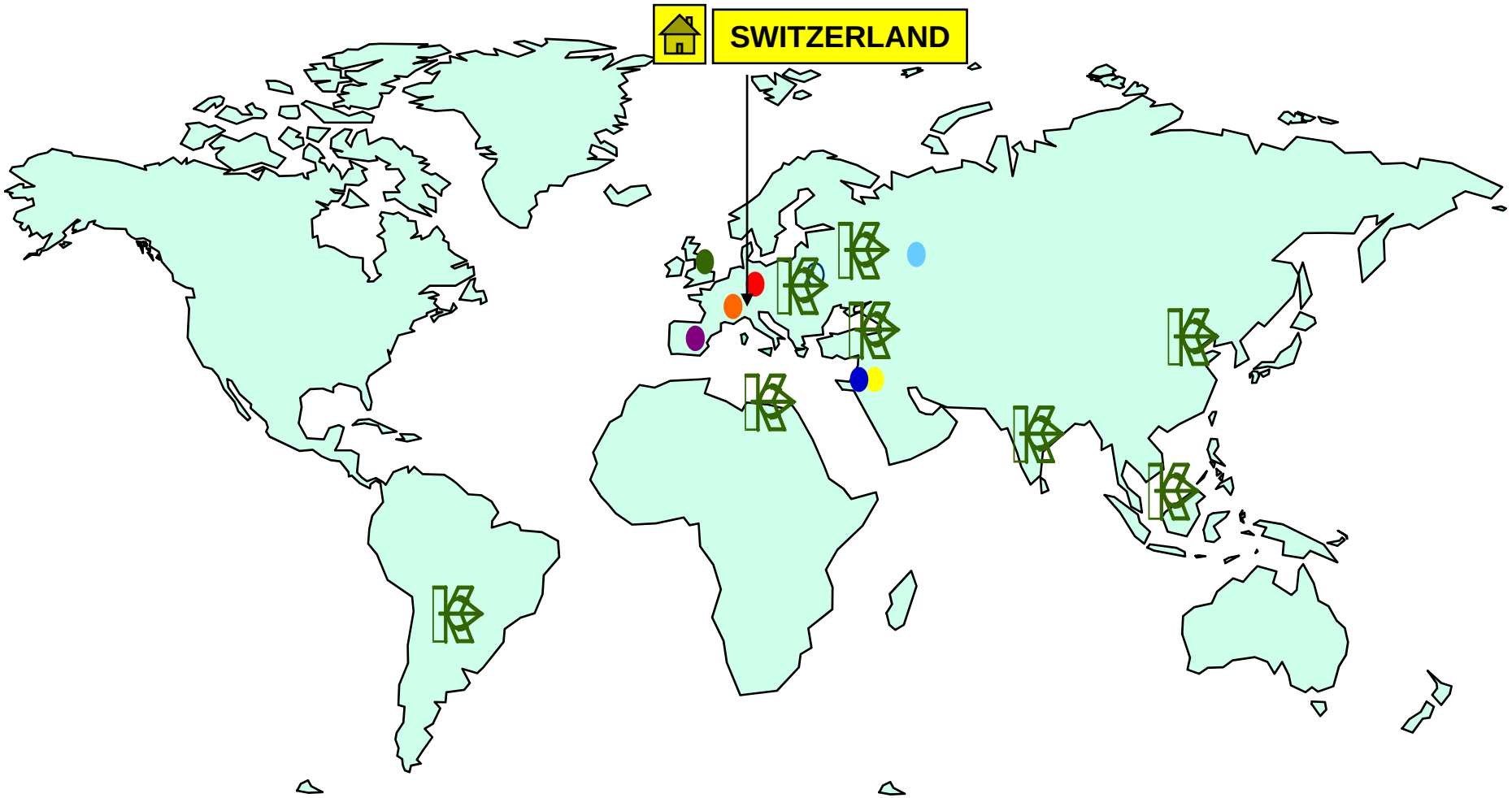
INTERNATIONAL POTASH INSTITUTE

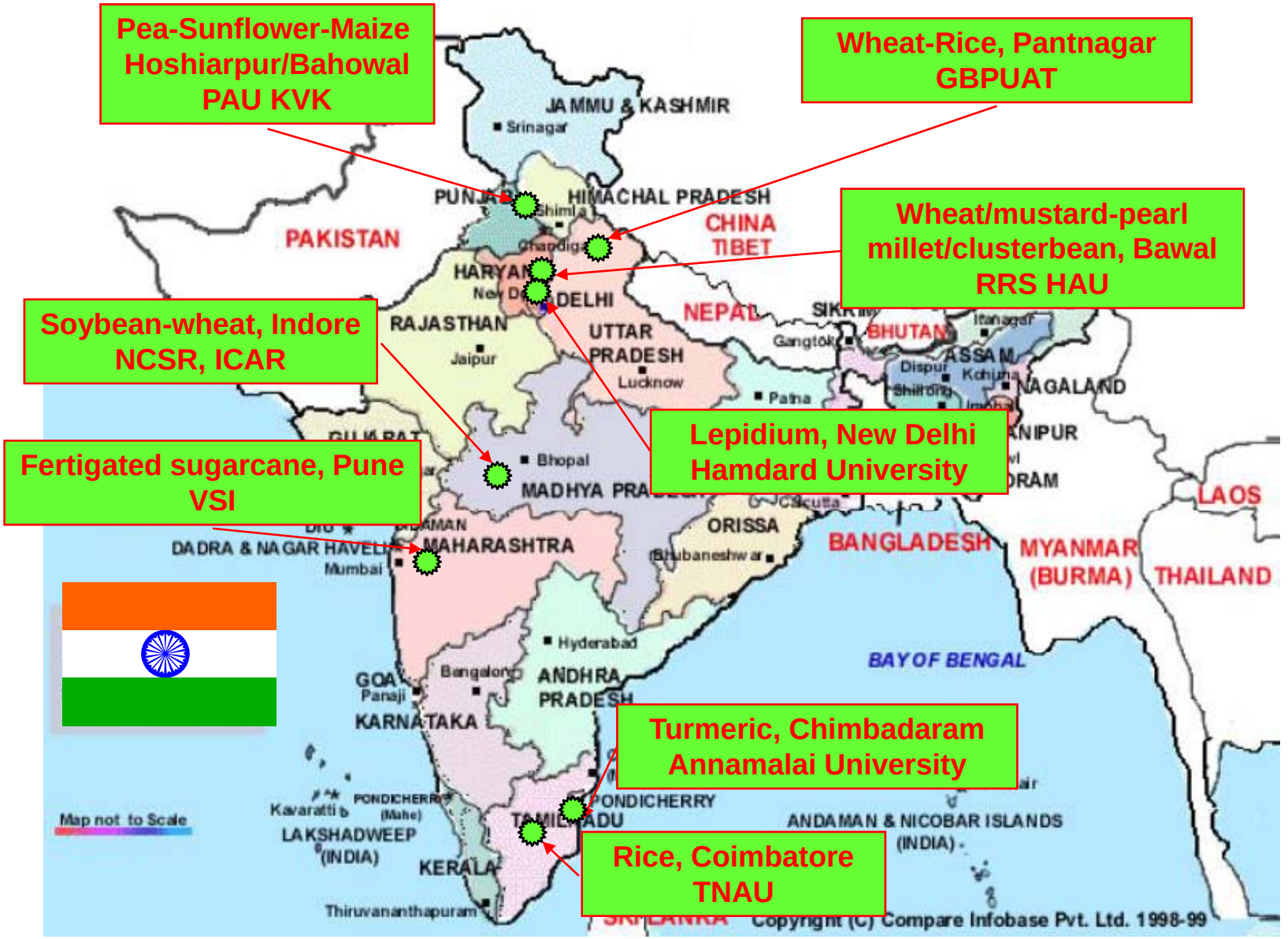
INDIA COORDINATION

ROLE OF POTASH FOR HIGH QUALITY PRODUCE UNDER INTEGRATED NUTRIENT MANAGEMENT

FAI-IPI Dealers Training Program
Kalpetta, Kerala, 16 September 2008


SWITZERLAND
DSW-ISRAEL
TSLO-BELGIUM
K+S GERMANY
IPC, Silvinit and Uralkali
RUSSIA

IPI PROJECTS IN INDIA



IPI ACTIVITIES IN INDIA

Balanced fertilization experiments

On-farm demonstration plots

Collaborative trials


Farmers & Dealers training courses

IPI ACTIVITIES IN INDIA


Farmers-scientists interaction


Farmers' meetings

Awards to local young researchers

Symposia & Workshops

IPI ACTIVITIES IN INDIA

Publications in local languages

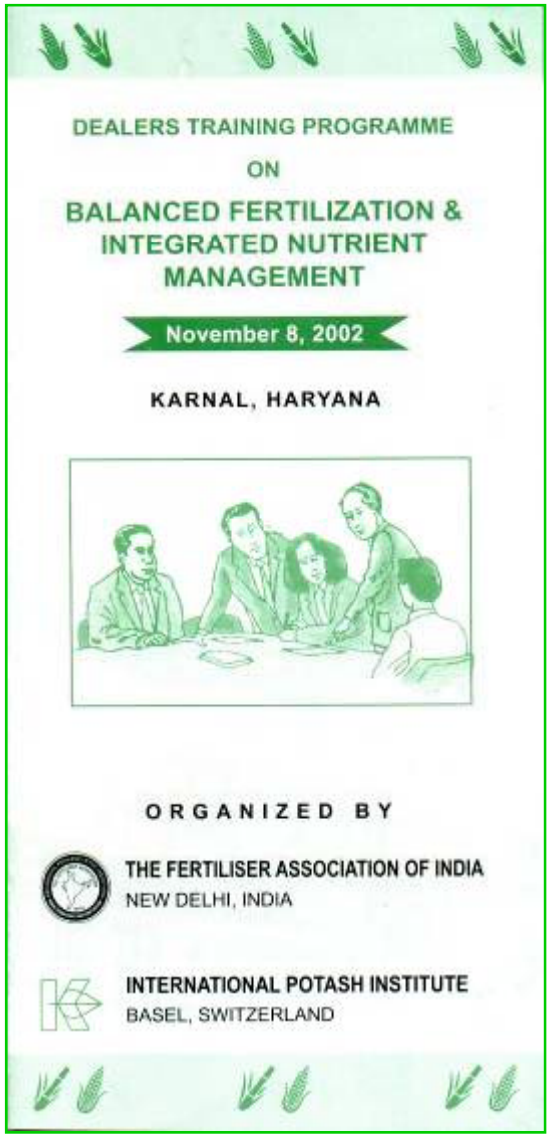
Scientific publications

EXTENSION ACTIVITIES IN INDIA – 2002-2007

IPI and FAI continued the joint program of training courses for fertilizer dealers at different locations in India. The purpose is to reach the last & closest link to the farmer in the marketing chain of MOP in India.

30 **Dealers training programs** on "Balanced Fertilization and Integrated Nutrient Management" at 4 FAI Regional Offices

- 1 in 2002
- 4 in 2003
- 6 in 2004
- 6 in 2005
- 6 in 2006
- 5 in 2007
- 2 in 2008



FAI-IPI dealers training programs

Ooty. April 24, 2006

Puri, Orissa., on March 3, 2004

FAI-IPI Dealers training programs 2002-2006

- **WEST:**
  - Pune, Maharashtra. March 5, 2003
  - Raipur, Chattisgar. March 1, 2004
  - Indore, Madhya Pradesh. Sept. 29, 2004
  - Bhopal, Madhya Pradesh. March 24, 2006
  - Satara, Maharasthra. April 27, 2006
  - Aurangabad, Maharashtra. September 25, 2006
- **EAST:**
  - Ashoknagar, WB. September 17, 2003
  - Puri, Orissa. March 3, 2004
  - Siliguri, W.B. October 4, 2004
  - Ranchi, Jharkhand. March 21, 2005
  - Patna, Bihar. October 1, 2005
- **NORTH:**
  - Karnal, Haryana. November 8, 2002
  - Jaipur, Rajasthan. September 21, 2003
  - Dehradun, Uttranchal. February 20, 2004
  - Lucknow, U.P. October 1, 2004
  - Manali, H.P. March 24, 2005
  - Jodhpur, Rajasthan. October 10, 2005
  - Ludhiana, Punjab. March 21 2006
  - Rudarpur, Uttranchal. September 29, 2006
- **SOUTH:**
  - Kanchipuram, T. Nadu. March 7, 2003
  - Kochi, Kerala. March 15, 2005
  - Pondicherry. October 4, 2005
  - Ooty, April 24, 2006

Fertigation programs

FAI-IPI fertigation training programs

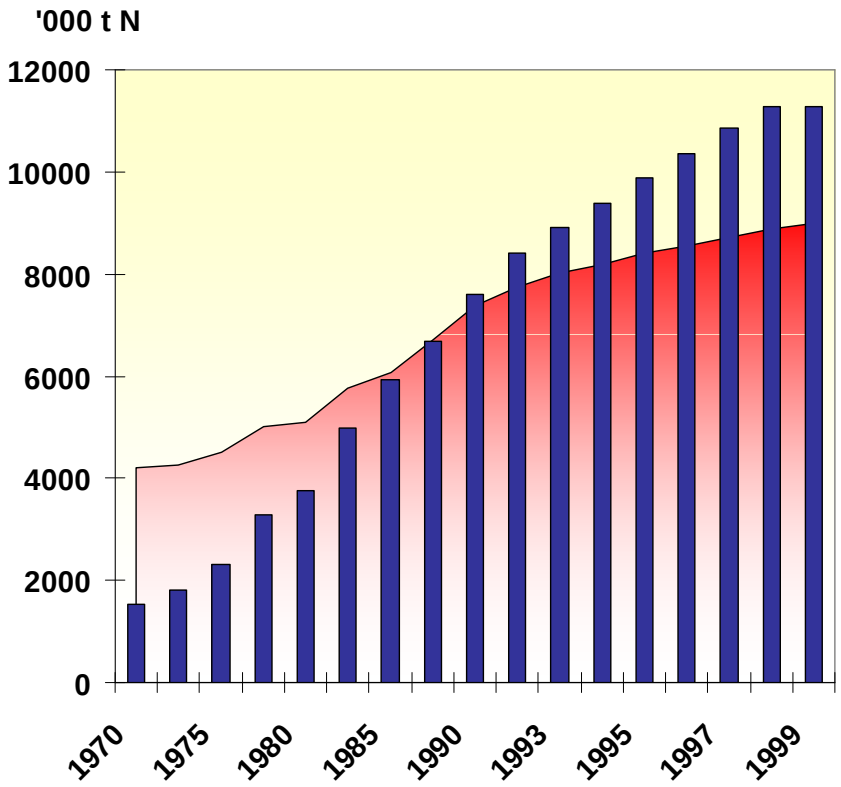
1. Pune, Maharashtra. September 15-17, 2003
2. Bangalore, Karnataka. February 27-28, 2004
3. Hyderabad, A.P. September 27-28, 2004
4. Vadodara, Gujarat. March 17-18, 2005
5. Nasik, Maharashtra. December 8-9, 2005
6. Coimbatore, Tamil Nadu. October 6-7, 2006
7. Aurangabad, Maharashtra. October, 2007

Participants: fertilizer dealers, progressive farmers practicing drip irrigation, State Department of Agriculture, the fertiliser industry and institutional agencies involved in the fertilizer marketing.

Create awareness about balanced fertilization: the nutrient balance in India is out of order

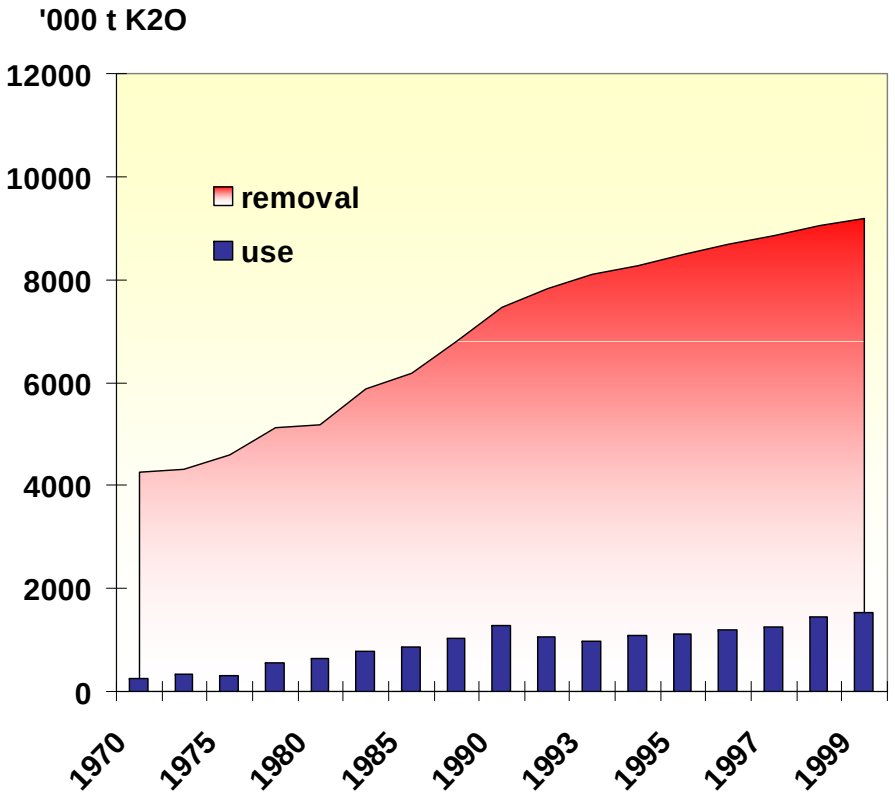
N

Use of mineral N in relation to N removal by crops



Use of mineral K in relation to K removal by crops

K

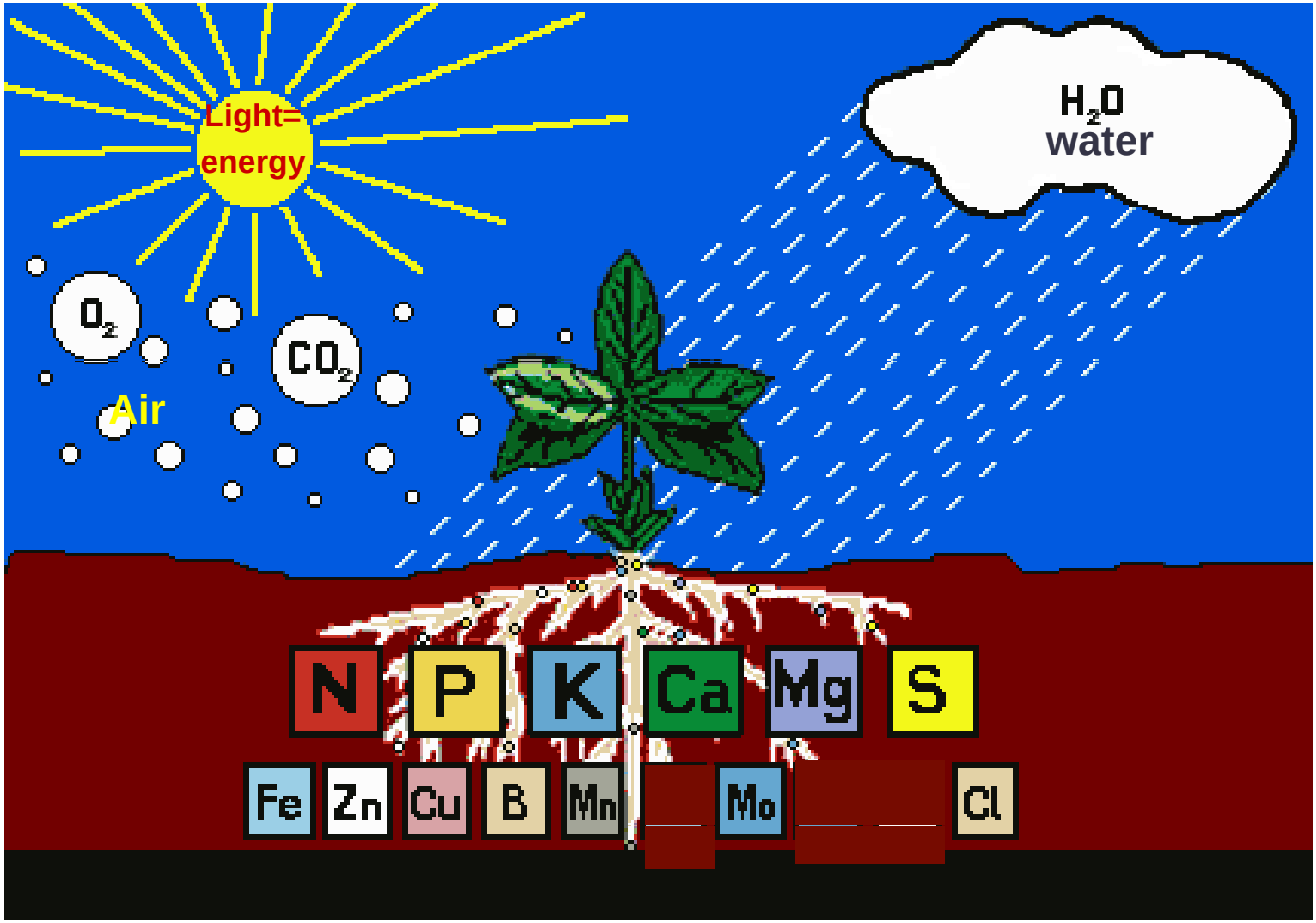


Nutrient Balances
the nutrient balance in India is out of order

Estimated Balance Sheet of K in Indian Soils		
	K_2O M t	Remarks
Potassium Additions		
Fertilizer	2.413	Actual
Urban compost	0.070	1% of 7 Mt
Rural compost	1.400	0.5% of 280 Mt
FYM	1.450	5% of dung availability (total 290 Mt)
Crop Residue	0.979	
Irrigation water	?	
Total Addition	6.242	
Potassium Removals	13.500	7.5% crop uptake is in situ recycled+ removals by leaching and erosion
Balance Sheet	-7.25 or -37.5 kg K_2O /ha of gross cropped area	

PLANT NUTRIENTS

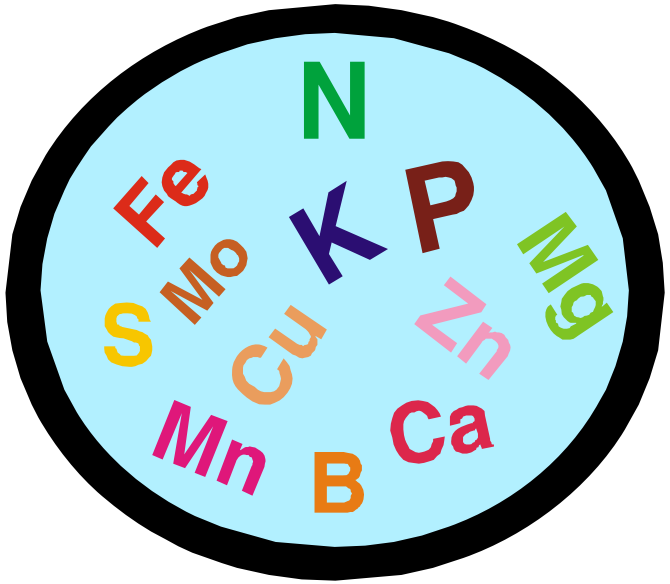
What does a plant need to live?



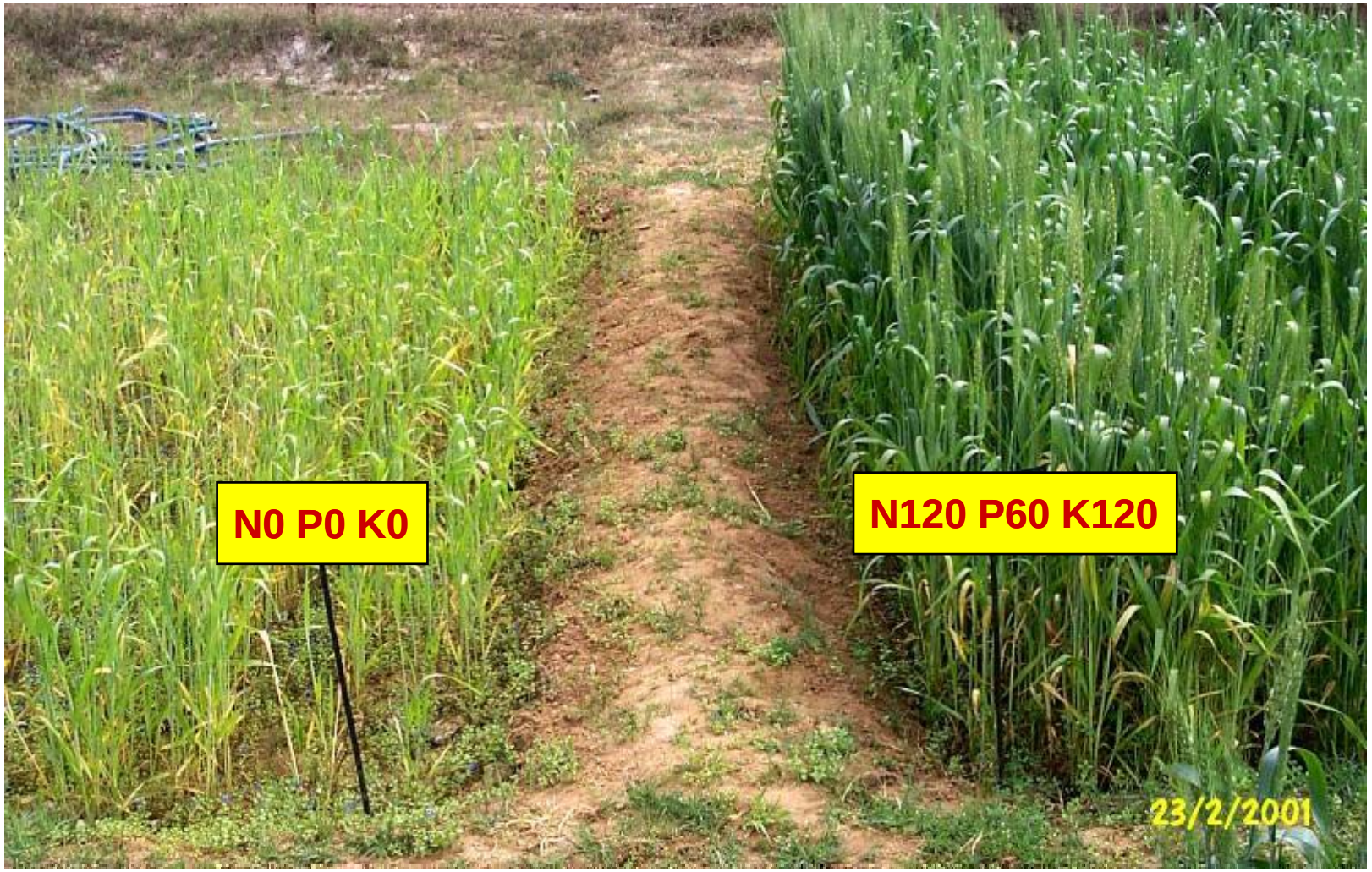
Balanced nutrition

Balance diet for human being

Balance diet for plants



Balanced nutrients application

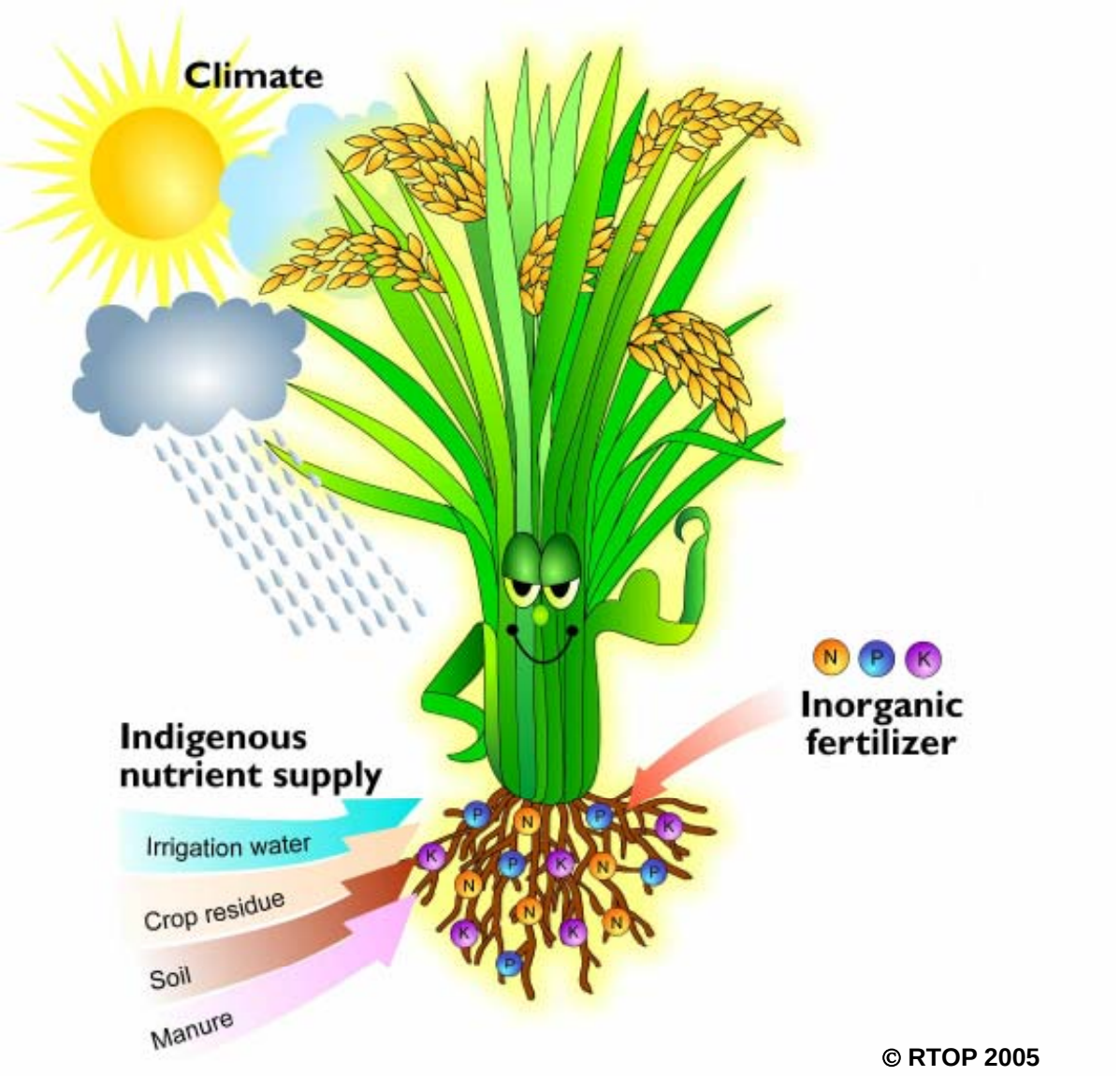


Long Term Fertilizer Experiments

Gurgaon, Haryana, February 2001

Long term effects (Wheat at PRII on 1-2-07 after 20 years)

Feeding the crops – Integrated nutrient management



Integrated nutrient management

N (nitrogen), P (phosphorus) and K (potassium)

UREA DAP or SSP POTASH (MOP)

ORGANIC MANURES

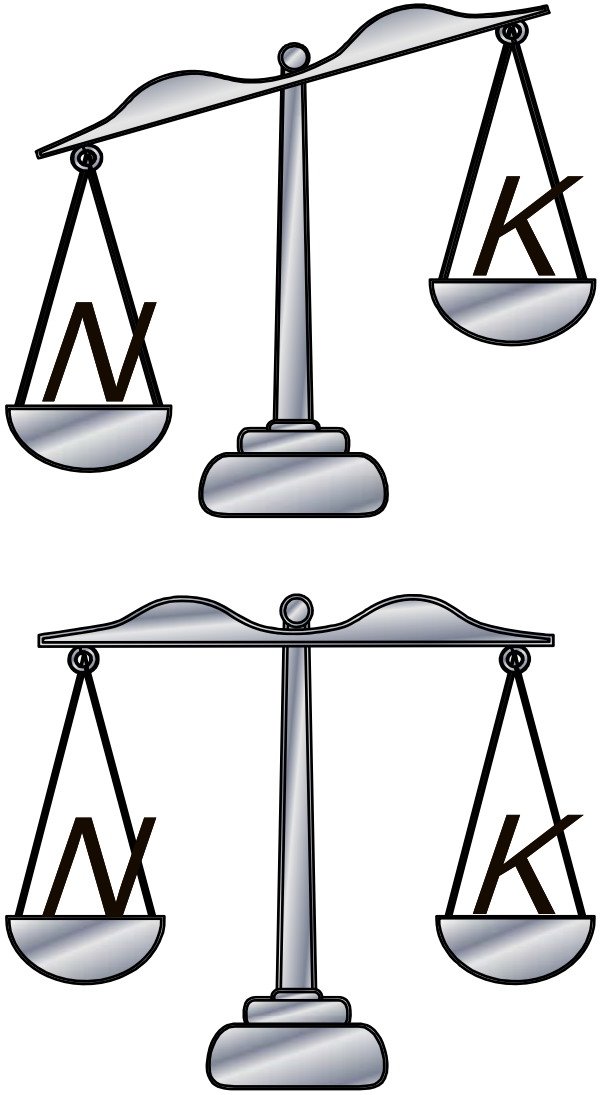
For improving soil structure, water holding, aereation & micronutrients

micronutrients

Balanced fertilization

Too much nitrogen …

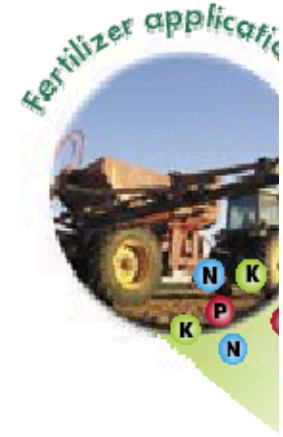
- Excessive vegetative growth
- Lodging
- Diseases, pests
- Low quality produce
- Low N fertilizer use efficiency
- Contamination of groundwater by unused nitrates
- Lower economic return

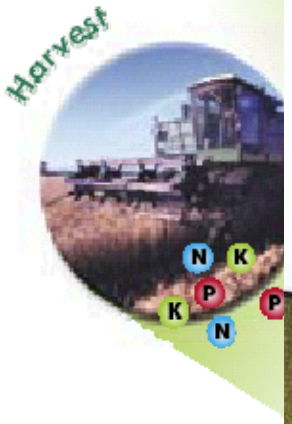


In INDIA

N:P_2O_5:K_2O ratio = 6.9 : 2.6 : 1

Average K dose = 8.6 kg K_2O/ha





oved with harvests

rops

m is depleted

rom soil reserves

be replenished to

gh fertilization

hot just adding
e soil. They are
rients that are
each harvest.

NUTRIENTS UPTAKE BY CROPS

Crop	Unit of produce	N	P_2O_5	K_2O	S
		kg per ton produce			
Cereal crops					
Rice	Grain	15	6	4	0.6
	Straw	8	3	30	0.3
Wheat	Grain	20	6	8	2.0
	Straw	28	8	37	-
Maize	Grain	15	6	5	1.2
	Stover	10	4	18	1.4
Oil crops					
Sunflower	Seed	20	15	30	5
Soybean[2]	Seed	65	14	23	2
Sugar crops					
Sugarcane	Dry matter	1.8	0.4	6.0	0.3
Tuber crops					
Potato	Tuber	3.4	1.0	6.0	0.5
Vegetable crops					
Tomato	Fruit	3.0	0.8	3.7	1.4
Cucumber	Fruit	1.7	1.3	2.9	-
Fruit crops					
Citrus	Fruit	1.7	0.5	3.2	0.1
Banana	Bunch	1.7	0.5	6.0	0.2

34 kg K_2O/ton * 5 t/ha =

170 kg K_2O/ha

A crop of rice yielding 5 t/ha removes

170 kg K_2O/ha

45 kg P_2O_5/ha

165 kg N/ha

Role of potassium in the plant

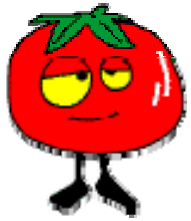
Functions

- Important in plant water uptake, water use and water balance in the plant
- Regulates > 60 enzymatic systems
- Aids in the photosynthesis
- Catalyses many metabolic processes like synthesis of carbohydrates, protein and lipids
- Facilitates cell division and growth
- Regulates opening and closing of stomata – leaf pores through which water leaves the plant (transpiration) and though which gases (oxygen and carbon dioxide) pass (i.e., gas exchange)
- Promotes the N uptake and protein synthesis

- Potassium regulates plant metabolism ensuring a healthy and sturdy crop which is more resistant to stresses. VIGOR &HEALTH

How potassium works to increase crop yields

- Increases root growth and improves drought resistance
- Maintains turgor; reduces water loss and wilting
- Aids in photosynthesis and food formation
- Reduces respiration, preventing energy losses
- Produces grain rich in starch, oils and proteins
- Builds cellulose & stronger stems, reduces lodging
- Improves winter hardiness & frost resistance
- Protects against pests and diseases



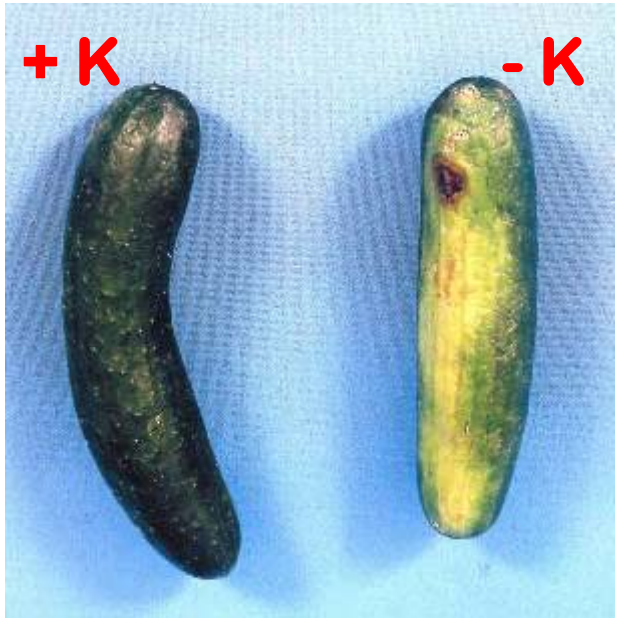
K increases the quality of the agro-products

QUALITY

- **Improves QUALITY of grains, vegetables & fruits:**
  - **Grains are bolder and more shining**
  - **Fruits & vegs have bigger size**
  - **Fruits & vegs have better color & flavor**
  - **Uniform ripening**
  - **Less fissures, cracks and lesions**
  - **Less incidences of diseases**
  - **Higher nutritional value (more protein, oil and vitamin C content in grains and fruits)**
  - **Improved storage, transportation & longer shelf life**

K IMPROVES VEGETABLES APPEARANCE

QUALITY – APPEARANCE



K INCREASES THE QUALITY OF THE AGRO-PRODUCTS - MANGO

Rubber *(Hevea brasiliensis Muell.Arg.)*

Nutrients immobilized, returned and removed in a 30-year period - Macronutrients				
Kind of removal/return	**kg/ha**			
	N	**P2O5**	**K2O**	**MgO**
Total immobilized in 30-year period	1500-1800	458-573	1440-1680	300-365
Total returned in leaf litter	1400	82	426	275
(annual range in 5th to 30th years shown in brackets)	(34-73)	(2.1-4.6)	(10.2-21.6)	(6.6-14.1)
Total removed in latex	485	94	418	120
(annual range in 6th to 30th years shown in brackets)	(6.1-35.7)	(2.4-17.6)	(6.0-39.1)	(1.4-9.3)
Total litter fall in 5th-30th years 104 t/ha, ranging from 2.5 to 5.4 t/ha/yr, peaking in 9th-12th years. - Total yield of dry rubber in 6th-30th years 46.6 t/ha, ranging from 0.62 to 3.0 t/ha/yr, generally highest from 12th to 23rd years				

Nutrient effects on latex quality

High N and Mg can adversely affect the technological properties of concentrate latex. Excessive Cu and Mn adversely affect the oxidative process of the rubber. Within the tree, excessive Mg and Ca can cause instability in the latex vessels resulting in early pre-coagulation on the excised bark, thus reducing the time of flow and yield.

Coconut *(Cocos nucifera L.)*

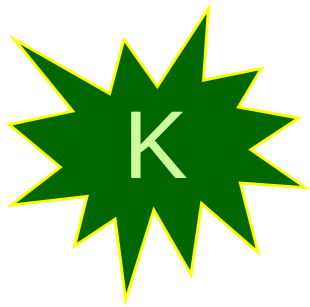
- **One hectare of coconuts (average of 150 palms) producing 12-14 leaves and 100 nuts/tree/year contains in the harvest (matured bunches) the following amount of nutrients (per year):**

49 kg N	**5 kg Ca**
16 kg P_2O_5	**8 kg Mg**
115 kg K_2O	**11 kg Na**
64 kg Cl	**4 kg S**

- **The husk contains 60 % of the K_2O, 18 % of N and 26 % of Mg removed in the harvest. It is therefore recommended that wastes such as coconut husks and leaf fronds be left in the field to undergo decomposition and mineralisation so that nutrients eventually return to the crop.**

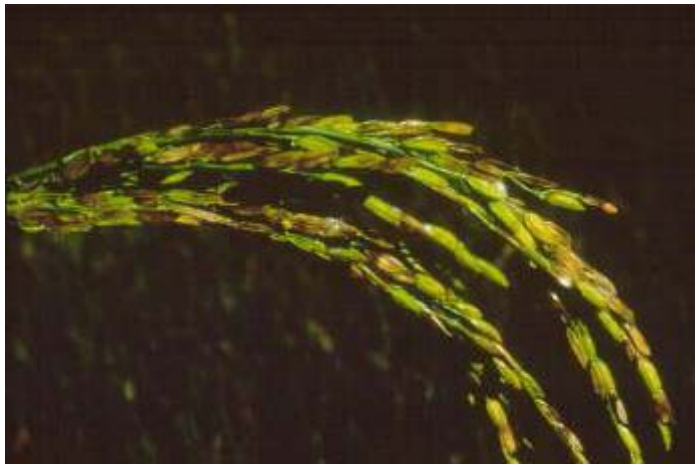
RESPONSES OF RICE TO POTASH FERTILIZATION

- **HIGHER YIELD**
- **BETTER RESPONSE TO N**
- **IMPROVED GRAINS**
  - ✓**MORE FILLED GRAINS**
  - ✓**HIGHER 1000 GRAIN WEIGHT**
- **INCREASED RESISTANCE TO LODGING**
- **RESISTANCE TO DISEASES (brown spot, stem rot, leaf blight)**



Source: De Datta and Mikkelsen, 1985; Von Uexkull, 1976

POTASSIUM DEFICIENCY SYMPTOMS



RICE

- *Stunted plants with dark green leaves and short, thin stem*
- *Yellowing at interveins on lower leaves, starting from the tip*
- *Drying up of the leaf tips and margins*
- *Dark, brown spots starting from leaf tips, spreading later over the whole leaf*
- *Irregular necrotic spots on the panicles*
- *Long thin panicles, with high percentage of sterile or unfilled grains*
- *A high percentage of rotten roots*

Potash increases number of grains and grain filling in rice

Gurdaspur (Punjab), 2000

Gurdaspur (Punjab), 2000

POTASH INCREASES PLANT HEIGHT AND NUMBER OF TILLERS

IPI-PAU experiments

Fertilizing rice with potash

Gurdaspur, Punjab

2001

Effect of K application on rice growth in near Pantnagar, distt. U.S Nagar, U.A.

Fertilizing rice with potash

IPI-GBPUAT, Pantnagar
2004

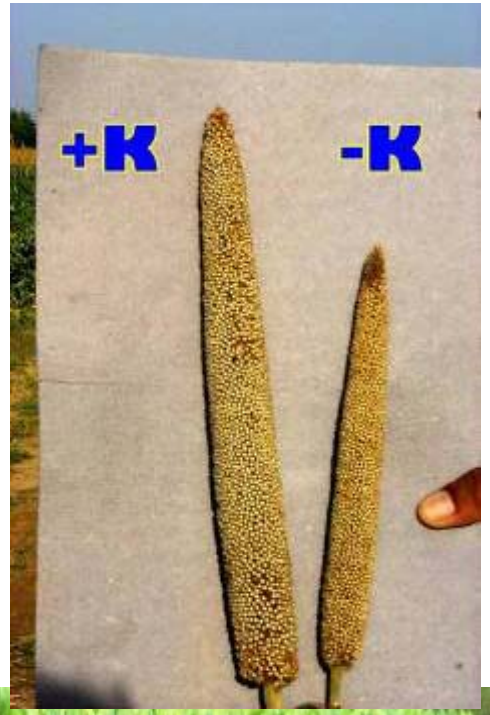
Response to potash application in IPI experiments

Response to potash application in IPI experiments

DISEASES

K decreases disease attack in rice

Response to potash application in IPI experiments



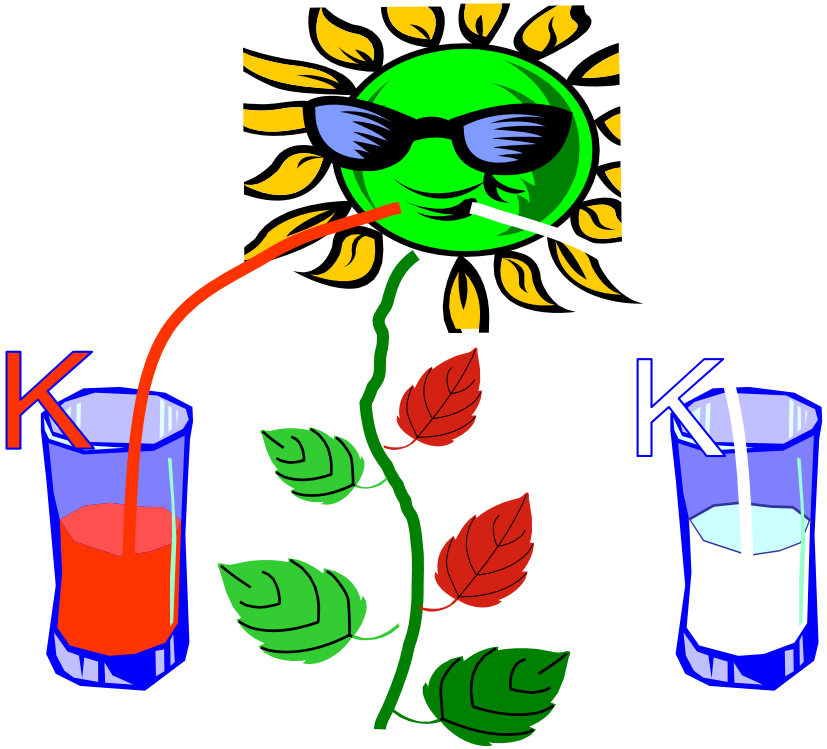
Response to potash application in IPI experiments

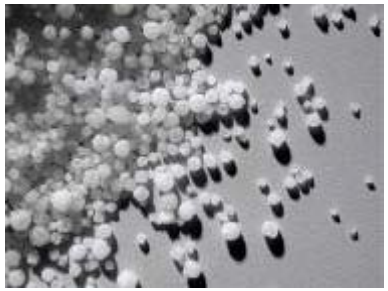
POTASH FERTILIZERS

Red & white potash

When it comes to potash,
Crops are color-blind

- Both red & white potash are chemically the same salt: potassium chloride (KCl)
- Both have equal amounts of potassium (60 % K_2O)
- Both are have equivalent agronomic effectiveness





WHITE POTASH

RED POTASH

Potash mines UK

Potash mines Spain

Composition of MOP

2 Kg others (*)

= MOP 23 Kg Cl uriate of

potash =

25 Kg K

chloride = KCl = 60

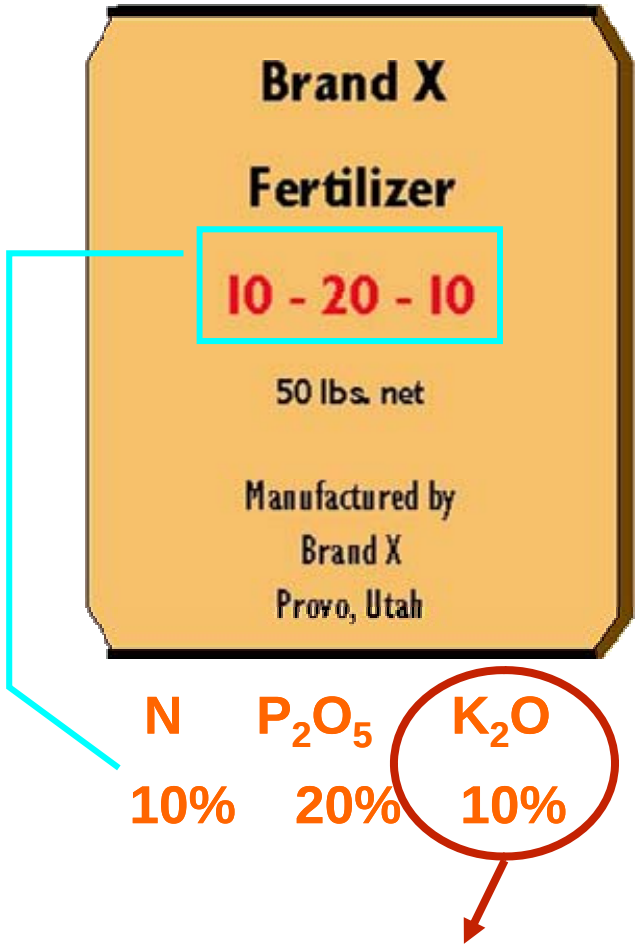
48 Kg KCl

30 Kg K_2O

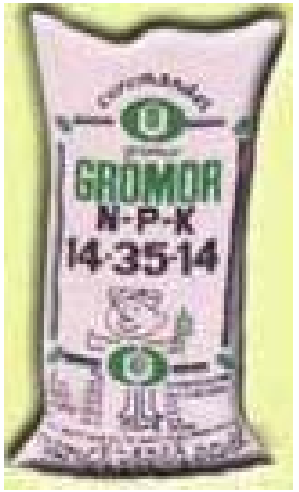
K_2O

(*) mainly $CaCl_2$, $MgCl_2$, and NaCl

POTASH IN COMPOUND FERTILIZERS



Compound Fertilizers used in India
10:26:26
17:17:17
12:32:16
15:15:15
14:35:14
19:19:19
14:28:14



Can organic manures supply potash as a source of potassium ?

K content of organic manures

MATERIAL	% K_2O
Farmyard manure	0.5-0.6
Compost	0.5-1.5
Green manure (cowpea)	0.6
Sewage sludge	0.5-1.7
Castor cake	1.0-1.1
Groundnut cake	1.3-1.4
Bird guano	2.0-3.0
POTASH	60

TO APPLY 60 KG K_2O/HA YOU NEED:

POTASH: 100 kg

FYM : 10,000 kg

Organic manures

- **Contain low amounts of nutrients NPK - Limited contribution to nutrient supply to crops**
- **Main value: supply of organic matter to the soil, improving soil structure, water holding, aereation.**
- **Micronutrients**

Potash contains 100 times more K !

Thank you very much !