Martin Phillips

Borax Europe Ltd U.K.

BORAX

Micronutrient deficiencies - some crops affected in Asian region

B	Cu	Fe	Mn	Zn
Alfalfa	Barley	Citrus	Cereals (with high pH)	Beans
Cauliflower	Carrot	Grapes	Potatoes	Citrus
Carrot	Onions	Ornamentals	Sugar beet	Coffee
Coffee	Wheat	Fruit trees	Peas	Maize
Cotton		Vegetables	Citrus	Rice
Oil palm		Groundnut	Soy bean	
Rapeseed		Rice		
Tobacco		Maize		
Sunflower				
Groundnut				

BORAX

Bangladesh – Zinc removal from Flood Plain soils

Cropping patterns	Biomass production (t $ha^{-1}yr^{-1}$)	Zinc removal (kg $ha^{-1}yr^{-1}$)
Summer Rice – Fallow – Rice	23.0	1.04
Wheat – Rice – Rice	28.5	1.16
Mustard – Rice – Rice	24.5	1.34`
Potato – Rice – Rice	28.0	1.30

Z Karim et al, Bangladesh Agricultural Research Council

BORAX

Micronutrient use by crops

Crop	Yield	Grams per hectare				
		B	Cu	Fe	Mn	Zn
Cotton	2.5 t/ha^{-1} seed cotton	120	110	140	190	480
Rice	5.0 t/ha^{-1} grain	60	20	810	600	215
Maize	4.0 t/ha^{-1} grain	36	20	120	36	60
Wheat	3.0 t/ ha^{-1} grain	36	43	380	120	180
Groundnuts	2.0 t /ha^{-1} nuts	550	60	480	400	50
Rapeseed	3 t/ ha^{-1} seed	50	17	150	90	50

Source: Khan and Nortcliffe (1982)

BORAX

India : Rice - response to zinc application

Crop	No of experiments	% Trials in the response range (kg ha^{-1}) of			Average response (kg/ha^{-1})	Extra crop Value / ha	C : B Ratio
		<200	200-500	>500			
Wheat	2453	39	37	24	380	$ 52	1:17
Rice	2289	23	43	34	760	$89	1:22
Maize	285	47	21	32	670	$72	1:18

Assumes 16 kg / ha Zn S 0_4 @ $ 0 .25/ kg

BORAX

Bangladesh - yield response of major crops to zinc application in zinc deficient areas

Crop	Number of trials conducted	Number of trials showed response > 10%	Number of trials showed response > 20%
Modern rice	293	130	76
Wheat	91	41	2
Mustard	10	2	2
Sugarcane	6	0	0

Z Karim et al, Bangladesh Agricultural Research Council , Dhaka 1215

BORAX

China : Rice - benefit of zinc sulphate application

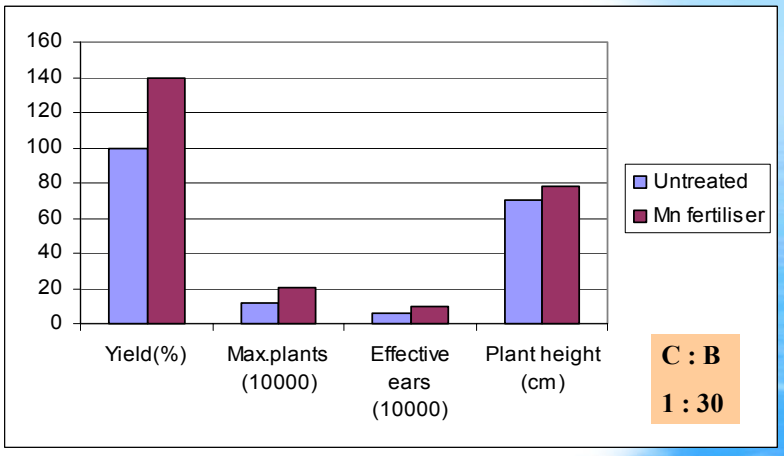
$ZnSO_4.7H_2O$ (kg ha^{-1})	Growth status Tiller number	Yield harvested (kg ha^{-1})	Extra yield	Value/ha $^{-1}$ of extra Yield US$	Benefit : Extra Yield – Costs of Zn
0	42.0	7124	-		
7.5	46.5	7620 (+6.5)	496	65	63
22.5	47.3	7799 (+8.8)	675	90	84

Soil conditions: pH value 6.30-8.80; available Zn content 0.16-0.94 ug/g.

Source: Zou Bangli Institute of Applied Ecology ,Liaoning Province China .

BORAX

China: Wheat - effect of Mn fertilization on increasing yield (kg/ha^{-1}) at Xingming, Shimian, Sichuan



Hu Sinong, Chen Yibing, Su Zhiqun, Lu Shihua and Luo Hanfu. Soil Status and Control Methods of Mn-deficiency on wheat in Sichuan. Proc Int. Symp. Role of Sulphur, Magnesium and Micronutrients in Balanced Plant Nutrition.

BORAX

Pakistan - crop responses and economics with boron application

Crop	Field Expts	Control Yield (kg ha^{-1})	Yield Increase %	Cost : Benefit
Wheat	16	3286	14	1:4
Rice	19	3081	14	1:5
Maize	9	2512	20	1:7
Cotton				
Soil	30	2377	14	1:16
Foliar	13	2156	12	1:33

Source: NFDC Pakistan 1997)

BORAX

Pakistan - Boron deficiency reduces paddy yield and impairs grain quality

Year	Sites	Cultivars	Paddy yield increase (%)	Cost : Benefit
2002	5	Basmati-385	25	1:55
		Super Basmati	20	1:41
2003	3	Basmati-385	14	1:31
	9	Super Basmati	18	1:37
	1	KS-282	11	1:31

Grain quality improvement:

- Milling recovery
- Elongation on cooking

Source: Rashid et al. IRRN (in press); Rashid et al. (unpublished data)

BORAX

China - effect of Urea / B on crop yields in soil deficient in B

Crop	Experiment number	Area (ha)	Yield increase (%) as compared with urea	
			Range	Average
Rice	20	125	5.0-15.7	9.6
Maize	46	39	6.5-22.1	13.8
Wheat	16	44	11.0-18.3	12.7
Soybean	2	7	19.3-20.0	19.4
Sugar beet	2	1	12.5-16.1	13.4
Sum	86	216	5.0-22.1	13.8

Zou Bangii, Zou Bangli Institute of Applied Ecology ,Liaoning Province China .

BORAX

Cotton India - growth parameters and yield following boron application

Treatment	No of branches/ plant	No of squares / plant	No of square drop/ plant	No of bolls/ plant	No of boll drop/ plant	Seed cotton yield (q ha^{-1})	% Increase
Control (Recommended NPK)	6.53	20.26	3.67	13.00	2.90	8.51	-
225 gm B/ha^{-1} (Average of 3(trmts))	7.48	24.95	2.07	20.44	0.86	10.63	25

Source: Marathwada Agricultural University, Parbhani

BORAX

India: Cotton - benefits and value of extra yield and quality following boron application

Treatment	Ginning %	Seed index (g)	Lint index (g)	Staple length (mm)	Increase in Value of Yield wt – Rs ($)
T_1 – Control (Recommended NPK)	34.63	6.00	3.17	19.20	
T_1 + Boron @ 225 g/ha^{-1}	39.47	7.30	4.79	22.02	3974 ($ 88)
CD at 5%	3.09	0.40	0.46	0.67	

Source: Marathwada Agricultural University, Parbhani

BORAX

India: Mango - benefits of boron application on high value variety

Alphonso Mango – Konkan Maharashtra

	Year 1 Yield increase	Year 2 Yield increase	Increased income over 2 years	Cost benefit
Boron 1gms/tree x 3 sprays + 25gms B to soil/tree	50 kg/tree 7,500 kg/ha $^{-1}$	44/tree 6,600 kg /ha $^{-1}$	Rs 3,760/tree Rs 564,000 / ha $^{-1}$	1: 48

* 150 trees/ha $^{-1}$

Dr Edward Raja, 11HR Bangalore

BORAX

Cotton India - N, P K concentration following boron application

Treatment	Concentration in seed cotton		
	N (%)	P (%)	K (%)
Control (Recommended NPK)	3.00	0.69	1.11
169 gm B/ha^{-1}	3.33	0.74	1.16
225 gm B/ha^{-1}	3.40	0.80	1.21
281 gm B/ha^{-1}	3.35	0.75	1.17
Average increase	+12	+10	+6.3

Source: Marathwada Agricultural University, Parbhani

BORAX

Concentration of Nutrients in Mustard following Application of boron

Boron rate for 4 growth periods (ppm)	N	P	K	Ca	Mg*
4 weeks	17.4	6.1	31.7	90.5	-3.1
6 weeks	3.27	8.33	49.2	38.13	-5.2
8 weeks	2.5	11.5	42.8	26.1	-5
12 weeks	2.6	3.8	37.3	25.7	-2.8
Average Increase 6-12 Weeks	6.44	7.4	40.3	45.1	-4.1

Karim, A.Q.M.B. & Deraz, Omar (1961). Effects of Micronutrients on the Absorption of Major Elements in Mustard.

BORAX

Micronutrient benefits and fertiliser use

	0 Micro	Micro	Year 2	Year 3
Crop Yield Q/ha^{-1}	20.0	22.0	At least maintenance of Regular rates NPK required	Additional macronutrient required
Cost Micro	0	$5.3		
Income	$275	$303		
C : B		1:4.9		
Extra Income		$28		
Extra N Extracted		+ 6 %		
Extra P Extracted		+ 6 %		
Extra K Extracted		+ 20%		

BORAX

Potential value of yield increases in rice and wheat using relevant micronutrient

	Rice Has m	Rice 5% increase mt m	Rice value increase $ m	Wheat Has m	Wheat 5% increase mt m	Wheat value increase $ m	Wheat and rice value increase $ m
China	28.2	4.9	592	24.4	4.9	683	1275
India	44.5	7.8	935	25	5.0	700	1635
Pakistan	2.3	0.4	48	8.1	1.6	228	276
Bangladesh	10.9	1.9	229	0.8	0.2	23	252
Total	85.9	15	1804	58.4	11.7	1634	3438

Rice 3.5 t /ha $120 mt

Wheat 4 t /ha $140 mt

BORAX

Benefits Summarised

- Closer to optimum yield and quality from existing Nutrients in soils. Better income for the farmer and better survival for him in terms of wherewithal for his family.
- Better purchasing power of farmers for crop inputs including fertiliser .
- Increased future requirement for fertilisers due to increased nutrient use. In short term opportunity for fertiliser companies to differentiate products – Added value for the same grade
- Sustainable fertiliser use for the future
- Increased income for the community and the country from use of the same land. Better quality of crops for export.
- Less loss of nutrient to environment.

BORAX