of things are remained to be done. Shortage of chemical fertilizer supply, distorted prices for agricultural products, and instability of input

prices will continue to be the production constraints. Labor immobility, in particular, is a major source of low production efficiency (Fan, 1991). Creation of employment opportunities in the rural areas by introducing labor-intensive enterprises will contribute to both a higher crop production efficiency and a lower social cost of current rural labor migration from rural areas to far-away cities.

Reforming and strengthening functions of agricultural extension agencies. More efficient and effective extension agents in the rural will make more successful introduction of new crops and extension of newly-established technologies. A stronger linkage between technology producers and extension agents is an urgently necessity. However, in the reform era, how to form an efficient extension network, and how to select and manage agricultural research projects based on the needs of society to serve the purposes, are challenging topics.