



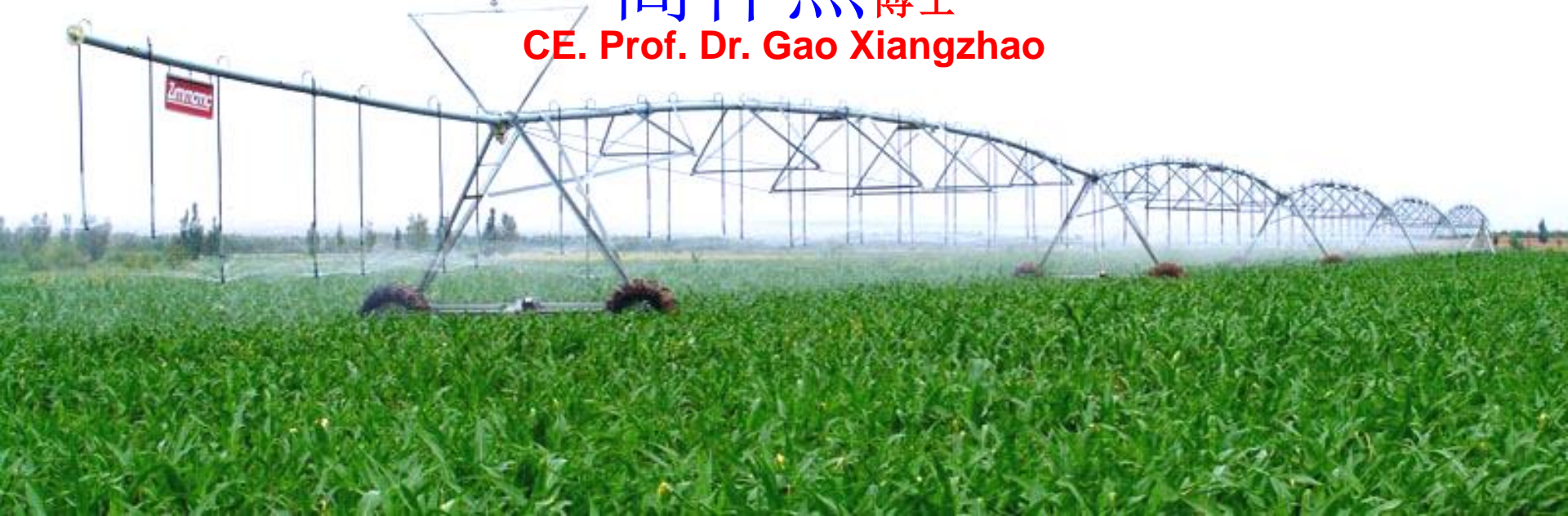


# 中国硫养分消费现状与展望

Sulphur Consumption in Chinese Agriculture:  
Situation and Outlook

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# 主要内容 Contents

- 土壤硫肥力状况 The soil S fertility in China
- 农田的硫养分投入状况 The S input on cropland in China
- 含硫肥料消费的现状 S fertilizer consumption in China
- 含硫肥料消费存在的主要问题 The problems of S fertilizer consumption in China
- 未来几年含硫肥料消费的发展走势 The trend of S fertilizer consumption in the future
- 引导硫养分合理消费的几点建议 Recommendations for efficient use of S fertilizer

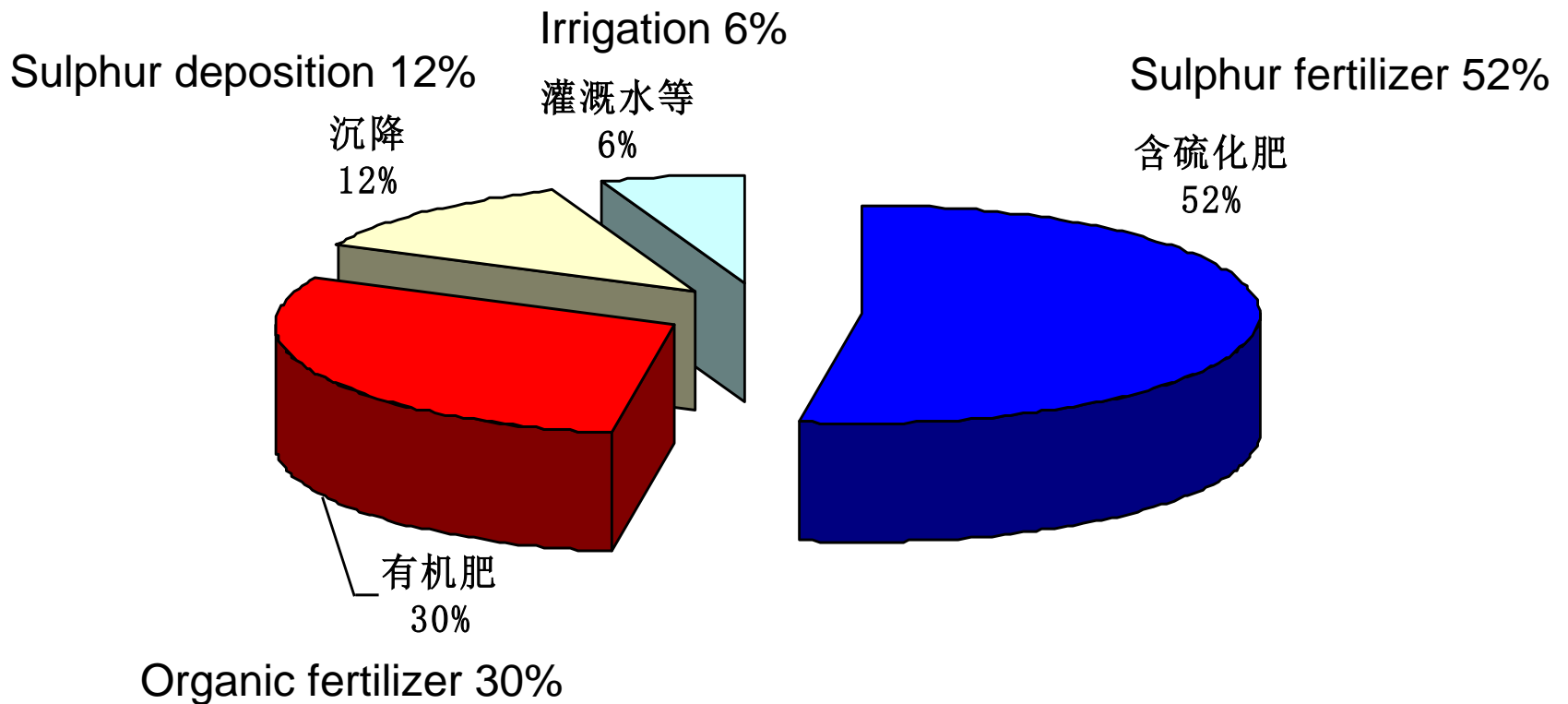
# 中国土壤硫肥力状况

## Soil S Fertility in China

- 全硫(S)含量大致在100-500 mg/kg 范围内,无机硫含量低。
- 南方湿热地区红黄壤中的硫容易分解淋失,含硫量较低
- 全国十几个省报道缺硫,硫肥施用效果明显
- Soil S contents range from 100 to 500 mg/kg, mostly are organic S, and inorganic S contents are low.
- S in red and yellow soils is easy to be mineralized and lost through leaching in South China
- More than ten provinces are reported S deficient in soils, and S fertilizers increased crop yields significantly.

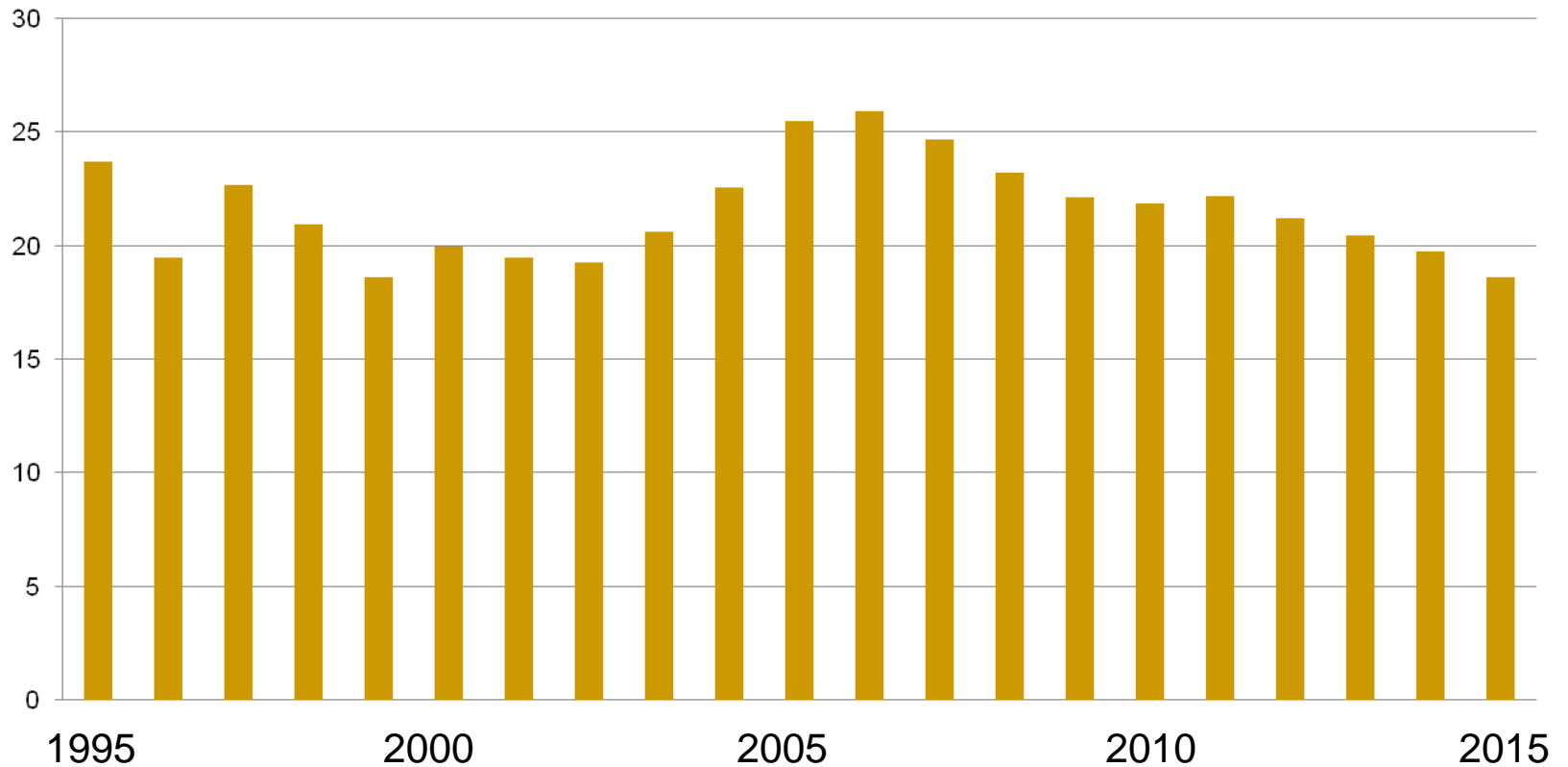
# 中国农田的硫资源投入状况

## S Input on Cropland in China

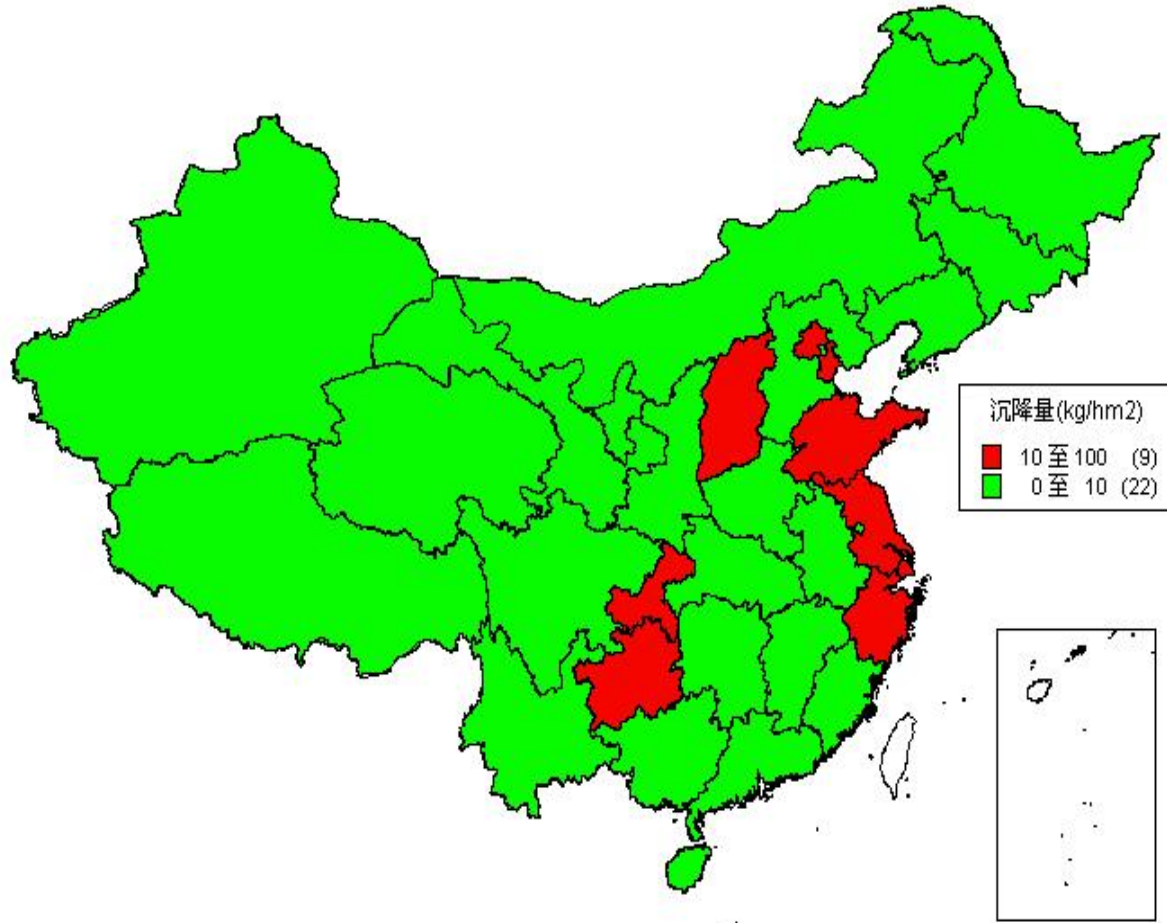


# 近年来中国SO<sub>2</sub>排放量基本稳定

## SO<sub>2</sub> Emission Stable in Recent Years



单位播种面积硫沉降量低于10kg/hm<sup>2</sup>的省份居多。  
S Deposition in Chinese Cropland: below 10 k  
g/ha in most provinces



# 农田系统硫资源平衡状况

## S Balance of Cropland in China

	1985	1995	2005	2015
农田系统硫资源的总投入量 Total S input on cropland	345.7	685.5	823.9	1200
作物生产的带出量 Removal of S by crops	138.6	378	490.1	630
农田损失和固定量 losses and fixation	207.2	307.5	333.8	570
作物带出占总投入的比例 (%) Ratio of crop removal to input	<b>40</b>	<b>55</b>	<b>59</b>	<b>47.5</b>



# 中国含硫肥料消费的现状

## S Fertilizer Consumption in China

- 中国含硫肥料消费的时空分布 The distribution of S fertilizer in China
- -----含硫肥料的消费结构与历史特征 The structure and history of S fertilizer consumption
- -----含硫肥料消费的区域分布 S fertilizer consumption by regions in China
- 基于主要作物的含硫肥料投入结构 S fertilizer consumptions and sources by cropping systems
- -----基于主要作物的过磷酸钙去向分析 About SSP
- -----基于主要作物的硫酸铵去向分析 About AS
- -----基于主要作物的硫酸钾去向分析 About SOP

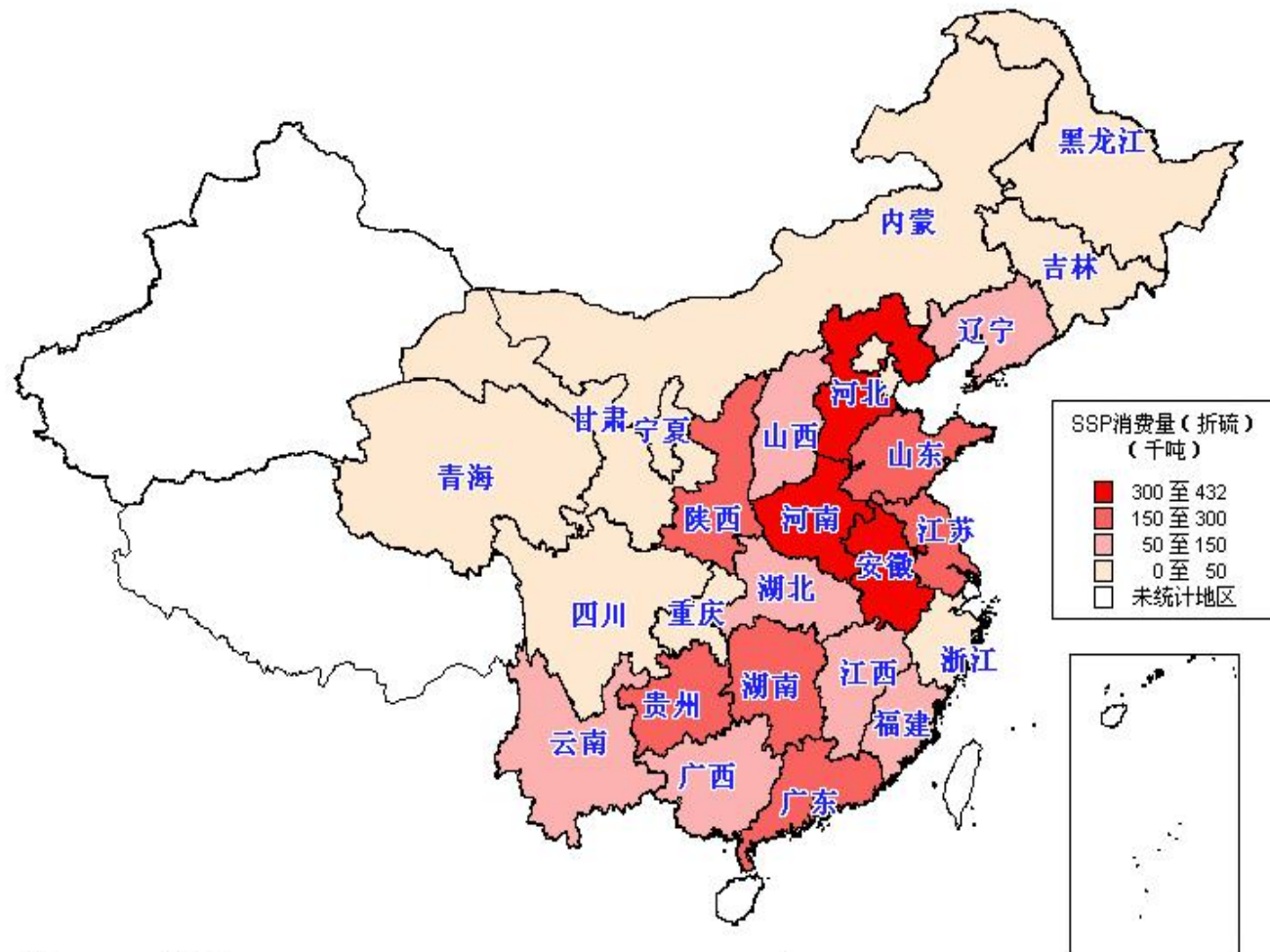
# 中国历年各种含硫肥料的消费状况

## S Consumption History in China (10,000 t S)

年份	过磷酸钙	硫酸铵	硫酸钾	重钙	硫基复合 肥	合计
Year	SSP	AS	SOP	TSP	NPK	Total
1952	0.1					0.1
1979	93.2	17.4				110.6
1983	126.2	13.4				139.6
1985	100.9	12.4				113.3
1987	175.1	13.0	5.0			193.1
1991	240.2	13.6	10.0	0.1		263.9
1994	256.3	11.5	10.8	0.2	3.7	282.5
1995	359.7	11.5	10.8	0.2	3.7	385.9
1997	313.7	11.0	12.0	0.3	8.5	345.5
2002	357.7	18.2	12.3	0.6	50.6	439.4
2005	352.6	20.0	20.3	0.9	49.6	443.4
2015	360.0	15.0	15.0	1.0	40.0	420.5

# 中国过磷酸钙消费的空间分布

## Spatial Distribution of SSP Consumption in China



# 中国硫酸铵消费的空间分布

## Spatial Distribution of AS Consumption in China

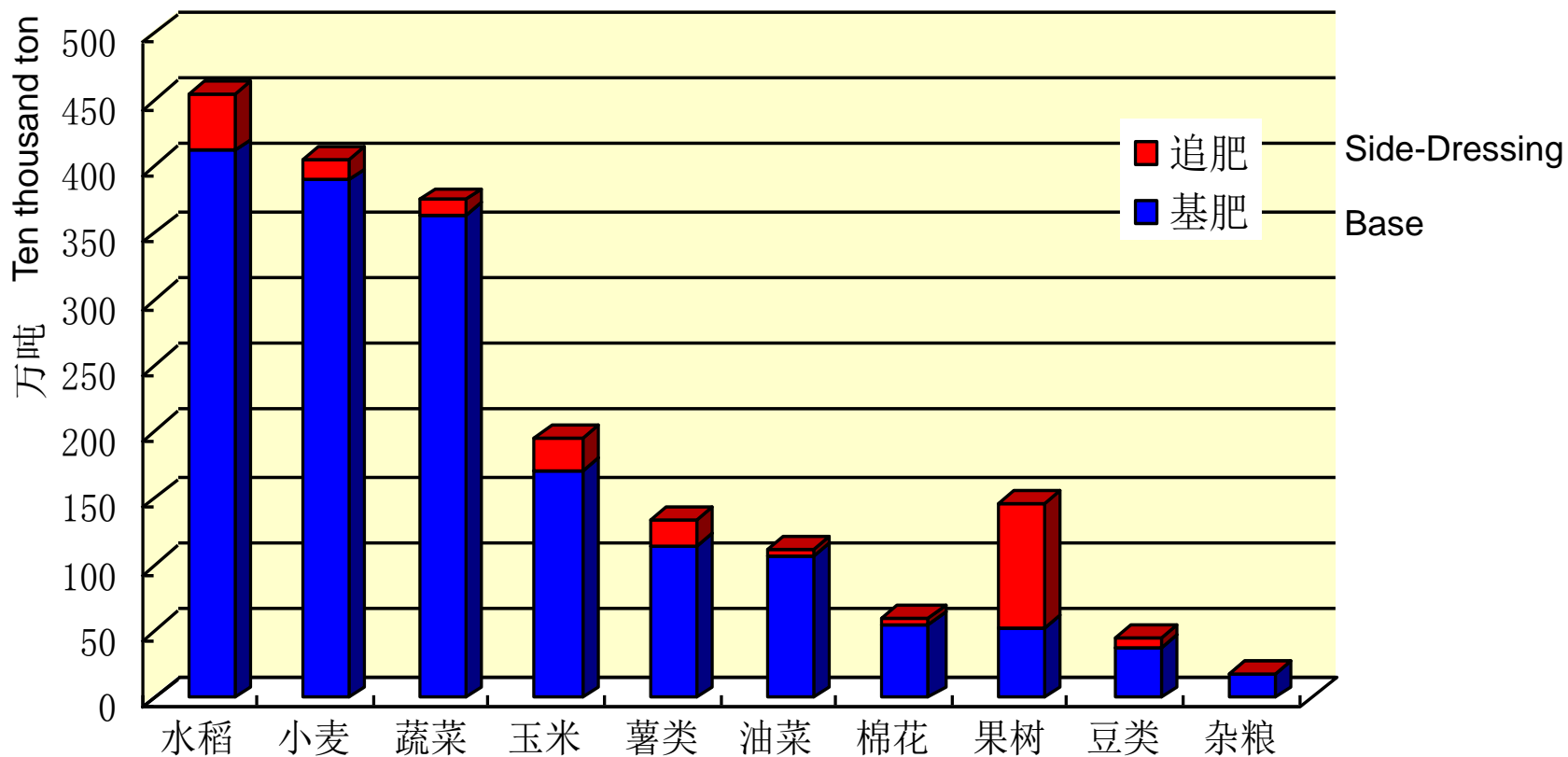


# 中国硫酸钾消费的空间分布

## Spatial Distribution of SOP Consumption in China



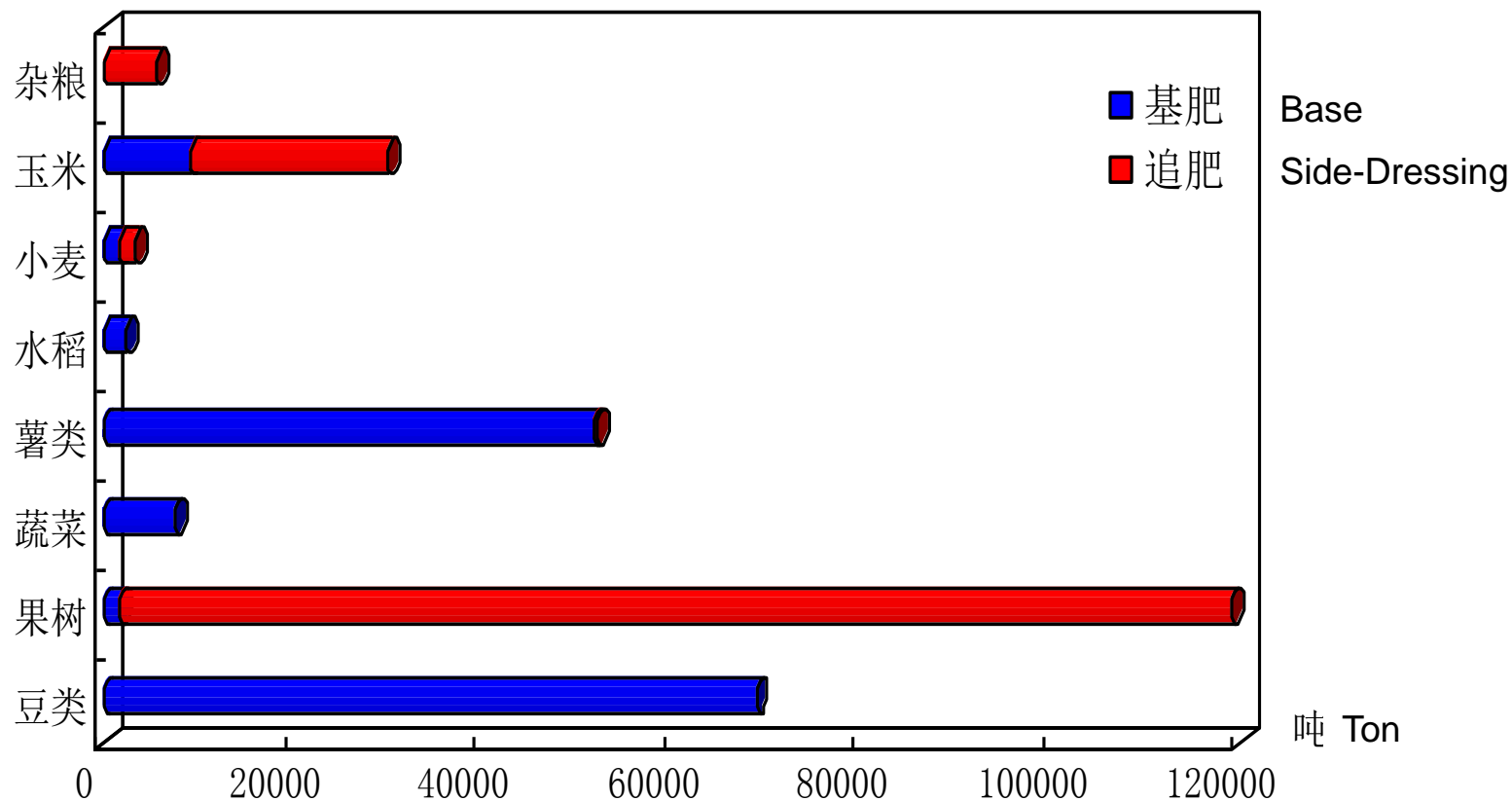
# 基于主要作物的含硫肥料投入结构 SSP Consumptions by Crops



基于主要作物的过磷酸钙去向 About SSP

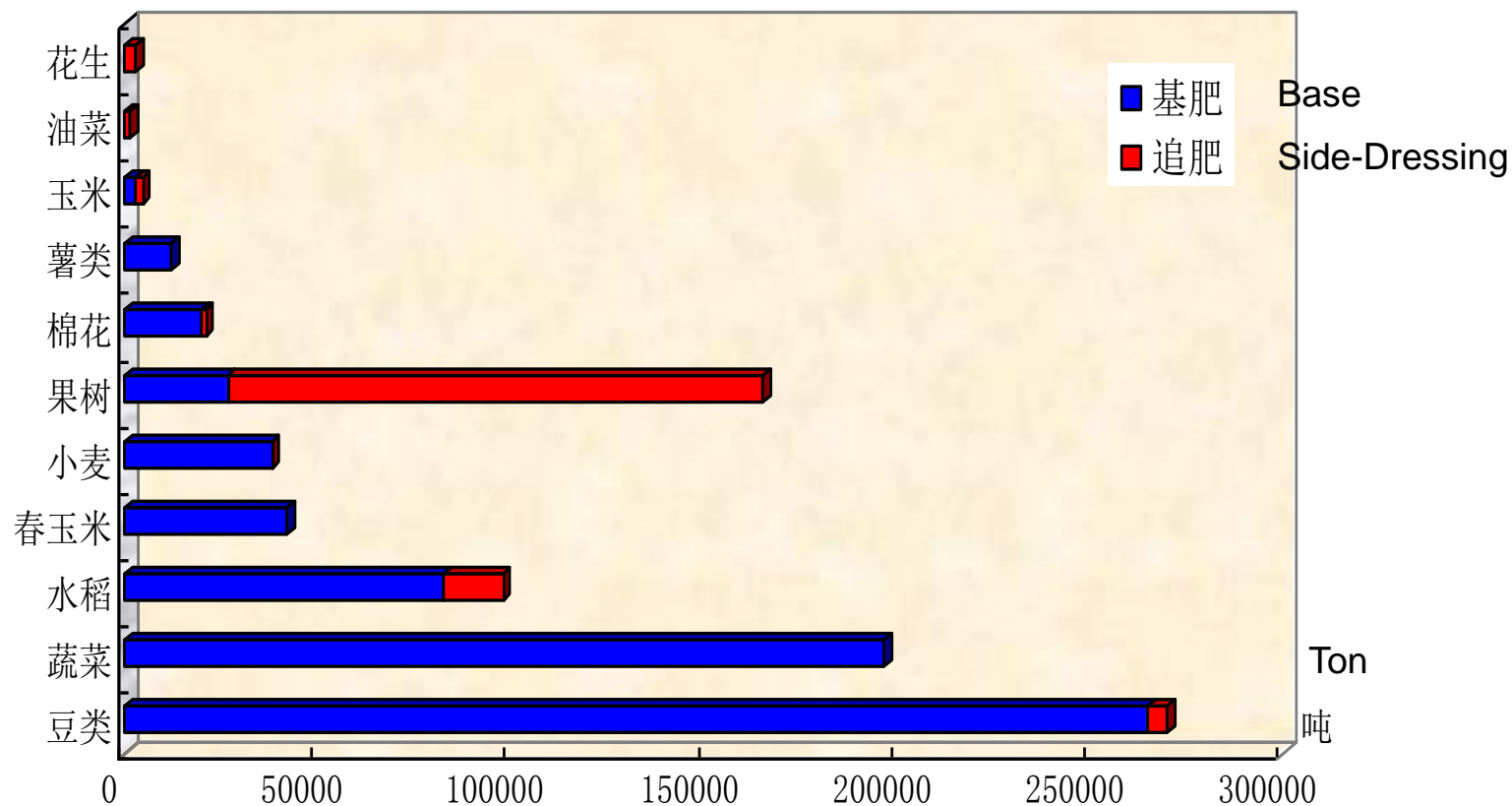
# 基于主要作物的硫酸铵去向

## AS Consumption by Main Crops



# 基于主要作物的硫酸钾去向

## SOP Consumption by Main Crops





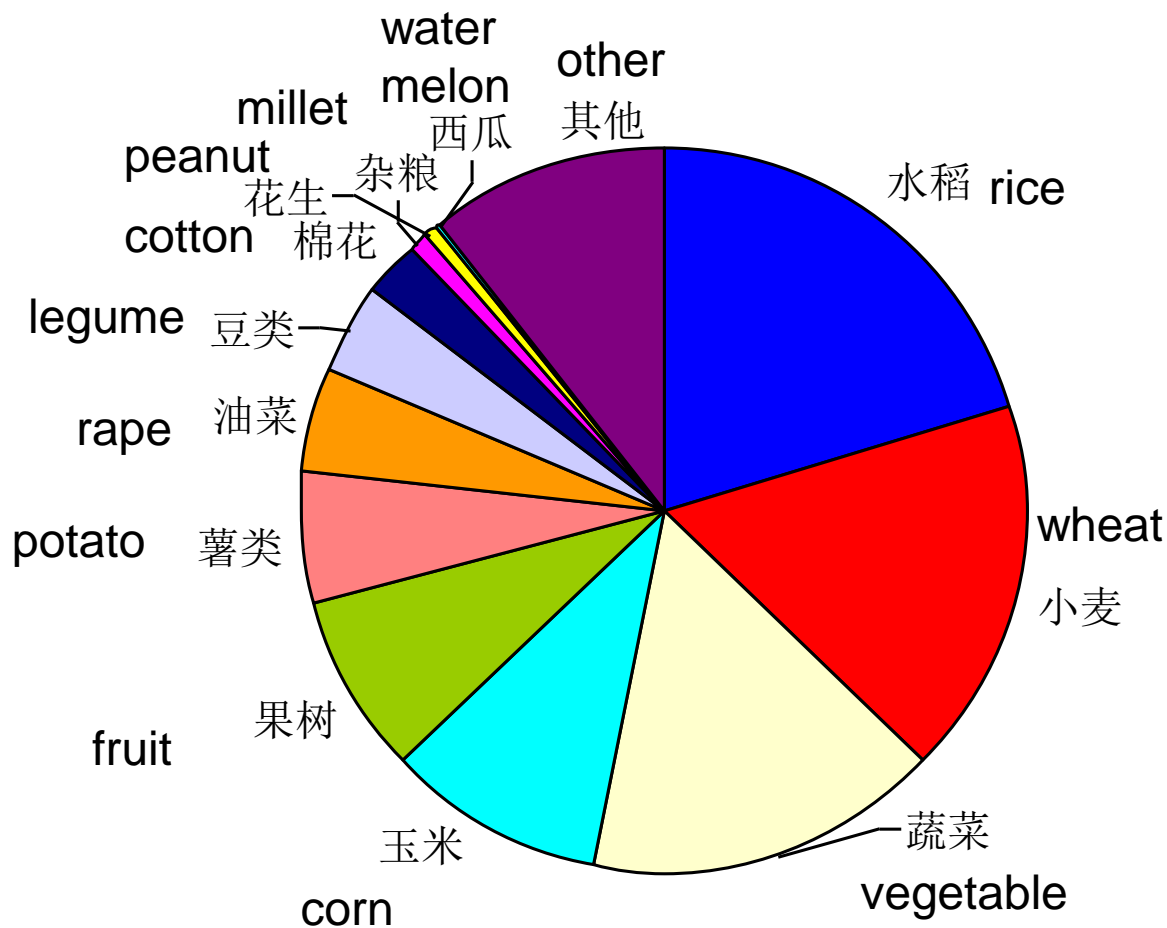
# 中国含硫肥料消费存在的主要问题

## The Problems of S Fertilizer Consumption in China

- 肥料硫的消费有很大盲目性
- S fertilizer consumption is mostly blindness nationwide, not based on crop requirement and soil S deficiency
- 单位面积硫的投入结构不合理
- S fertilizer consumption is irrational per area
- 土壤硫丰缺度和作物需求的应用研究不够深入
- Less research and extension work on soil S deficiency and crop S requirement.

# 含硫肥料过多投入到大田作物

Too much S fertilizers were used on grain crops



粮食作物的单位面积硫养分投入过量，油料作物投入不足  
 S use per area is excessive on grain crops, but deficit on oil crops

作物 Crop	单位面积基础养分投入 Basic S using per ha		单位面积硫 施用量 S use per area	总投入 Total Input	推荐施肥 recommendation	
	环境 environment	有机肥 Organic fertilizer			低值 low	高值 high
水稻 rice	9.5	15.9	31.2	56.7	14.0	30.0
小麦 wheat	9.5	15.9	32.8	58.2	14.0	27.9
玉米 cotton	9.5	15.9	16.2	41.7	14.0	27.9
油菜 cole	9.5	15.9	29.2	54.7	41.9	69.8
豆类 legume	9.5	15.9	12.9	38.3	41.9	69.8
棉花 corn	9.5	15.9	22.6	48.0	41.9	69.8

(kg/hm<sup>2</sup>)

# 未来几年含硫肥料消费的发展走势

## S Fertilizer Consumption Trends in The Future

肥料品种 S Fertilizer Sources	优势 advantage	劣势 disadvantage	应用前景 foreground
过磷酸钙 SSP	1、富含多种养分，有施用传统 2、中、碱、微酸性土均可施用，适应农民习惯 3、后效可延续多年 4、消耗低品位磷矿，可持续发展	1、不可长期存放 2、当季利用率低，只有10%~20%	常青树 Very good
硫基复合肥 S-NPK	伴随复合肥的市场需求，易于推广	施用盲目	来势汹汹 dimness
硫酸铵与硫酸钾 AS & SOP	1、产量稳定，有施用传统 2、施用效果好、见效快	大面积使用动力不足	星星之火 Good
有机肥（粪尿、秸秆、绿肥） Organic fertilizer	1、资源量巨大，养分含量丰富 2、在土壤中不易损失，肥效长 3、与其他硫肥配施的效果好	1、有机态硫到可溶性硫酸盐的转化过程缓慢 2、还田率不稳定	后起之秀 With potential
磷石膏 phosphoric gypsum	磷石膏硫资源量巨大，含硫量高。	1、价值低、运输不便 2、大量使用会使土壤表层板结	困难重重 Hard
硫磺以及其他新型硫肥 Elemental S and other new S fertilizer sources	在国外有成功的经验	代价高、效果优,待验证	摸着石头过河 On the way

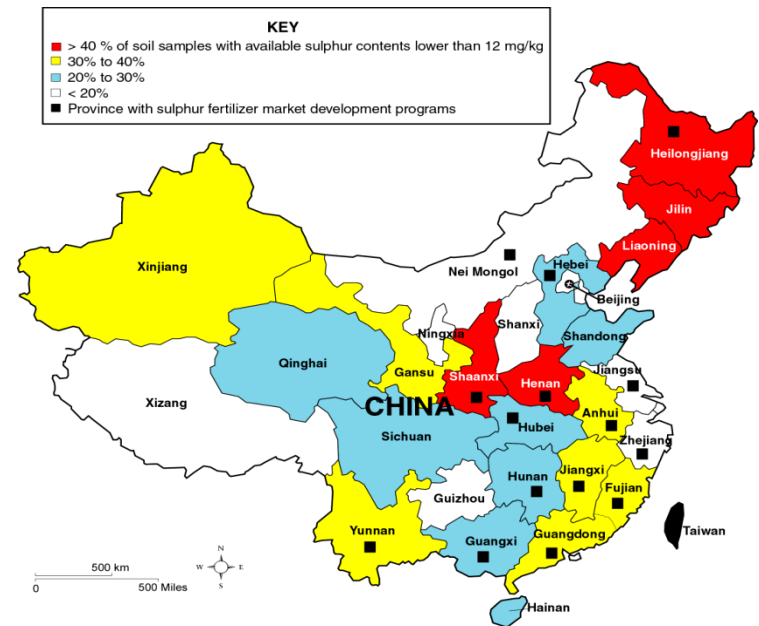
# 中国主要缺硫土壤及其区域分布

## The distribution of soil S deficiency in China

- 南方地区的铁铝土、淋溶土、华北半淋溶土、东北的半淋溶土、半水成土中容易缺硫 **Most of the S deficiency soil are located in South , North and Northeast China**



国内报道的缺硫土壤分布  
Soil S deficiency of domestic report

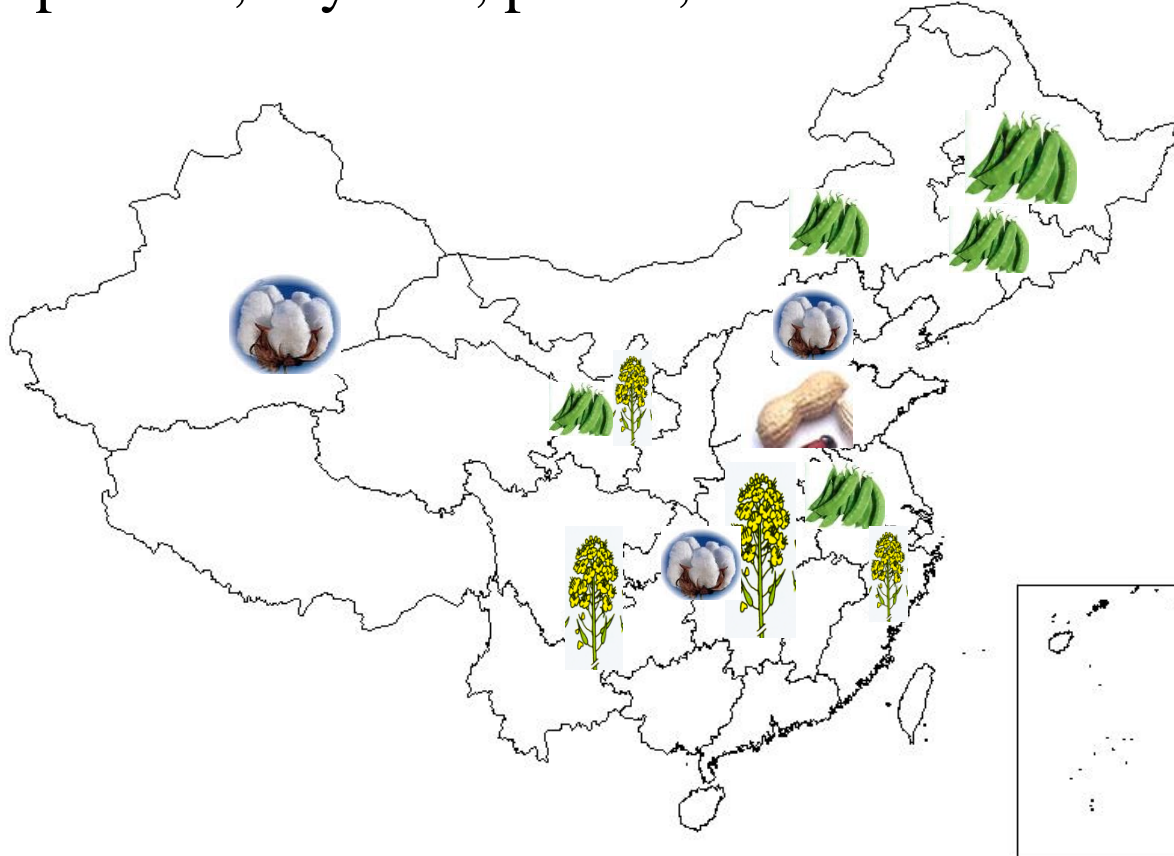


国际硫研究所关于有效硫试验的结果  
Soil available S content of TSI report

# 中国主要缺硫作物及其区域分布

## The distribution of S deficiency crops

- 油菜、大豆、花生、棉花是需硫量较大的作物，也是中国目前主要的缺硫作物 S deficiency showed on many crops, such as rape-seed, soybean, peanut, cotton etc.



# 中国目前主要作物对硫的需求估算

## The S demand of different crops in estimate

主要作物 Main crop	对硫的需求 S demand	目前已投入 S input	内部调节比 (%) Up and down	需要增加硫 S deficiency
合计 total	3236	2591		1212
水稻 rice	604	901	33 ↓	(297)
小麦 wheat	477	747	36 ↓	(270)
玉米 corn	552	428	29 ↑	124
油菜 cole	406	213	91 ↑	193
豆类 legume	720	166	333 ↑	554
棉花 cotton	282	114	147 ↑	168
花生 peanut	195	22	779 ↑	173

单位:千吨 (Unit: '000 tons)

# 引导硫养分合理消费的几点建议

## Recommendations:

- 启动全国尺度土壤硫肥力和硫肥及使用技术研究 To start-up nationwide research on soil S fertility and S fertilizer technology on soil testing
- 跟踪环境硫的状况，科学的预测农业硫需求 To forecast S demand based on S balance in various agri-ecosystems, especially the S input and output.
- 稳定过磷酸钙、硫酸钾等传统含硫肥料的投入 To continue use traditional S fertilizers in production regions
- 研发新硫肥产品，满足局部地区需求 Introduce new S fertilizer products for some special regions



*Thanks*



*Great Thanks to Dr. Ming Xian  
Fan & TSI for the S created wo  
rk in China !*



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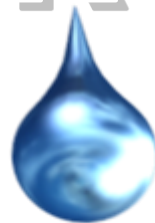
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# Thank You !



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