Micronutrient Fertilization on a Typic Acrorthox at Manaus, Brazil

Manoel S. Cravo, EMBRAPA
Thomas Jot Smyth, N.C. State University

Annual crops have not provided significant yield responses to micronutrient applications during the initial years of cultivation on a Typic Acrorthox at Manaus, Brazil. A field study with micronutrient fertilization was initiated in 1982 on previously cultivated land in order to gain further information on the micronutrient status of this soil. The experimental site had been cropped to a corn-cowpea rotation during the five preceding years with N, P, and K as the sole fertilizer inputs.

Treatments, as described in Table 1, were established in a randomized complete block design with four replications. Two rates of each micronutrient tested were established as separate treatments. The Complete 1 treatment contained intermediate levels of each micronutrient in order to compare with the other levels applied. Micronutrients were applied only at planting of the initial corn crop. All other nutrients and lime were supplied by uniform applications to all plots. Corn and cowpeas were grown annually in rotation.

Yield Response to Micronutrients

Yield differences among treatments were not significant for the six crops harvested. Cowpea yields on treatments with micronutrients were similar to the treatment without micronutrient fertilization (Table 2). Yield trends for corn in 1984 and 1985 suggested a response to B and Zn. Foliar levels of B for corn in 1983 approached the lower limit of the recommend-

Table 1. Micronutrient fertilizer rates applied to the initial corn crop in the micronutrient study.

Treatment	B	Cu	Mn	Zn
	kg/ha			
Cjeck	0	0	0	0
B0	0	1	5	5
B1	1	1	5	5
Cu0	0.5	0	5	5
Cu2	0.5	2	5	5
Mn0	0.5	1	0	5
Mn0	0.5	1	10	5
Zn0	0.5	1	5	0
Zn10	0.5	1	5	10
Complete 1	0.5	1	5	5
Complete 2	1	2	10	10

Table 2. Relative yields of corn and cowpeas during six consecutive crops after micronutrient treatments were established.

	Corn			Cowpeas		
Treatment	1983	1984	1985	1983	1984	1985
	relative yield, %*					
Check	100	100	100	100	100	100
B0	96	102	101	102	100	99
B1	94	138	105	105	108	106
Cu0	79	111	104	91	102	89
Cu2	98	126	95	109	108	94
Mn0	86	127	98	97	100	88
Mn10	100	127	91	90	97	78
Zn0	109	111	93	93	106	94
Zn10	97	140	131	96	105	95
Complete 1	87	146	112	100	103	99
Complete 2	109	114	100	102	115	89
CV (%)	18	22	19	11	11	16

* Yields for the check treatment in t/ha were as follows: Corn, 1983: 2.7; corn, 1984: 2.0; corn, 1985: 2.8; cowpeas, 1983: 1.5; cowpeas, 1984: 1.4; cowpeas, 1985: 1.1.

ed sufficiency range (Table 3). Although Zn fertilization rates have provided consistent increases in Mehlich 1 extractable soil Zn, no such differences have been observed in foliar Zn levels for corn (Table 4). Foliar micronutrient analyses have been impeded by laboratory modifications and instrument problems.

Mehlich 1 extractable Cu and Mn have declined during the three years of cultivation on treatments with and without the application of these elements (Table 4). The absence of a yield response to Mn, despite the low soil-test levels, may be related to the maintenance of soil pH within a range of 5.4-5.0. Other studies performed on-site have provided evidence of Mn deficiency when soil pH was greater than 5.5.

Table 3. Foliar B levels for the 1983 crops of corn and cowpeas as a function of B applied prior to planting corn.

Treatment	Leaf B	
	Corn	Cowpeas
	ppm	
B0	8	25
Complete 1	5	31
B1	6	32

Conclusions

1) Results thus far on this study have indicated marginal yield responses with corn to B and Zn. These elements have been included in blanket fertilizations for corn in other on-site experiments where micronutrient deficiencies were to be avoided.

2) Yield trends with cowpeas have suggested that native soil levels of micronutrients were sufficient for this crop.

Table 4. Leaf and soil Zn levels and soil Cu and Mn levels in three corn crops as a function of micronutrient rates.

Treatment	Mehlich 1 Extractable			Foliar Analyses		
	1983	1984	1985	1983	1984	1985
	Zn, ppm					
Zn0	1.0	.8	.6	21	49	14
Zn10	2.0	2.5	1.8	28	52	10
LSD .05	.6	.8	.4	ms	ns	ns
	Cu, ppm					
Cu0	1.8	1.8	0.3			
Cu2	2.8	1.8	0.6			
LSD .05	ns	ns	0.1			
	Mn, ppm					
Mn0	5	2	2			
Mn10	7	2	4			
LSD .05	3	ns	1			