

Food Security-Indian Scenario

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This presentation was made at the IPI-OUAT-IPNI International Symposium, 5-7 November 2009, OUAT, Bhubaneswar, Orissa, India. The Role and Benefits of Potassium in Improving Nutrient Management for Food Production, Quality and Reduced Environmental Damage.

Demand projections for various food products in India (mt)

Commodity	Base year (2004-05)	Projection 2020-21
Cereals	192.8	262.0
Pulse	14.2	19.1
Foodgrains	207.0	281.1
Milk and milk products	91.0	141.5
Egg (number billion)	44.1	81.4
Meat	6.0	10.9
Fish	5.9	11.2
Edible oilseeds	35.5	53.7
Vegetables	90.6	127.2
Fresh fruits	52.9	86.2
Sugar in terms of cane	262.3	345.3

Source: Chand.2007

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Required Growth to achieve domestic demand by 2020.

Commodity	Domestic production 2006-07 (mt)	Growth rate during 1998-99 to 2006-07 (%)	Required growth rate over 2006-07 to meet the demand (%)
Cereals	201.9	0.62	1.9
Pulses	14.2	0.47	2.1
Foodgrains	216.1	0.61	1.9
Oilseeds	23.6	1.96	6.0
Vegetable	111.8	3.68	0.9
Fruit	57.7	3.06	2.9
Sugarcane	315.5	-0.60	0.6
Milk	111.9	3.65	2.4
Fish	6.9	2.89	3.5
Egg (billion)	50.7	6.60	3.4

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Productivity growth pattern

- **Deceleration in the growth of total factor productivity in agriculture since 90s, especially in IGP states**

State	1981-82 to 1989-90	1990-91 to 1996-97
West Bengal	5.13	1.25
Haryana	3.22	0.10
Bihar	1.47	0.24
Uttar Pradesh	1.40	0.54
Punjab	1.24	1.20

Source : Kumar et al. (2004)

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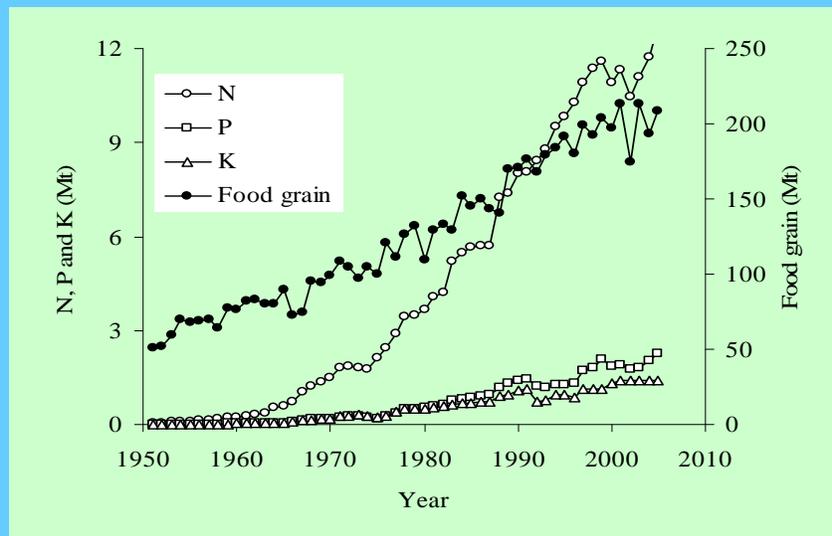
Productivity growth rate (% per annum) of major crops in India

Crop	Productivity		
	1980-81 to 1989-90	1990-91 to 1999-2000	2000-01 to 2002-03
Rice	3.19	1.27	-0.72
Wheat	3.10	2.11	0.73
Pulses	1.61	0.96	-1.84
All Food grains	2.74	1.52	-0.69
Oilseeds	2.43	1.25	-3.83
Non-food grain	2.31	1.04	-1.02

Source : Rajendra Prasad (2006)

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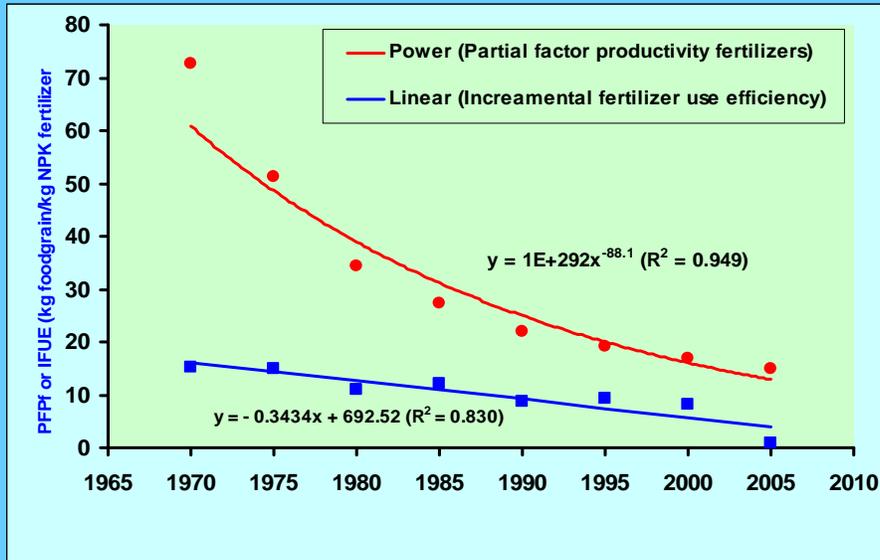
Food grain production and fertilizer use



Fertilizers – An important input contributing 50% towards improvement in crop productivity

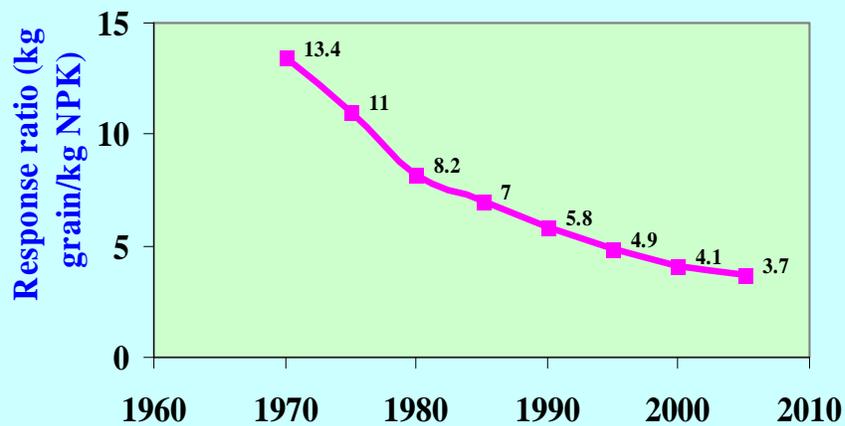
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Partial factor productivity of fertilizers



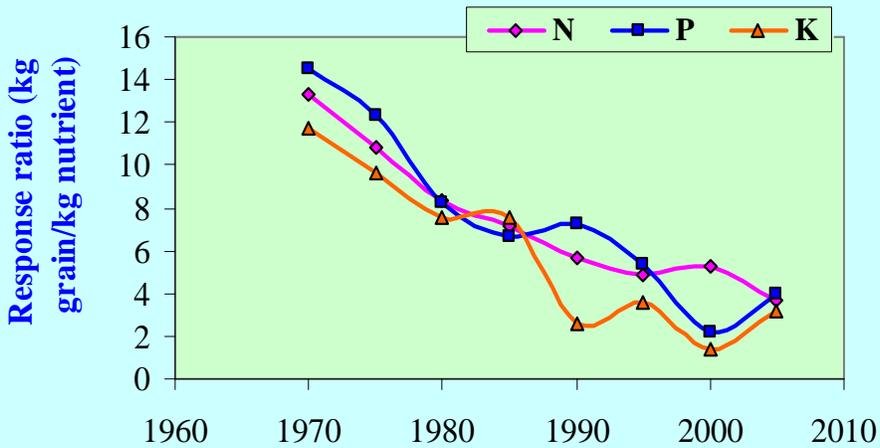
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Fertilizer Response Ratio - Irrigated Areas



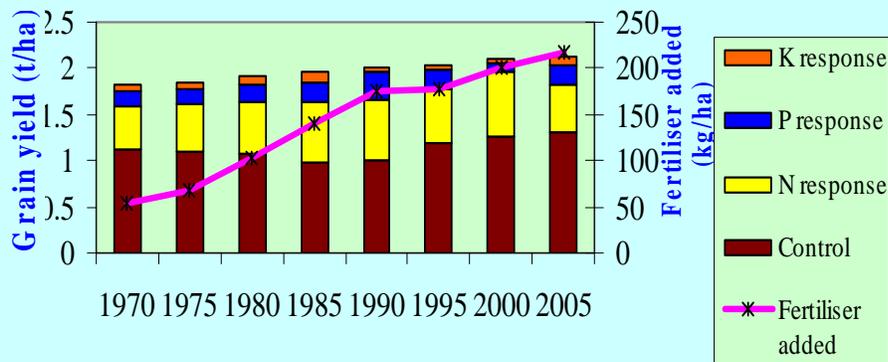
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Fertilizer Nutrient Response Ratios- Irrigated Areas



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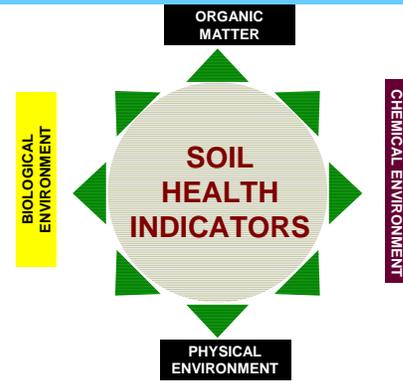
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Decline in Soil Health- A Cause of low fertilizer response

- Decline in soil health due to improper fertilizer use coupled with neglect of organic manures under intensive agriculture.
- The United Nations Millennium Development Task Force on hunger made Soil Health Enhancement as one of the five recommendations for increasing agricultural productivity and fight hunger in India.



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Emerging Multi-Nutrient Deficiencies in Soils

Year						?
					B	B
					Mn	Mn
					S	S
			K	K	K	K
			Zn	Zn	Zn	Zn
			P	P	P	P
			Fe	Fe	Fe	Fe
		N	N	N	N	N
		1950	1960	1970	1980	1990

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Nutrient deficiencies in soils of India

Nutrient	% Deficiency
N	89
P	80
K	50
S	41
Zn	49
B	33
Mo	13
Fe	12
Mn	5
Cu	3

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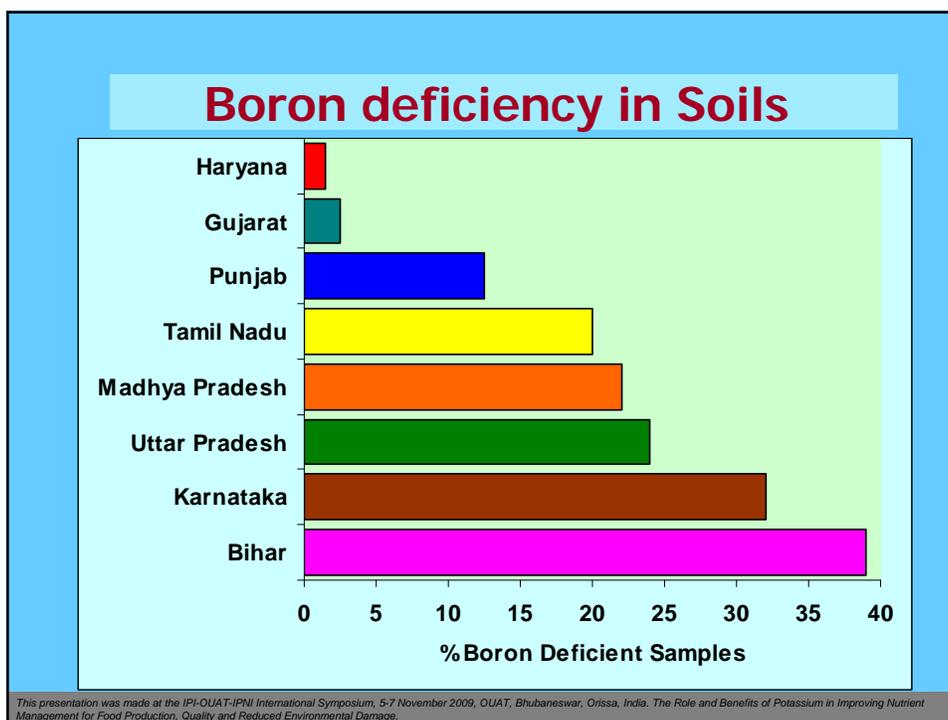
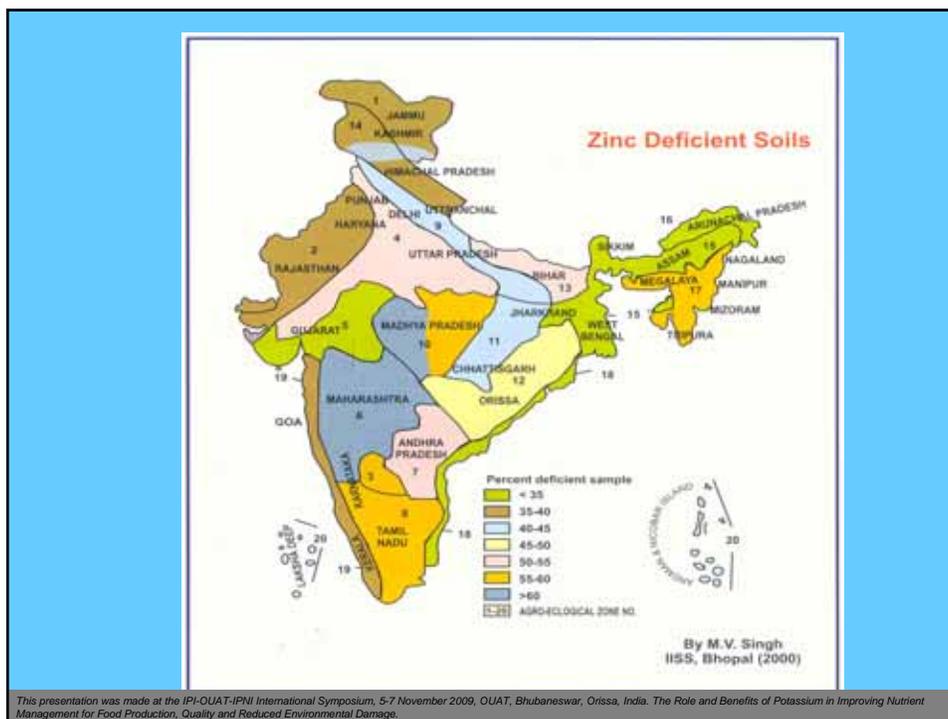
Sulphur Deficiency in Indian Soils

- The deficiencies are widespread covering 40- 45% districts and 60mha of net sown area; occurrence more in the southern region.
- The deficit to the tune of 1mt/annum.

Region / State	No. of Samples	% samples in category		
		Low	Medium	High
Northern Region	15323	44	30	26
Western Region	12474	45	30	25
Eastern Region	10108	35	33	32
Southern Region	11289	63	26	11
All India	49194	46	30	24

Source : TSI-FAI-IFA, 2006

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Ensuring Nutritional Security

- **Food security implies availability of food to meet nutritional needs of people for healthy & productive life.**
- **Over one-fifth of Indian Population suffers from protein-energy-trace elements-malnutrition syndrome.**
- **Zn deficiency a big public health issue and second in importance to Fe.**

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Zn malnutrition

- **About 49 % soil and 44 % plant samples deficient in Zn.**
- **Around 25 % Indian population under risk of Zn deficiency related problems.**
- **About 65 % of pregnant women found to have low serum Zn concentration in Haryana in a recent study.**
- **Zn deficiency related bone and joint disorders and thickening of skin in animals in Punjab and Haryana**
- **Wool-shedding syndrome in sheep in Hissar due to Zn deficiency**

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Combating Zn- malnutrition

- **More incidence of Zn-deficiency in India due to more consumption of cereal based foods low in Zn.**
- **Addition of micro-nutrient fertilizers for bio-enrichment of food grains while improving crop production**
- **Anatolian experience (Turkey) merits replication in other Zn-deficient areas**

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Nutrient mining in soils of India (mt)

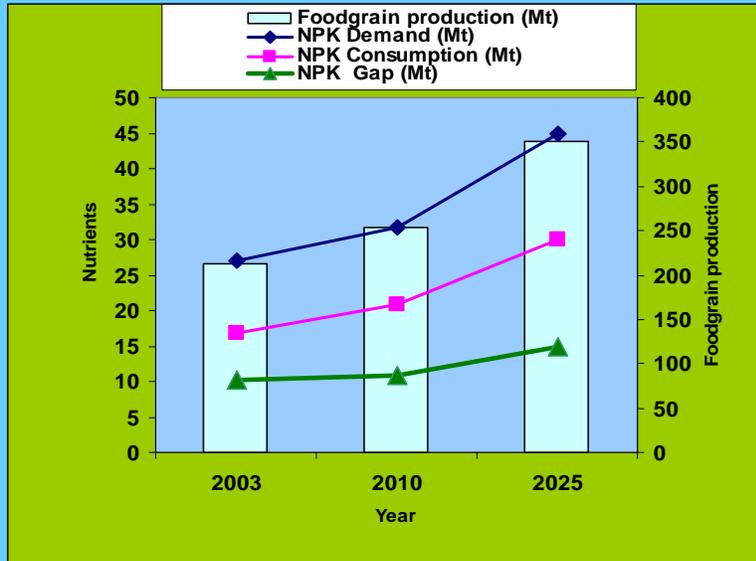
Nutrient	Gross balance			Net balance		
	Addition	Removal	Balance	Addition	Removal	Balance
N	10.9	9.6	1.3	5.5	7.7	-2.2
P₂O₅	4.2	3.7	0.5	1.5	3.0	-1.5
K₂O	1.4	11.6	-10.2	1.0	7.0	-6.0
Total	16.5	24.9	-8.4	8.0	17.7	-9.7

• **Increased mining of soil potassium a cause of more rampant decline in rice yields compared to wheat in IGP (data from 24 research stations)**

Source : Tandon (2004)

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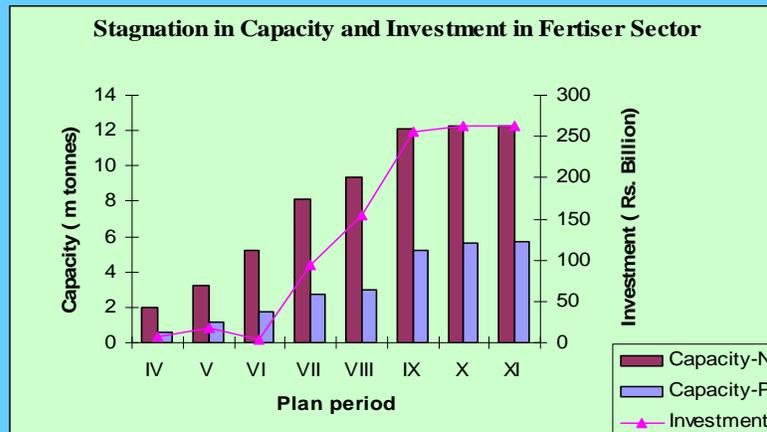
Projected food grain production, fertilizer demand, likely consumption and gap



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Fertilizer Industry Scene

- Met growing demand of fertilizers in 80s and 90s with large capacity build-up and investments
- Facing virtual stagnation in capacity and production of fertilizers for almost a decade due to poor margins and less attractive investments.



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- **The pricing of fertilizers under subsidy regime a major cause of poor health of the industry**
- **Steep rise in prices of inputs- raw materials, intermediates, feedstocks like naphtha, fuel oil, LSHS and gas**
- **Frozen MRPs of fertilizer.**
- **Inadequate provisions for fertilizer subsidy and delay in its disbursement**

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Ensuring adequate supply of Fertilizers

- **Conducive environment and more investments in the fertilizer sector for its sustained growth**
- **Adequate subsidy on fertilizers and its timely allocation and disbursement to manufacturers**
- **Priority allocation of natural gas to fertilizer sector**
- **Forging joint ventures abroad with buy-back arrangements**

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Balanced and Integrated Nutrient Management (INM)

- **Balanced and Conjunctive use of chemical fertilizers, organic manures and biofertilizers a panacea for good soil health, increased nutrient use efficiency, productivity and profitability**
- **Need to augment supplies of organic manures, biofertilizers, fortified, coated & customized fertilizers supplying secondary and micronutrients, and soil amendments to have INM on a sound footing.**

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Site Specific Nutrient Management (SSNM)- Irrigated Areas

Location, State	Extra yield kg/ha/yr	Nutrients applied	Extra returns Rs./ha
Sabour, Bihar	+ 5,191 (60%)	N P K S (4)	33,621
Palampur, HP	+ 2,941 (42%)	N P K S B Zn (6)	18,576
R.S.Pura, J&K	+ 3,464 (36%)	N P K S Cu Mn Zn (7)	19,771
Ranchi, Jharkhand	+ 4,755 (77%)	N P K S B Cu Mn Zn (8)	30,195
Ludhiana, Punjab	+ 414 (3%)	N P K S B Mn Zn (7)	(-) 4,372
Faizabad, UP	+ 4,904 (66%)	N P K S B Mn Zn (7)	31,414
Kanpur, UP	+ 2,950 (25%)	N P K S (4)	17,612
Modipuram, UP	+ 5,345 (47%)	N P K S Cu Mn Zn (7)	36,917
Varanasi, UP	+ 1,120 (10%)	N P K S B Cu Mn Zn (8)	7,384
Pantnagar	+ 2,473 (25%)	N P K S B (5)	14,185
Average	3,355.7 (39%)		20,530.3

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Yield under INM-Rainfed Areas

Watershed	Crop	Normal Fertilization	Normal Fertilization + B+Zn+S	% Increase
Sripuram	Maize	2980	4570	53
Malleboinpal ly	Maize	2380	4370	84
	Pigeonpea	240	420	75
Nemikal	Mung bean	840	1100	31
	+ Pigeonpea	350	660	89
Tirumalapur am	Castor	430	640	49
	+ Pigeonpea	410	460	12
Nandavaram	Pigeonpea	1630	2640	62
Nandavaram	Castor	860	1290	50
Karivemula	Groundnut	1440	1960	36
	+ Pigeonpea	130	330	154

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Policy decisions for balanced fertilization

- **Nutrient Based Pricing and Subsidy.**
- **Allowing additional cost of fortification and coating to manufacturers (5-10% above MRP)**
- **Providing regular upward revision of rate of concession on SSP to revive the SSP industry.**

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Promoting Fertigation and Water Soluble / Speciality Fertilizers

- Fertigation increasing nutrient use efficiency by 40% to be popularized for fruits, vegetables, flowers and plantation crops.
- Hold great promise as micro-irrigation to be expanded on 69 m ha in subsequent plan periods.
- The fully water soluble fertilizers are costly due to heavy custom duty & sales tax besides higher initial cost.
- Need to be manufactured in India and brought under FCO 1985.



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Enhancing availability of organic manures

- Recycling and composting/ vermi composting of urban, animal and agro industrial waste
- About 57MT of urban solid waste generated per annum with potential to supply 8MT of good quality compost.
- Present availability 383 mt against the moderate requirement of 900 mt / annum (@5 t / ha on gross cropped area of 185 mha).

FYM	Rural compost	Urban Compost	Vermi Compost	Others	Total
186	169	15	3	9	383



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Promoting bio-fertilizers

Production (thousand tonnes)

2003-04	9.8
2004-05	10.6
2005-06	10.8
2006-07	16.1
2007-08	20.1

•164 units producing only one-third of installed capacity of 67,000 t/annum

Production zone wise (%)

South	60
West	29
North	2.5
East	7.3
North-East	0.5

•The consumption is skewed - 90% in south & west zones of the country

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Development of Quality Biofertilizers

- Development of more effective and quality biofertilizers for different agro-climatic situations
- Evaluating new carrier materials including liquid formulations for enhanced shelf life and reduced cost of biofertilizers
- Region and crop specific consortia of biofertilizers



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Ameliorating Degraded Lands

- About 121 mha constituting 36 % of total area degraded due to soil erosion, alkalinity/salinity, soil acidity, water logging
- Increasing productivity of these lands central to the planning for food-secure India
- Proper land use planning consistent with prevailing socio-economic-environmental-market imperatives

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Eroded Lands

- Soil erosion major cause of soil degradation affecting 86 mha
- About 39 % total area having erosion more than the permissible limit ($10\text{t ha}^{-1}\text{ yr}^{-1}$)
- Watershed management to conserve soil and water resources, increase productivity, ameliorate socio-economic conditions of rainfed regions and act as a drought mitigation strategy

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Amelioration of Acid Soils

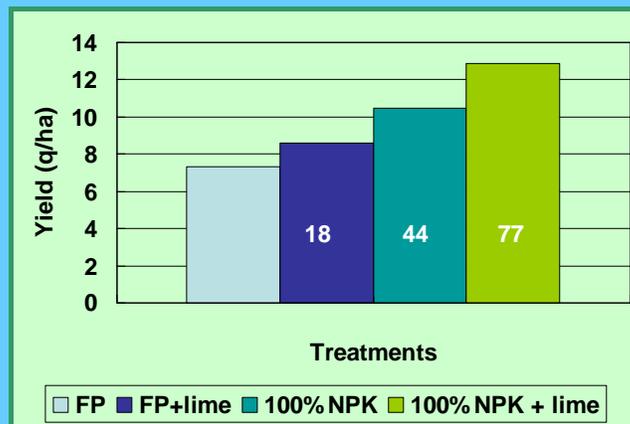
- About 12 m ha of arable acid soils with pH<5.5 have low nutrient use efficiency and crop productivity
- Liming to enhance nutrient use efficiency and productivity of crops, especially of pulses and oilseeds
- The practice saves 50% of fertilizers and doubles the productivity



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Use of fertilizers and lime on acid soils

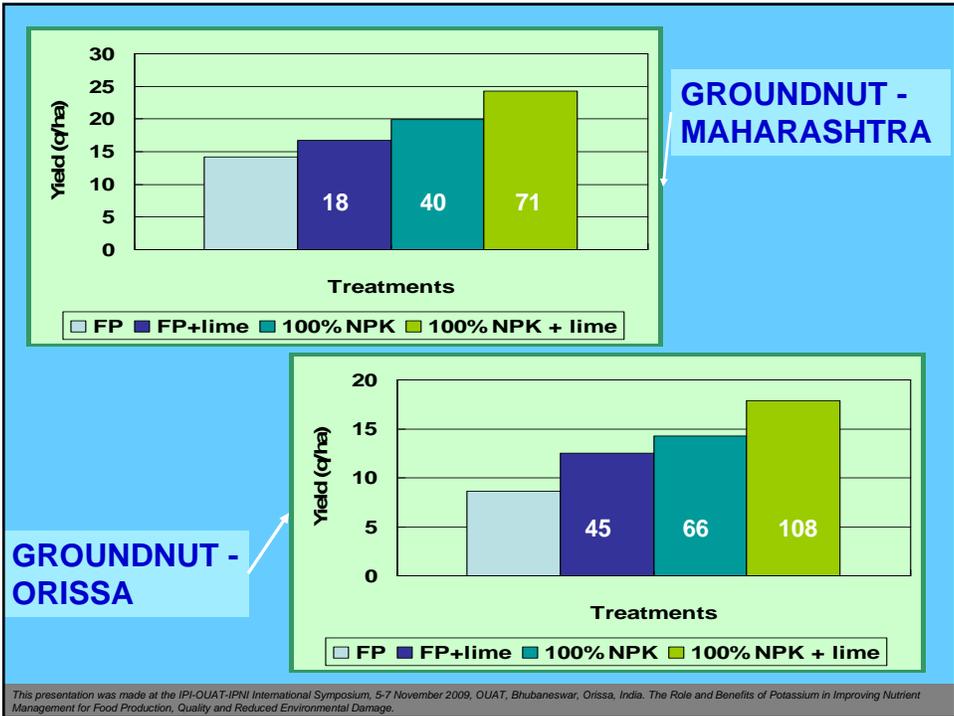
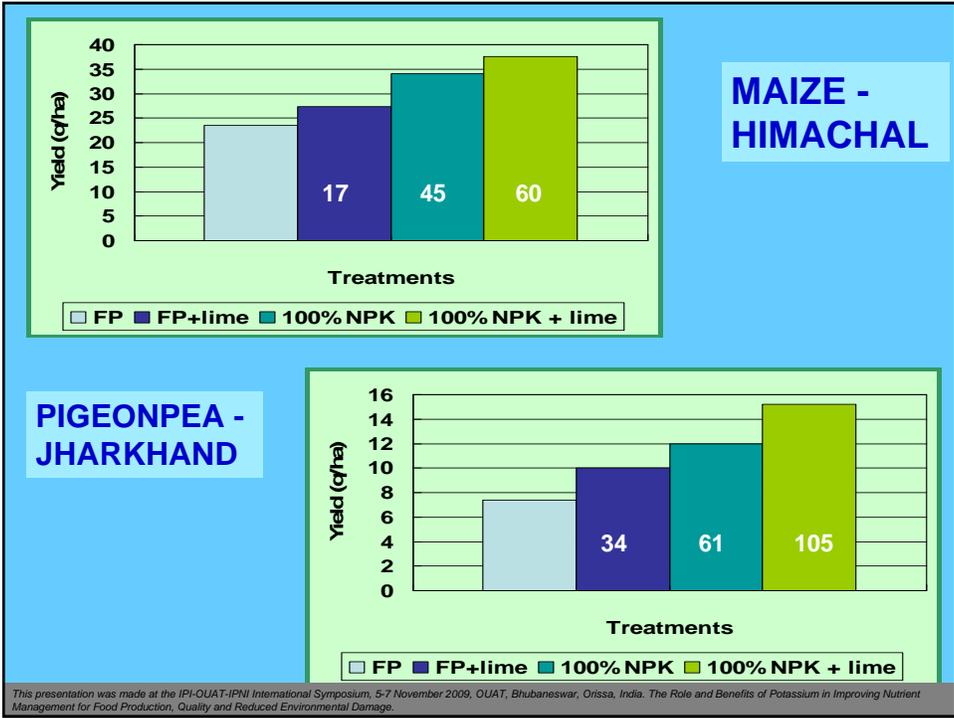
Rapeseed - Assam



FP = Farmers practice

Figures in bars are percent increases over farmer's practice

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Crop Response(q/ha) to lime & Fertilizer Application

State	Crop	RDF	50% RDF +Lime
Assam	Rapeseed	9.70	10.10
	Summer green gram	4.42	5.17
Kerala	Cowpea	8.57	10.65
	Black gram	6.38	8.10
Meghalaya	Maize	30.50	30.30
	Groundnut	14.20	21.30
West Bengal	Mustard	8.15	8.40
	Wheat	16.70	17.15
Jharkhand	Maize + Pigeon pea (Maize equiv. yield)	69.0	65.0
	Pea	38.4	50.8
Orissa	Groundnut	22.5	23.6
	Pigeon pea	12.0	12.2

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Reclamation of Salt Affected Soils

- Reclamation of 7m ha of salt affected soils for increased nutrient use efficiency and productivity



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Utilization of Indigenously Available Nutrient Sources

- Large reserves of low grade rock phosphate(160MT) and K bearing mica in the country could be co-composted for production of P & K enriched manure
- Phosphogypsum, a by-product of fertilizer industry containing 16% S and 21%Ca, a potential source of S and Ca for crops.
- About 7MT of phosphogypsum generated per annum has a potential to supply 1 mt of S and 1.4 mt of Ca
- Coarse textured acidic and sodic soils low in S and Ca to benefit from its supplementation.

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Strengthening Soil Testing Service

- The service presently inadequate with a capacity to analyze only 7m soil samples/ annum against 120 m farm holdings in the country.
- Need to open more soil testing laboratories at least one each in different districts with state of art facilities.
- The laboratories to participate in the preparation of geo-referenced soil fertility maps at district and block levels.
- National Commission on Farmers has recommended additional 1000 advanced soil testing laboratories in the country.

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Augmenting Water Resource

- The share of irrigation sector for fresh water to decline from 83 % to 72 % by 2025 and 68 % by 2050
- Required irrigation potential of about 180 mha to be met from major and medium irrigation sources (58.5 mha), minor irrigation sources (64.1mha ground water, 17.4 mha surface water) and inter-basin river water transfers (35 mha).
- As execution of major irrigation projects takes long time and inter-basin transfer remains a debatable subject, the augmentation of water resource in the short term viewed in efficient water management.

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Rain water Harvesting

- About 29 % of 400 M ha-m annual precipitation are used as surface flow and ground water and rest is lost as runoff to sea or as water vapour to atmosphere.
- Potential for harvesting 24 M ha-m in small water storages in the country.
- 30 % of it to be available for pre-sowing and protective irrigations in rainfed areas.
- The intervention promises 50 MT additional food grains per annum

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Arresting Fall in Ground water Table

- Ground water being depleted in Central Punjab, Haryana, Western Uttar Pradesh, Rajasthan, Tamilnadu and West Bengal.
- Decline in ground water used for irrigating over 60 % area poses a threat to food security.
- Marginal and small farmers hard hit with their shallow/dug wells going dry with water moving deeper.
- States need to adopt Model Bill drafted by CGWB for sustainable and equitable ground water development.
- Recharging ground water through watershed management.

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Use of waste waters

- India generates about 18.4 million m³ of sewerage and industrial effluents
- Waste waters generally loaded with toxic compounds, heavy metals and pathogens pose human and animal health hazard
- Only 20 % of waste water treated
- Need to pre-treat waste waters to remove/reduce the toxic load

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Enhancing water-use efficiency

- **Need to enhance surface water efficiency from 35 to 60 % and of ground water from 65 to 75 %**
- **Lining of canals and distribution network; adoption of pipe distribution system**
- **Improved on-farm water management through efficient irrigation scheduling, water application, choice of crops/cropping systems matching water supplies and micro-irrigation**

This presentation was made at the IPI-OUAT-IPNI International Symposium, 5-7 November 2009, OUAT, Bhubaneswar, Orissa, India. The Role and Benefits of Potassium in Improving Nutrient Management for Food Production, Quality and Reduced Environmental Damage.

Managing climate change

- **Increased GHG emissions and global warming to have far reaching repercussions on sustainability of agriculture and food security**
- **The change likely to alter agro-meteorological parameters, overall crop – water balance, pest and disease incidence, land use, melting of glaciers**
- **Increase water, shelter and energy requirements of livestock**
- **Affect fish breeding, migration and harvests**

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Managing climate change

- Developing new genotypes suitable to changing climatic situations
- Devising simple manipulations on planting dates to escape aberrant weather due to climatic change
- New land use and soil management systems having minimal soil disturbance and soil carbon loss into atmosphere
- Soil, water and fertilizer management practices reducing CH₄ and N₂O emissions.
- Sequestering organic carbon through agro-forestry on wastelands (10-14 Tg C yr⁻¹).

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Conclusion

- Providing food security to ever-growing population a formidable challenge in the backdrop of declining factor productivity and fertilizer response
- National Agricultural policy recognizes efficient conservation and management of natural resources for higher productivity and agricultural growth
- Adoption of balanced and integrated nutrient management involving major, secondary and micro nutrients, organic manures, biofertilizers and amendments.
- Conducive policy environment for more investments in the fertilizer sector for sustained supplies of fertilizers.
- Promoting soil and crop specific customized, fortified, coated and fully water soluble fertilizers
- Utilizing all indigenously available nutrient sources to supplement fertilizer supplies.
- Effective soil testing service to back up precise fertilizer use.
- Improved water management at basin, command and farm levels
- Amelioration of eroded, salt affected and acidic lands

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Thank you

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