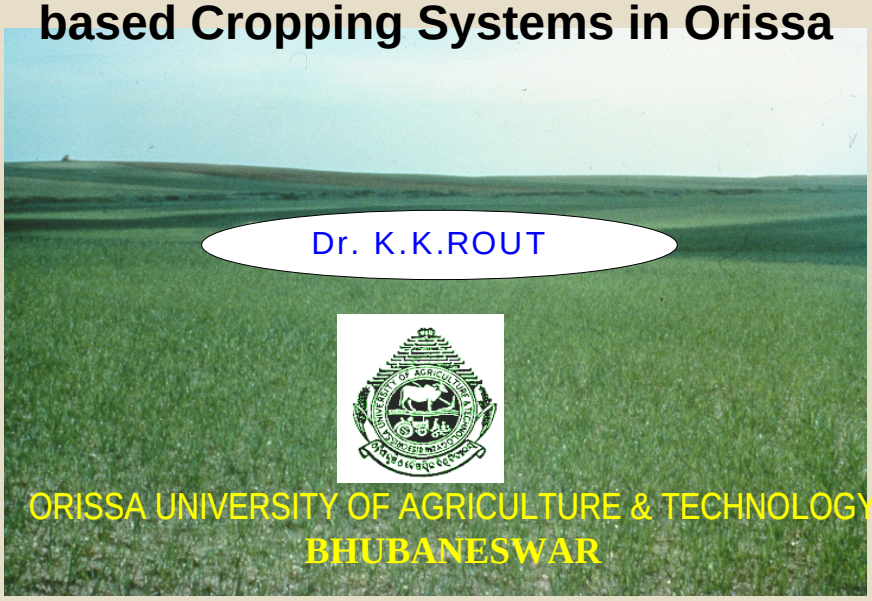
Potassium Management in Rice based Cropping Systems in Orissa



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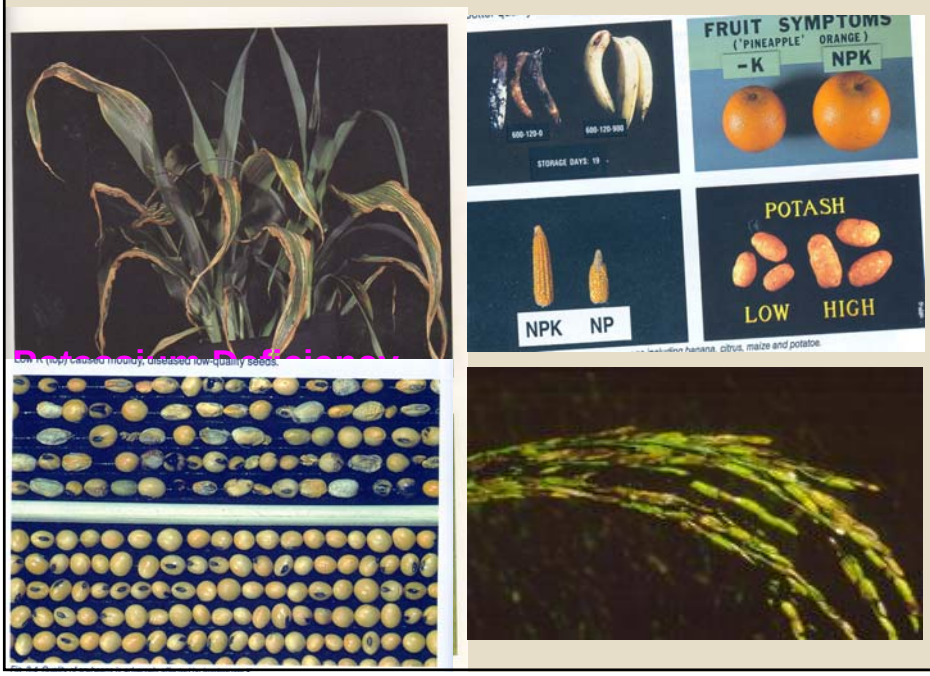
Nutrient Uptake by Some Selective Crops

Crop	Yield(t/ha)	Nutrient Uptake(kg/ha)		
		N	P_2O_5	K_2O
Rice	6	100	50	160
Wheat	6	170	75	175
Maize	6	120	50	120
Groundnut	2	170	30	110
Rape seed	3	165	70	220
Potato	40	175	80	310
Onion	35	120	50	160
Tomato	50	140	65	190

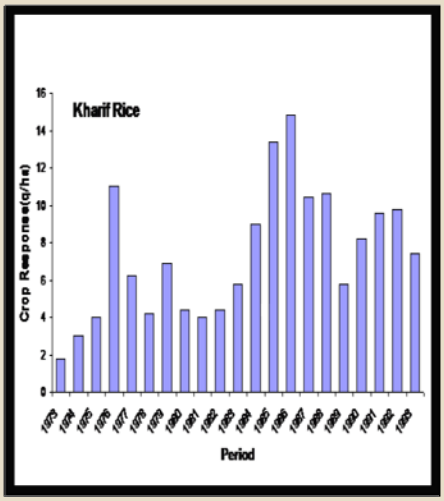
K Deficiency Symptoms

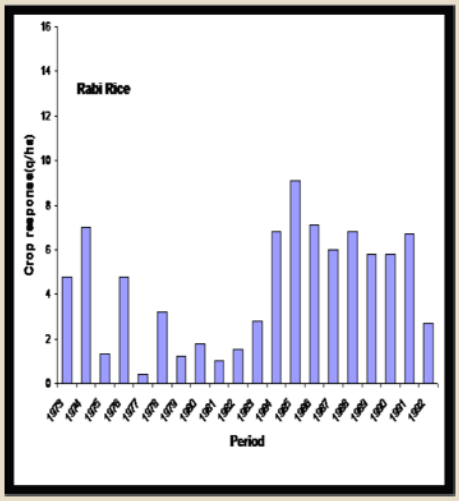


Mitra and Misra(2001) reported huge nutrient deficit in the soils of Orissa

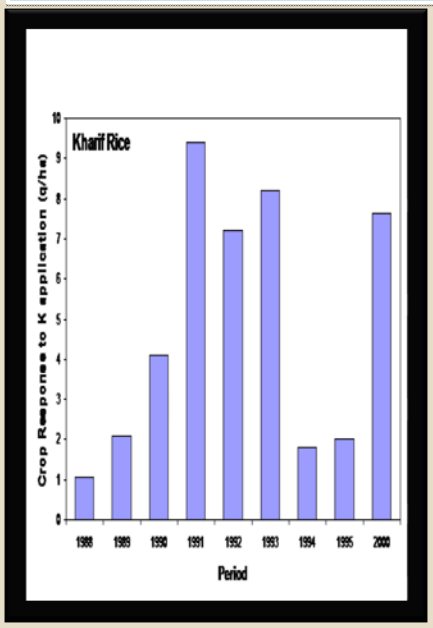
Nutrients	Deficit (000'tonnes)	Deficit (kg/ha)
N	-31.58	-3.78
P_2O_5	-48.90	-5.88
K_2O	-242.87	-29.16

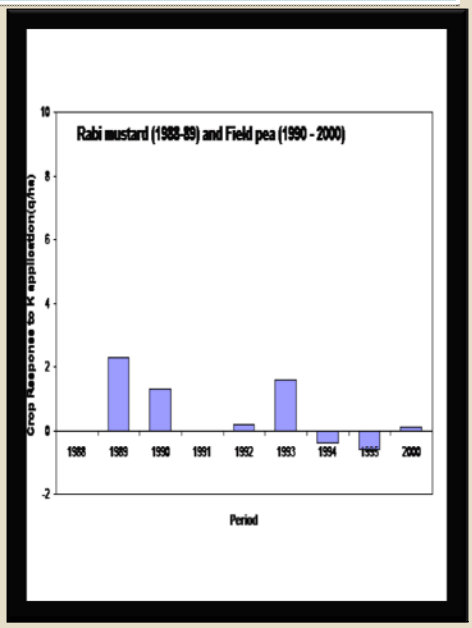
Crop response to K application over years of manuring in rice at Bhubaneswar

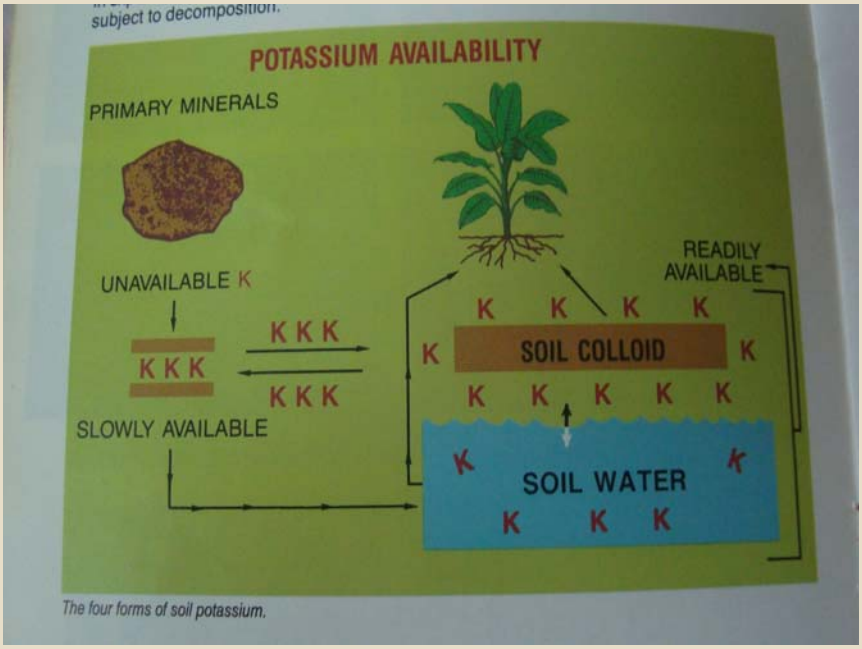




Crop response to K application over years of manuring at Keonjhar



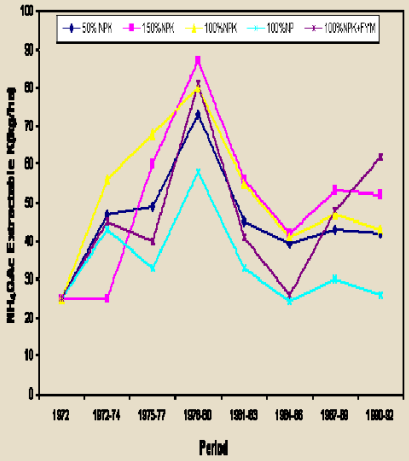




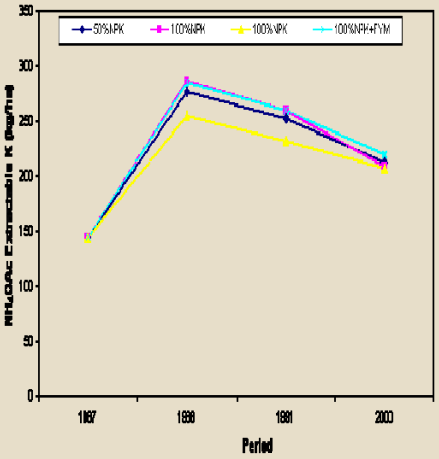
Mean annual K balance over 20 years (1972 - 1992) of cropping at Bhubaneswar

Treatments	Mean annual K application (kg/ha)	Mean annual K uptake (kg/ha)	Mean annual K balance (kg/ha)
100% NP	0	90	-90
100% NPK	100	137	-37
100% NPK + FYM	120	167	-47
150% NPK	150	157	-7
50% NPK	50	106	-55

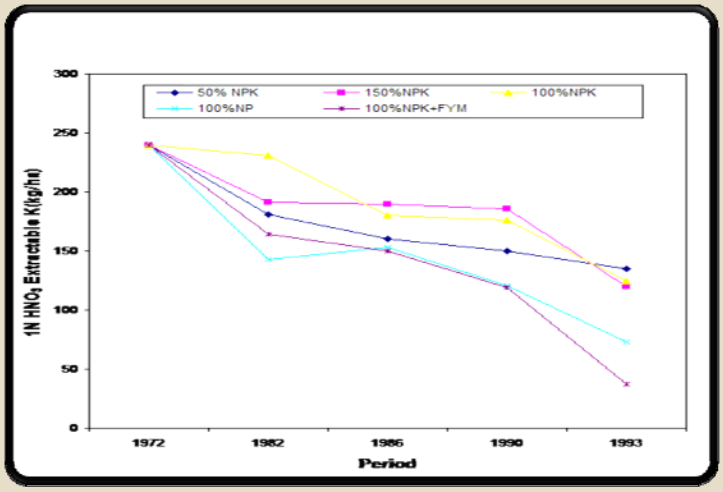
Variation in NH_4OAc Extractable (available) -K status of soil under long term manuring



BHUBANESWAR



KEONJHAR



Variation in 1N HNO_3 -Extractable K over the years at Bhubaneswar

NH_4OAc-K, 1N HNO_3-K and Total K in three layers at the end of 1987-88 cropping cycle at Bhubaneswar

Treatments	NH_4OAc-K (kg/ha)			1N HNO_3-K (kg/ha)			Total K (kg/ha)		
	0-15 cm	15-30 cm	30-45 cm	0-15 cm	15-30 cm	30-45 cm	0-15 cm	15-30 cm	30-45 cm
100% NP	35	26	33	150	154	113	2800	2700	3100
100% NPK	45	35	56	230	195	200	3300	3000	3500
100% NPK + FYM	43	25	38	167	102	147	2600	2200	3000
150% NPK	55	35	60	243	201	227	3300	2600	3000
50% NPK	48	35	55	200	158	183	2700	3000	3900
Initial	25	44	71	240	233	313	3500	3200	4100

NH_4OAc-K and 1N HNO_3-K in three layers of soil after 12 years of cropping at Keonjhar

Treatments	NH_4OAc-K (kg/ha)			1N HNO_3-K (kg/ha)		
	0-15 cm	15-30 cm	30-45cm	0-15cm	15-30cm	30-45cm
100% NP	227	205	220	533	660	573
100% NPK	208	224	221	640	667	673
100% NPK + FYM	219	299	255	813	960	817
50%NPK	212	250	253	593	633	706
Initial	144	325	298	706	950	1098

Effect of nitrogen and potassium levels on pod yield, shelling %, oil Content of rabi groundnut (Av.3yrs.) and K-status of alluvial soils after three years on a rice-groundnut cropping sequence

Treatments $N:P_2O_5:K_2O$	Pod Yield(q/ha)	Shelling %	Oil Content(%)
$N_{20}P_{40}K_0$	16.2	62.0	40.8
$N_{20}P_{40}K_{40}$	18.31	65.4	42.7
$N_{20}P_{40}K_{60}$	20.19	67.1	44.5
$N_{20}P_{40}K_{80}$	20.48	67.7	45.5
$N_0P_{40}K_0$	16.59	63.3	51.0
$N_0P_{40}K_{40}$	18.85	64.9	43.2
$N_0P_{40}K_{60}$	20.93	68.0	45.5
$N_0P_{40}K_{80}$	21.31	68.3	46.2

Effect of Potassium application on grain yield of green gram

Levels of K_2O (kg ha^{-1})	Crop Yield(q/ha)		
	1990-91	1991-92	Mean
Control(K_0)	3.66	2.26	2.96
K_{15}	3.94	2.46	3.20
K_{30}	4.63	2.66	3.64
CD $_{0.05}$	0.44	0.27	

Effect of K & S on greengram

Kg/ha	Yield, kg/ha	% increase
Ko So	296	-
K_{15}	320	8
K_{15} S_{30}	369	25
K_{30}	364	23
K_{30} S_{30}	421	42

Effect of N-K interaction on grain yield of green gram

Treatments(N-P_2O_5-K_2O) (kg/ha^{-1})	Grain yield(kg ha^{-1})
20-40-0	333
20-40-20	483
20-40-30	433
20-40-40	492
0-40-0	342
0-40-20	567
0-40-30	538
0-40-40	454
$CD_{0.05}$: N-Level: NS; K-Level : 90 NXK : NS	

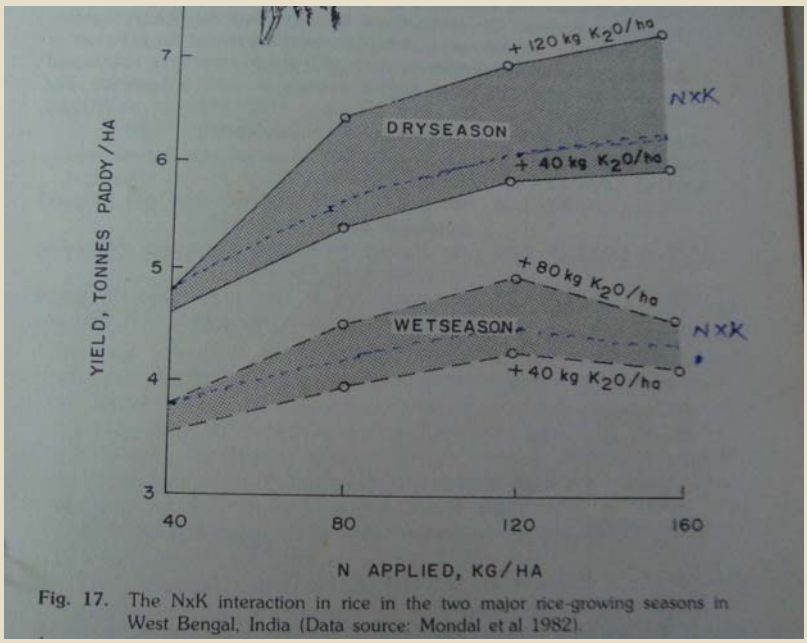


Fig. 17. The NxK interaction in rice in the two major rice-growing seasons in West Bengal, India (Data source: Mondal et al 1982).

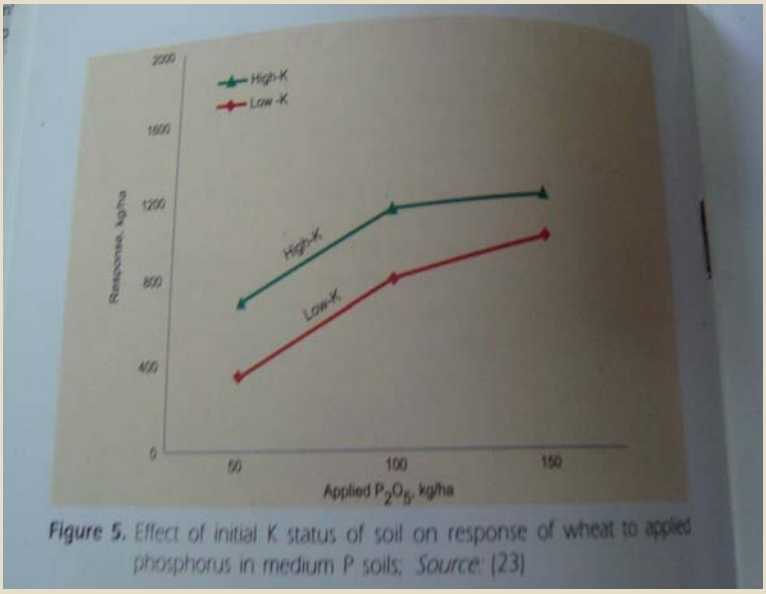


Figure 5. Effect of initial K status of soil on response of wheat to applied phosphorus in medium P soils. *Source*: [23]

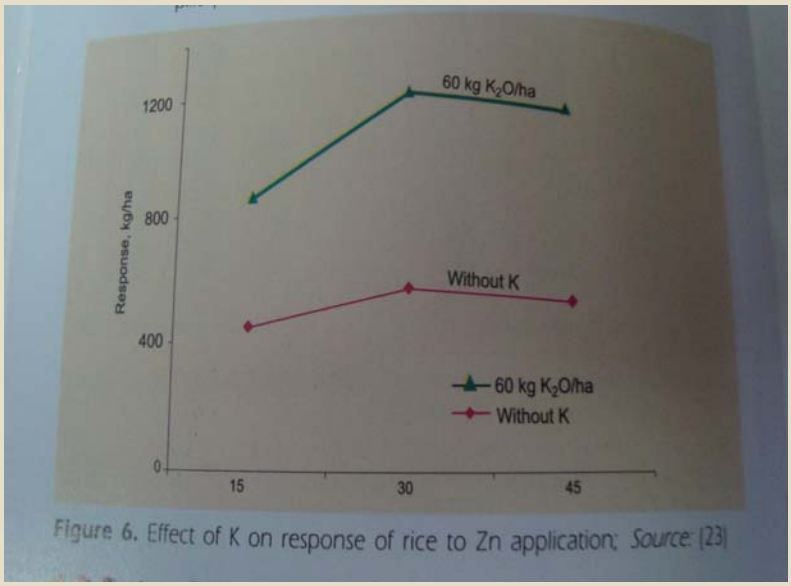


Figure 6. Effect of K on response of rice to Zn application; *Source*: [23]

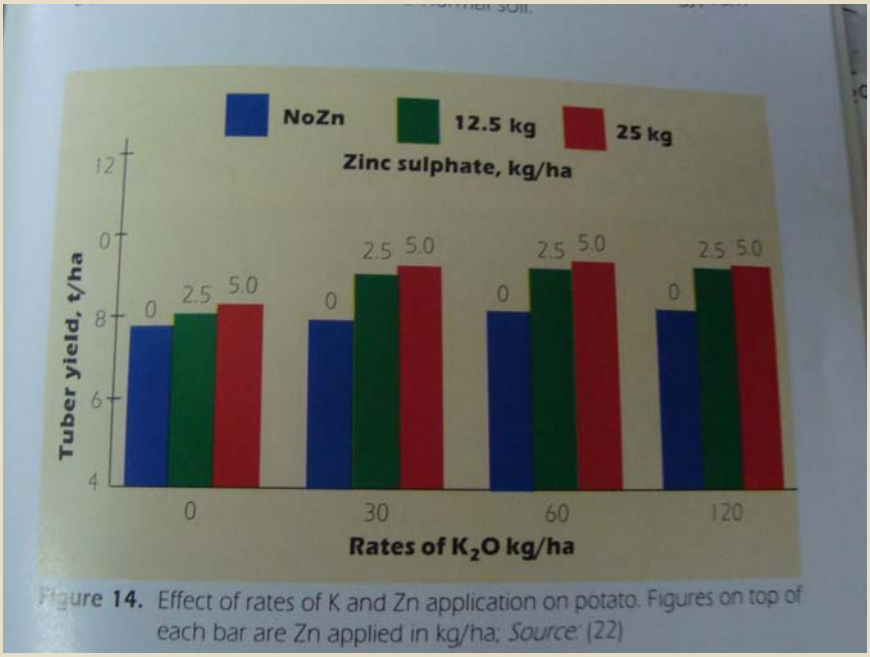


Figure 14. Effect of rates of K and Zn application on potato. Figures on top of each bar are Zn applied in kg/ha; *Source*: [22]

CONCLUSION & SUGGESTIONS

- The Conventional Practice of Plant Nutrition has caused huge negative balance of K in the soils Orissa as the per ha use is very less.
- This exploitive activity has caused huge mining of reserve K from Soil.

- The present method K indexing by NH_4OAC extractable K is not sufficient to diagnose crop response & K deficiency in soil.
- The method of K indexing needs to be modified to suit to different type of soils.
- Methods for integration of exchangeable and non exchangeable K for soil testing purposes should be developed and calibrated.
- Sampling may be done from deeper layers as sub soil also significantly contributes to K nutrition even in shallow rooted crops.

- Potassium has got significant interaction with many nutrients and practices.

- While recommending K fertilizers these effects need to be given due consideration.

- **There is large potential of non fertilizer source of K in crop residues and organic manures.**

- **There is an urgent need to exploit these sources in the nutrient management plan for all cropping systems.**

- Instead of considering crop respone as a criterion, K needs to be applied to crops from all possible sources in order to maintain or improve the K status in the soil