

# Cotton Accumulates Small Amounts of Copper, Iron, Manganese, and Zinc

By G.L. Mullins and C.H. Burmester

*Micronutrients are elements required in small or "micro" amounts by all plants. Although a mature crop may accumulate less than an ounce of some micronutrients per acre, plants will not grow and yield properly without adequate levels of these nutrients. Cotton is no exception. However, there has never been an intensive study of the micronutrient uptake characteristics of the cotton plant in the U.S.*

**TO EVALUATE** cotton's accumulation of copper (Cu), iron (Fe), manganese (Mn), and zinc (Zn), a field study was conducted during 1986 and 1987. The two non-irrigated sites were a Decatur silt loam soil in north Alabama and a Norfolk sandy loam soil in central Alabama. Copper, Fe, Mn and Zn are not normally recommended for cotton on these soils and there were no supplemental applications of these nutrients during this two-year study.

Four genetically varied cotton varieties were compared: Deltapine 90, an Acala cotton; Coker 315, a Midsouth cotton resulting from Carolina breeding; Stoneville 825, a Midsouth cotton from Delta breeding; and Paymaster 145, which was developed for the High Plains area of Texas. Micronutrient uptake was evaluated by sampling whole plants at two-week intervals over the growing season beginning approximately 30 days after planting. Plants were separated into stems, leaves, and fruit for dry matter and micronutrient analysis. Bolls were divided into seed, burs, and lint. The bur fraction included squares and flowers.

## Results

Even though the four cotton varieties resulted from genetically different breeding, all varieties were very similar in their ability to accumulate Cu, Fe, Mn and Zn. There were no consistent differences among the varieties in total uptake of the four elements or uptake by a given plant

part. At the last sampling for each year, total Cu, Fe, Mn and Zn uptake averaged over soils and varieties were 0.40, 8.90, 5.49, and 1.47 oz/A, respectively (**Table 1**). Total Fe and Zn uptake was very similar for the two soils. However, total Cu and Mn uptake was lower on the Norfolk soil compared to the Decatur soil. The Norfolk soil had lower levels of dilute double-acid extractable Cu and Mn as compared to the Decatur soil. Micronutrient removal in seed cotton represented 30 percent of the total plant Cu, 13 percent of the Fe, 6 percent of the Mn, and 48 percent of the Zn (**Table 2**). Seed cotton yields for the study averaged 1,874 lb/A. Combining yield data with total micronutrient uptake data indicated an average uptake of 0.06 oz of Cu, 1.4 oz of Fe, 0.90 oz of Mn and 0.24 oz of Zn for every 100 lb of lint produced.

The maximum daily uptake rates for the micronutrients studied occurred at 58 to 98 days after planting (first to fourth week of bloom), very close to the period of maximum dry matter production. Except for Zn, none of these nutrients were

**Table 1. Accumulation of Cu, Fe, Mn and Zn by mature cotton (average of four varieties) on two soils.**

Plant part	Cu	Fe	Mn	Zn
	oz/A			
Stems	0.12	1.82	1.08	0.26
Leaves	0.10	3.74	3.24	0.34
Burs	0.06	2.19	0.86	0.17
Seed	0.12	1.15	0.31	0.70
Total Uptake	0.40	8.90	5.49	1.47

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**Table 2. Distribution of Cu, Fe, Mn and Zn in mature cotton plants (average of four varieties).**

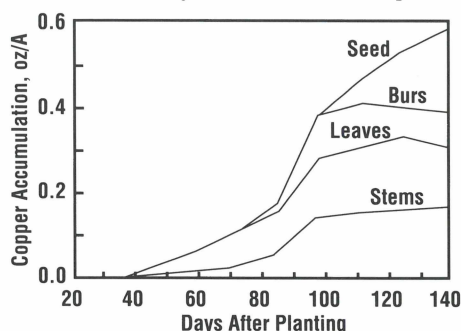
Plant part	Cu ----- % of total uptake -----	Fe ----- % of total uptake -----	Mn ----- % of total uptake -----	Zn ----- % of total uptake -----
Stems	30	20	20	18
Leaves	25	43	56	23
Burs	15	24	18	11
Seed	30	13	6	48

redistributed within the cotton plant during the growing season (Figures 1, 2, 3, and 4). Zinc in the bur fraction was apparently redistributed into the seed.

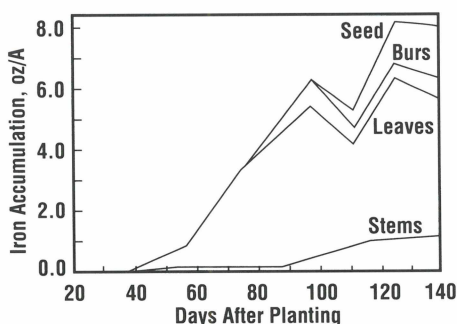
### Summary

Four varieties of cotton were very similar in their ability to accumulate and parti-

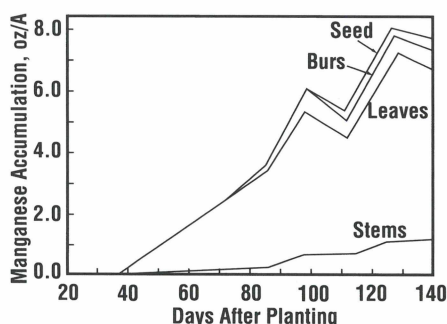
tion Cu, Fe, Mn and Zn. Seasonal accumulation of Cu, Fe, Mn and Zn averaged 0.40, 8.90, 5.49 and 1.47 oz/A, respectively. During the two-week interval corresponding to the maximum uptake rate for each element, an average of 42 percent of the total Cu, 51 percent of the total Fe, 42 percent of the total Mn, and 34 percent of the total Zn was accumulated. Maximum micronutrient uptake occurred during the first to fourth week of bloom. An average of 30 percent of the total Cu, 13 percent of the total Fe, 6 percent of the total Mn and 48 percent of the total Zn was removed in seed cotton. Cotton grown accumulated an average of 0.06 oz of Cu, 1.4 oz of Fe, 0.90 oz of Mn, and 0.24 oz of Zn for every 100 lb of lint produced. ■



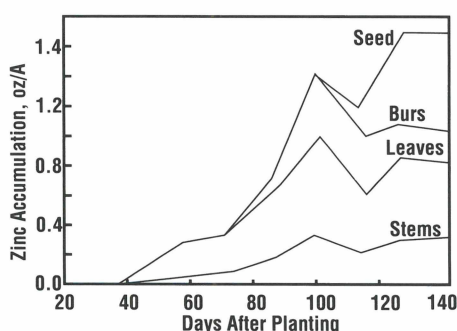
**Figure 1. Average uptake of Cu by four cotton varieties grown on a Decatur soil in 1986. Sampling was initiated 36 days after planting and continued at 14-day intervals throughout the growing season.**



**Figure 2. Average uptake of Fe by four cotton varieties grown on a Decatur soil in 1986. Sampling was initiated 36 days after planting and continued at 14-day intervals throughout the growing season.**



**Figure 3. Average uptake of Mn by four cotton varieties grown on a Decatur soil in 1986. Sampling was initiated 36 days after planting and continued at 14-day intervals throughout the growing season.**



**Figure 4. Average uptake of Zn by four cotton varieties grown on a Decatur soil in 1986. Sampling was initiated 36 days after planting and continued at 14-day intervals throughout the growing season.**