NUTRIENT SURVEY

SWEET CORN

WILLAMETTE VALLEY, 1978

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During the summer of 1978, soil and plant samples were taken from 90 sweet corn fields in the Willamette Valley. The objectives of this survey were: (1) to identify plant nutrition problems that might be affecting the yield and quantity of sweet corn in the Willamette Valley and (2) to study the relationship between chemical analyses of soil and plant samples on these fields.

Approximately 30 of these fields were planted between May 1 and 10 (the early planting date), another 30 were planted between May 10 and 25 (mid-season planting dates), with the remaining 30 fields being planted after May 25. Plant samples were taken at two stages of growth: (1) third leaf from the top of the plant was taken when the corn was about 20 inches tall (the early plant sample), and (2) the leaf opposite the first ear taken at tasseling time, this is commonly called an ear leaf sample. The ear leaf was taken from the same area where the soil sample and first leaf sample were taken. A soil sample was taken at the first plant sampling from the same area as the leaf samples. An area between one-half and one acre in size was sampled; this limits the soil variation that might be encountered in field size samples. Soil samples were taken away from the fertilizer band to avoid the influence of one or two cores with a sample of the fertilizer bands applied at planting time.

The summary of this data will not represent a statistical average of the nutritional levels found in sweet corn fields in the Willamette Valley. However, with 90 fields being sampled and by selecting fields to cover the range of soil series on which sweet corn is grown in the mid-Willamette Valley, we should have obtained a reasonable sampling of the extremes in nutrient levels that might be found in the area. We believe that this was a reasonable procedure to follow in selecting these samples.

All the data obtained for both plant samples and the soil samples was placed on computer cards so that correlation analyses could be completed. Regression equations were calculated for a number of nutrient variables. In assessing the information obtained from this survey, it is important to remember that a correlation coefficient of 1.0 is perfect. Our best correlation coefficient (r) was 0.85, 0.81, 0.91 (line 5) for Ca and Mg soil analyses. The best soil-plant analyses correlations were for zinc (r = .77, line 13, 2nd planting group) and copper (r = 0.72, line 15, 1st planting group). Correlation coefficients are designated as either negative or positive. A negative correlation coefficient shows that one factor or variable might be interfering with the second variable that was measured. For example, it was evident that high levels of magnesium in the plant reduced the amount of potassium found in the plant. A correlation coefficient less than about 0.35 shows there was little or no relationship between two variables tested. It is important to know that there are direct relationships between two variables, for example, it would be very important to know that we could use a copper soil test to predict the level of copper we might find in a sweet corn leaf. Also, it is important to know that one variable or level of a nutrient does not adversely affect the uptake of a second nutrient. A correlation approaching zero could tell us that we do not have any antagonistic effects and that we could make any desired application of one fertilizer without having this interfere with the uptake of other nutrients by the plant.

Correlations were calculated for: (1) all fields sampled and then broken down to (2) early planted fields, (3) mid-season plantings, and (4) late plantings. Soil test values were correlated with soil test values in all possible combinations, soil test values were also correlated with nutrient levels found in the plants for both sampling dates in all possible combinations. Correlations between the level of nutrients found in the plants on both sampling dates were calculated.

We decided that it would be logical to present the correlation coefficients for four of these groupings. We are therefore showing the correlations between soil test values (e.g. soil pH with soil P). Next, the relationship between soil test values and nutrient levels found in both plant samples is shown, and fourth is the relationship between the different nutrients taken up by the corn plants for the first samples taken (when the plants were about 20 inches high).

As we study the range of correlation coefficients found it is important to recognize that these do not establish a cause and effect relationship. For example, we found a positive correlation between magnesium levels in soils and the amount of copper in a soil. This does not mean that application of magnesium would increase the amount of copper found in these soils. For some reason those soils that happened to be high in magnesium and calcium were also relatively high in copper. This point warrants further investigation. We need to recognize that we did not attempt to integrate or identify effects of fertilizer applications made by the growers in this correlation study. This explains the relatively poor correlation between phosphorus concentration in sweet corn leaves and the phosphorus soil test values. Virtually all the sweet corn growers in the valley apply a band of phosphorus fertilizer near the seed at planting time; this band application of phosphorus has a much greater influence on the phosphorus found in the sweet corn leaves than residual soil phosphorus as measured by the soil test values between the rows. We should, therefore, not expect a very good correlation between a phosphorus soil test value and a level of phosphorus found in the leaves. In contrast, there are no or very few farmers that applied copper, we therefore found a reasonably good relationship between the copper extracted by a soil test and the amount of copper in sweet corn leaves.

We selected about 30 relationships for the computer to plot two variables and illustrate the scatter of points found for different correlation coefficients. These will be discussed to help us to understand the information obtained from correlation coefficients for all of the data.

RELATIONSHIPS FOR POTASSIUM, CALCIUM, AND MAGNESIUM

We will discuss the relationships between potassium, calcium, and magnesium levels found in plant and soil samples first. I think most of us have some concept of the possible competition between these three cations; this will help us to understand the information obtained from this kind of a survey. Figure 1 shows the relationship between the potassium soil test values and the potassium found in the corn leaves on the first plant sampling for the early planted field. This correlation coefficient was .58 and shows a reasonably good relationship. As we examine the actual plot of the data, we find two or three samples with relatively high potassium in the corn leaves (above 2.5%) with relatively low potassium soil test values. These higher levels of potassium might logically have come from potassium applied in the fertilizer band with the phosphorus; we know that some farmers in the area apply potassium. All fields with high soil test values (above 300 ppm/K) had more than 2% potassium in the first leaf samples.

Some other interesting relationships were evident concerning the amounts of potassium found in first leaf samples. Figure 2 shows that magnesium in the soil did not have a marked effect on the potassium found in corn leaves. However, Figure 3 shows there was a negative relationship between the amount of magnesium in the leaf and the amount of potassium in the leaf; this correlation coefficient was -.59. A plot of the data shows considerable variation in the potassium and magnesium contents at middle levels but for the higher levels of potassium (above 2.5% K) there was a general reduction in the amount of magnesium found in the plant samples. Also, those plant samples having more than .28% magnesium had potassium levels below 2.9% K. This is an example of the competitive relationship that exists between potassium and magnesium. We know that if we are on the borderline of either a potassium or magnesium deficiency that a heavy rate of fertilization with the competing nutrient will probably accentuate that deficiency.

There was a very good relationship (r = .81) between the amount of calcium and magnesium found in soil samples. This should have been expected since most of the soils that are acid, and have been leached, are low in both calcium and magnesium. Recent alluvial soils, except for those with a sand or sandy loam texture, generally have high levels of both calcium and magnesium.

It is interesting to note that there is very little relationship between calcium soil test values and calcium in corn leaves. All soils tested had adequate levels of calcium for sweet corn nutrition and other factors such as potassium, magnesium and possibly manganese had more effect on the calcium taken up by the corn plant than did calcium in the soil.

COPPER RELATIONSHIPS

One question when the survey was initiated was the possibility of a copper deficiency on sweet corn growing on mineral soils in the Willamette Valley. The average copper content of leaf samples for the three sampling dates were 6.6, 7.1, and 8.6 ppm of copper, with the copper content increasing as the planting date was delayed. In examining the copper concentration found in leaf samples, there were 10 out of the 32 samples on the early planting date that had 5 or less ppm copper, 4 samples out of 29 had 5 ppm copper or less on the second planting date, and only 1 sample had less than 5 ppm copper on the third planting date. A review of the literature would suggest that about 5 ppm is probably a critical level for copper; this would suggest that some of these fields were deficient in copper. This data also suggests that planting date, probably because of lower soil temperatures, is a major factor influencing the uptake of copper during early stages of growth by sweet corn.

Figures 5, 6, and 7 show the relationship between the copper soil test values and copper found in leaf samples for the three planting dates respectively. There were correlation coefficients of .72, .70, and .13 for the three groups of samples with the lowest correlation coefficient on the late planting date. The poor correlation between copper soil test value and copper found in leaf samples on the late planting date could be related to the fact that all plant samples had much higher levels of copper on the late planting dates. The positive relationships found were dominated by those samples with soil test values below 1.8 for copper and leaf levels below about 6 or 7 ppm copper. In any event, there was a reasonably good prediction value for the amount of copper found in leaf samples with soil tests on the earlier planted sweet corn. The copper soil test values should be a reasonable basis for selecting fields for copper experiments on sweet corn, especially if these experiments are established on corn fields that are planted around the first of May.

A number of other interesting relationships were evident for soil test copper and other soil test values, and for the possible relationship between phosphorus and magnesium uptake and the amount of copper found in the plant. Figures 8 and 9 show a positive relationship between copper soil test values and calcium and magnesium soil test values for those sweet corn fields planted between May 10 and 15. There was some positive relationship between copper and magnesium soil test values for the earlier planted sweet corn fields; but, this relationship approaching 0 on the late planted fields. In reviewing the location of sweet corn fields for these different planting dates, it was evident that many of the earlier planted sweet corn fields were around the Stayton area with the mid planting being concentrated along the main stem of the Willamette River and the later planted fields being concentrated on the old valley floor soils, such as Woodburn and Amity. The higher level of copper in soil samples from May 10-25 planting date and the positive relationship between calcium or magnesium and copper found in soil samples may be the result of bordeaux sprays that were applied in earlier periods of time for production of hops and fruit crops on these soils, or it may be that alluvial deposition from sedimentary Coast Range soils have higher levels of copper and this is reflected in these samples. These questions need further evaluation.

It is interesting to note that with fields planted after May 25 that the relationship between copper soil test values and magnesium soil test values disappears; there was a -.04 correlation coefficient, which shows essentially no relationship. With the positive relationship between soil test magnesium and soil test copper for the second planting date, there is also a positive relationship (correlation coefficient .70) between soil test magnesium values and leaf copper values for this group of fields. The relationship between leaf copper and soil test magnesium that is plotted in Figure 11 shows a reasonable scatter of points along a fairly straight line that can be drawn for this regression equation.

Some people have suggested that phosphorus fertilization might interfere with copper uptake by some plants. Since many fields used for vegetable crop production in the Willamette Valley have received fairly liberal applications of phosphorus for a number of years, we thought it would be of interest to examine the relationships between phosphorus soil test levels and copper soil test levels, as well as any possible relationships between phosphorus soil test levels or phosphorus found in plants and the amount of copper found in the plants. First, the correlation coefficients for soil test copper versus soil test phosphorus were -.08 for all samples and -.06, -.52 and +.24 for the three planting groups, respectively. These correlation coefficients would indicate no relationship on one group of soils, a possible negative relationship on the second planting group, and a positive relationship on the third planting group. In examining the relationship between the phosphorus soil test values and copper found in plants, it was evident that there was no relationship for the first planting date, but a possible negative relationship for the second and third planting groups. However, as we examine a printout of the points for leaf copper versus soil test phosphorus in Figures 12 and 13, there was essentially no relationship for Figure 12 (r = +.11) and possible negative relationship for Figure 13 (r = -.43). Two samples with relatively low phosphorus soil test values and very high copper values had a major impact on the slope of this regression line. An evaluation of the relationship between phosphorus found in plants and copper found in plants shows that correlation coefficients were .08, .07, and .01 for the first, second and third planting groups respectively. This indicates no relationship between phosphorus in the plant and the amount of copper found in corresponding plant samples. Fig 15, 16, Tables 2,3,4

In summarizing the information obtained on copper from this survey, it is probably evident a number of fields have relatively low copper levels found in leaf samples. At this point we do not know that these fields will respond to applications of copper. It will be important to establish copper fertilizer experiments, especially on early planted sweet corn fields, in 1979.

As we examine possible relationships between other nutrients and the amount of copper found in sweet corn plants, it seems evident that the second group of soils that were dominated by fields along the main stem of the Willamette River had somewhat higher levels of magnesium and there was a positive relationship between the magnesium and copper found in these soils. Also, there was a positive relationship between the magnesium found in the soil and the amount of copper taken up by sweet corn growing on these soils. There is nothing in the literature to suggest that this is a cause and effect relationship and that we should anticipate that application of magnesium would increase the uptake of copper by plants. As we examine relationships between the amount of phosphorus found in the soil or plants and copper soil test values or the amount of copper found in leaf samples, it seems very doubtful if phosphorus has any antagonistic relationship with copper (any possible effect of reducing copper uptake).

BORON RELATIONSHIPS

We have had questions over a period of years concerning the possibility of boron deficiency for sweet corn fields in the Willamette Valley. We recognize that a number of factors other than the amount of boron in the soil will influence the amount of boron taken up by a plant. The soil moisture and soil organic matter both play an important role in boron taken up by plants. Soil temperatures also influence the amount of boron taken up by the plants. These factors cause boron deficiency to vary considerably from one year to the next. Also, most people concerned with soil and plant analysis work recognize that it is difficult to obtain a good measure of the level of boron in either soil or plant samples, especially when the levels are relatively low. In our soil testing program, it might be better to classify all soils below .5 ppm boron as being low rather than to identify a difference between .2 or .4 ppm boron.

The average level of boron in soil analyses for these three planting groups were .34, .40 and .47 for the first, second and third planting groups, respectively. The average level of boron in the plant samples were 3.7, 8.9, and 11.1 ppm of boron for the first, second and third planting groups, respectively. This indicates that some factor, such as soil temperature or some other soil condition, probably had a greater influence on the amount of boron being taken up by sweet corn on the early planted fields. These data would also suggest that there were some quite low levels of boron in leaf samples for the early planted fields; research work in other areas has suggested a critical level of boron around 7 ppm for corn plants. As we examine the printout on the relationship between the amount of boron found in leaf samples and the boron soil test values, it is evident there was a very limited spread of boron soil test values in the lower range, but a wider range of boron levels found in leaf samples. The correlation coefficient for boron soil test values versus boron in leaf samples had four errors in B soil tests recorded on the computer sheet. Therefore, correlations were not recorded.

It is evident from a plot of the data points (Figures   ) that there were very low correlation coefficients for these relationships. This would be expected with the low B soil test values.

As we would expect, the relationship between boron soil test values and boron found in the plant for the third planting group approached 0 or no relationship, this probably resulted from the relatively higher levels of boron in plant samples on this planting date.

The Willamette Valley is an area of widespread boron deficiency for those plants that have a significant boron requirement or are inefficient in taking up boron. Even though the level of boron found in the leaf samples might not be very accurate, there were a relatively large number of fields with quite low boron concentrations for the early planting dates. Field applications of boron should be investigated with the effort being concentrated on earlier planted sweet corn on fields that have relatively low boron soil test values.

PHOSPHORUS RELATIONSHIPS

The relationship between phosphorus soil test values and phosphorus found in leaves of sweet corn plants is given in Figures 19 and 20. As previously mentioned, the amount of phosphorus found in a plant sample is probably influenced more by the band application of phosphorus made at planting time than by the residual or carryover levels of phosphorus found in the soil, especially with the relatively high rates of phosphorus that many growers apply. The r value for the first planting group was .48 and for the second planting group was .01. This indicates some relationship which is evident in the distribution of points in Figure 19 for the first planting date, but a very poor relationship for the second group of plant samples.

The planting date for the sweet corn, soil temperatures for the different planting seasons, and the rate of phosphorus applied will all undoubtedly affect the correlation coefficients that might be obtained in a study of this kind.

ZINC RELATIONSHIPS

Relationships between soil test zinc, the amount of zinc found in the plant, and other nutrient variables are given in Figures 21 through 25. A more detailed evaluation of the information obtained on zinc could be obtained by studying the correlation coefficient found in Tables 1 though 5. Zinc deficiency has been observed on sweet corn in the Willamette Valley and fairly widespread use is made of zinc fertilizer in the Stayton area. Previous applications of zinc undoubtedly influence the relationship between zinc soil test and zinc found in the plants in some of these areas. The correlation coefficients (r values) for the zinc soil test values and the amount of zinc found in the corn leaves on the first sampling date were .40, .77, and -.13 for the first second and third planting groups, respectively. A printout of zinc leaf analysis versus zinc soil test relationship for the first two planting groups are given in Figures 21 and 22. Most of the fields in the first planting date were in the Stayton area where some of the growers apply zinc each year and have applied zinc in previous years. The application of zinc at planting probably accounts for some of the fields with relatively high zinc concentrations in leaf samples with fairly low soil test values. The second planting date was concentrated along the main Willamette River, where fewer growers apply zinc fertilizer. In this group of samples, there was quite a good relationship (r = .77) for a soil test versus plant analysis value. We don't have an explanation for the low the correlation coefficient for zinc soil test versus leaf zinc for the third planting group. Further study of these fields may help explain this question. An examination of the data for these plant samples shows that all values were above 30 ppm on the first plant sampling; since these were above the critical level, we should not anticipate a very good relationship between zinc soil test values and the zinc level found in the plants. This survey would indicate that where lower levels of zinc are found, that zinc soil test values should give a reasonable prediction for the amount of zinc found in sweet corn leaves.

Some concern has been expressed about the possible effects of phosphorus fertilization reducing the amount of zinc taken up by sweet corn. The r values for soil test phosphorus and leaf zinc on the first sampling date were .03, -.10 and -.40 for the first, second and third planting groups, respectively. This would indicate that the correlation approached 0 for the first two planting dates with a possibility of some negative relationship on the third planting date (r = -.40). Examination of the printout for leaf zinc versus soil test P for the third planting groups shows two fields with relatively high zinc values and low phosphorus soil test values. If these two samples were removed from the population, the r value would have probably been comparable to that found for the first planting date.

When we examine the relationship between phosphorus in plant samples and zinc in plant samples (phosphorus in plant samples would be the result of both residual P in the soil and P fertilization) we find correlation coefficients of .28, .66, and .25 for the first, second and third planting dates, respectively. These r values would indicate that, if anything, the higher levels of phosphorus found in the sweet corn plants would be associated with increased levels of zinc. The relatively good correlation coefficient (r = .66) for the second planting date, where most of these fields were along the main stem of the Willamette River with little zinc fertilizer being applied, would indicate that phosphorus application probably increased zinc uptake. It might be quite significant that for the plot of these data points in Figure 25, especially at the higher levels of leaf phosphorus, there seem to be a very good positive relationship between high levels of leaf phosphorus and high levels of leaf zinc.

When we examine the relationships for both soil test phosphorus and leaf phosphorus versus the amount of zinc in sweet corn plants, it would seem evident that antagonistic effects were not present between zinc and phosphorus. If anything, the application of phosphorus fertilizer increased the amount of zinc found in plants. This conclusion would be supported by previous work done in the Willamette Valley and in the Klamath Basin where response from both phosphorus and zinc has been measured.

Average values for plant and soil analyses; sweet corn survey, 1978.

	All Plantings	Early Plantings	Mid-Season Plantings	Late Plantings
Soil Analyses				
pH	5.5	5.6	5.5	5.5
P ppm	55	57	51	56
K	250	269	243	247
Ca meq/100 g	10.7	11.1	9.7	11.3
Mg	3.2	2.8	3.4	3.4
B ppm	.4	.3	.4	.5
SMP lime req.	6.2	6.2	6.3	6.2
Cu	1.6	1.4	1.7	1.8
Zn	1.5	1.7	1.4	1.3
1st Sampling		Plant Samples		
P %	.36	.34	.35	.41
K %	2.79	2.63	2.27	3.57
Ca %	.34	.39	.32	.31
Mg %	.23	.25	.22	.23
Zn ppm	47	47	47	48
Mn ppm	95	106	91	87
Cu ppm	7.4	6.6	7.1	8.6
B ppm	7.7	3.7	8.9	11.1
2nd Sampling		Plant Samples		
P	.29	.29	.28	.30
K	2.39	2.37	2.29	2.53
Ca	.74	.75	.75	.70
Mg	.33	.33	.34	.33
Zn	41	40	43	39
Mn	148	136	155	155
Cu	8.3	8.3	8.7	7.9
B	8.7	8.1	10.6	7.1
N	2.8	2.97	2.76	2.75

Correlations between soil and plant analyses, sweet corn survey, 1978.
Marion Co. Ext. Service and Dept. of Soil Science, OSU.
All planting dates.

Soil anal.		Correlations for soil analyses							
		pH	P	K	Ca	Mg	B	Zn	Cu
1.	pH	1.00							
2.	P	.01	1.00						
3.	K	.06	.34	1.00					
4.	Ca	.33	-.30	.09	1.00				
5.	Mg	.15	-.35	.02	.83	1.00			
6.	B						1.00		
7.	Zn	-.04	.04	.15	.32	.23		1.00	
8.	Cu	-.12	-.08	.05	.28	.36		.25	1.00

Plant anal.		Correlation - 1st plant samples (corn 20" ht.):soil anal.							
9.	P_1	.01	.26	.21	.15	.01		-.01	.23
10.	K	-.10	.06	.26	.11	.01		.06	.12
11.	Ca	.34	.28	-.21	-.01	-.24		-.13	-.14
12.	Mg	.15	-.16	-.42	.35	.41		.06	.24
13.	Zn	-.25	-.08	.28	.05	.03		.45	-.04
14.	Mn	-.32	.23	-.01	-.44	-.47		.02	-.18
15.	Cu	-.08	-.26	-.07	.45	.56		.23	.44
16.	B	-.13	-.06	-.12	-.16	.04		-.22	-.06

Plant anal.		Correlation - 2nd plant samples (ear leaf at tassel):soil anal.							
17.	P_2	.12	.35	.26	.24	.04		.16	.06
18.	K	-.07	.18	.29	-.29	-.39		.01	-.13
19.	Ca	.36	.04	-.16	.08	-.06		.05	-.10
20.	Mg	.19	-.31	-.30	.45	.57		.04	.19
21.	Zn	-.22	-.07	.23	.16	.17		.51	.09
22.	Mn	-.39	.19	.26	-.39	-.32		-.02	.15
23.	Cu	.05	-.29	.06	.29	.33		.12	.28
24.	B	.20	.01	.10	-.07	-.01		-.11	.14
25.	N	-.16	-.03	.01	-.01	-.13		.16	-.12

Plant anal.		Correlations between plant nutrient levels - 1st samples							
		P_1	K	Ca	Mg	Zn	Mn	Cu	B
26.	P_1	1.00							
27.	K	.41	1.00						
28.	Ca	-.11	-.30	1.00					
29.	Mg	-.12	-.25	.45	1.00				
30.	Zn	.37	.26	-.26	-.30	1.00			
31.	Mn	-.03	-.03	.04	-.14	.27	1.00		
32.	Cu	.18	.25	-.16	.20	.16	-.26	1.00	
33.	B	.12	.19	-.34	-.11	.02	-.12	.11	1.00

Correlations between soil and plant analyses, sweet corn survey, 1978.
Marion Co. Ext. Service and Dept. of Soil Science, OSU.
Planting Group #1, May 1-10.

Soil anal.	Correlations for soil analyses							
	pH	P	K	Ca	Mg	B	Zn	Cu
1. pH	1.00							
2. P	.08	1.00						
3. K	.21	.30	1.00					
4. Ca	.31	-.22	.01	1.00				
5. Mg	.07	-.28	-.12	.85	1.00			
6. B						1.00		
7. Zn	.15	.13	-.05	.50	.40		1.00	
8. Cu	-.09	-.06	-.04	.29	.36		.26	1.00

Plant anal.	Correlation - 1st plant samples (corn 20" ht.):soil anal.							
9. P	.38	.48	.30	.25	.01		.41	-.05
10. K	-.10	.08	.58	.04	.01		.15	.16
11. Ca	.24	.42	-.40	-.15	-.24		.10	-.16
12. Mg	-.08	-.20	-.68	.27	.47		.03	.08
13. Zn	-.05	.03	.23	-.04	-.17		.40	-.08
14. Mn	-.31	.29	.16	-.37	-.45		.04	-.15
15. Cu	-.07	.11	.01	.32	.40		.47	.72
16. B	-.03	-.12	.02	-.26	-.12		-.31	-.21

Plant anal.	Correlation - 2nd plant samples (ear leaf at tassel):soil anal.							
17. P_2	.24	.47	.38	.42	.19		.34	-.10
18. K	-.01	.25	.68	-.21	-.37		-.05	.20
19. Ca	.30	.15	-.25	-.02	-.12		.09	.06
20. Mg	.04	-.41	-.51	.34	.53		.08	.37
21. Zn	-.28	-.04	-.06	.33	.24		.60	.11
22. Mn	-.23	.21	-.25	-.18	.20		.06	-.05
23. Cu	.06	-.28	.01	.39	.33		.12	.40
24. B	.05	.05	.26	-.18	-.27		-.19	-.19
25. N	-.25	.07	-.08	-.06	-.15		.16	-.24

Plant anal.	Correlations between plant nutrient levels - 1st samples							
	P_1	K	Ca	Mg	Zn	Mn	Cu	B
26. P_1	1.00							
27. K	.13	1.00						
28. Ca	.08	-.42	1.00					
29. Mg	-.14	-.59	.37	1.00				
30. Zn	.28	.46	-.20	-.41	1.00			
31. Mn	.08	.27	-.21	-.39	.45	1.00		
32. Cu	.08	.06	-.07	.01	-.07	-.15	1.00	
33. B	-.31	.07	-.08	-.13	.03	.12	-.33	1.00

Correlations between soil and plant analyses, sweet corn survey, 1978.
Marion Co. Ext. Service and Dept. of Soil Science, OSU.
Planting Group #2, May 10-25.

	Correlations for soil analyses							
Soil anal.	pH	P	K	Ca	Mg	B	Zn	Cu
1. pH	1.00							
2. P	-.07	1.00						
3. K	-.01	.20	1.00					
4. Ca	.34	-.55	.13	1.00				
5. Mg	-.01	-.48	.31	.81	1.00			
6. B						1.00		
7. Zn	-.22	-.19	.45	.43	.47		1.00	
8. Cu	-.14	-.52	.23	.74	.90		.46	1.00

Plant anal.	Correlation - 1st plant samples (corn 20" ht.):soil anal.							
	pH	P	K	Ca	Mg	B	Zn	Cu
9. P	-.10	.01	.16	.09	-.05		.43	-.08
10. K	-.16	-.20	.15	-.03	.05		.28	.14
11. Ca	.72	.12	-.24	.24	-.21		-.17	-.29
12. Mg	.34	-.12	-.13	.49	.50		.05	.32
13. Zn	-.44	-.10	.40	.15	.31		.77	.34
14. Mn	-.33	.39	-.18	-.48	-.42		-.18	-.37
15. Cu	.11	-.55	-.02	.69	.70		.50	.70
16. B	-.13	.32	.01	-.29	.04		.08	-.12

Plant anal.	Correlation - 2nd plant samples (ear leaf at tassel):soil anal.							
	pH	P	K	Ca	Mg	B	Zn	Cu
17. P_2	.28	.19	-.13	.01	-.22		.05	-.23
18. K	.03	.14	.01	-.39	-.46		-.05	-.40
19. Ca	.55	-.20	-.27	.46	.07		-.03	.02
20. Mg	.24	-.30	-.09	.67	.69		.14	.51
21. Zn	-.20	-.08	.55	.17	.16		.66	.11
22. Mn	-.48	.36	-.29	-.41	-.40		-.12	-.28
23. Cu	-.08	-.55	-.27	.39	.41		.19	.43
24. B	-.09	.01	-.07	-.29	-.20		-.06	-.07
25. N	-.15	-.06	-.19	-.13	-.14		-.05	-.11

Plant anal.	Correlations between plant nutrient levels - 1st samples							
	P_1	K	Ca	Mg	Zn	Mn	Cu	B
26. P	1.00							
27. K	.18	1.00						
28. Ca	-.02	-.36	1.00					
29. Mg	-.20	-.48	.51	1.00				
30. Zn	.66	.36	-.45	-.18	1.00			
31. Mn	.25	-.05	-.03	.09	.19	1.00		
32. Cu	.07	.16	.06	.43	.41	-.18	1.00	
33. B	-.19	.13	-.06	.15	-.01	.10	-.06	1.00

Correlations between soil and plant analyses, sweet corn survey, 1978.
Marion Co. Ext. Service and Dept. of Soil Science, OSU.
Planting Group #3, May 25–June 10.

Soil anal.		Correlations for soil analyses							
		pH	P	K	Ca	Mg	B	Zn	Cu
1.	pH	1.00							
2.	P	.03	1.00						
3.	K	-.08	.56	1.00					
4.	Ca	.39	-.21	.13	1.00				
5.	Mg	.42	-.33	-.08	.91	1.00			
6.	B						1.00		
7.	Zn	-.32	.16	.18	-.28	-.31		1.00	
8.	Cu	-.10	.24	.03	-.05	-.04		.24	1.00
Plant anal.		**Correlation - 1st plant samples (corn 20" ht.):soil anal.**							
9.	P_1	-.07	.31	.40	.07	.05		-.02	-.03
10.	K	.05	.21	.53	.07	-.10		.09	.10
11.	Ca	-.08	.14	-.13	-.22	-.21		.37	.20
12.	Mg	.19	-.20	-.43	.32	.41		-.04	.42
13.	Zn	-.33	-.40	.22	.05	-.02		-.13	-.42
14.	Mn	-.44	-.12	-.14	-.55	-.52		.14	.02
15.	Cu	.28	-.43	-.10	.44	.55		-.01	.13
16.	B	-.09	-.16	-.19	-.10	-.03		.04	-.10
Plant anal.		**Correlation - 2nd plant samples (ear leaf at tassel):soil anal.**							
17.	P_2	-.05	.36	.45	.19	.11		-.04	.33
18.	K	-.18	.11	.12	-.44	-.42		.33	.13
19.	Ca	.21	.16	.05	-.08	-.12		-.02	-.32
20.	Mg	.30	-.11	-.19	.45	.52		-.21	-.26
21.	Zn	-.31	-.09	.07	.05	.15		-.01	.05
22.	Mn	-.41	.04	-.25	-.51	.38		.14	-.15
23.	Cu	.17	.08	.08	.16	.30		-.04	.05
24.	B	.42	.02	.10	.12	.16		-.14	.36
25.	N	-.28	-.19	.10	.01	-.04		.20	-.01

Plant anal.		Correlations between plant nutrient levels - 1st samples							
		P_1	K	Ca	Mg	Zn	Mn	Cu	B
26.	P_1	1.00							
27.	K	.39	1.00						
28.	Ca	.06	-.20	1.00					
29.	Mg	.06	-.19	.39	1.00				
30.	Zn	.25	.18	-.23	-.31	1.00			
31.	Mn	-.27	-.03	.18	-.30	.11	1.00		
32.	Cu	.01	.06	-.18	.36	.25	-.33	1.00	
33.	B	.06	-.31	.19	.35	.09	-.08	-.01	1.00

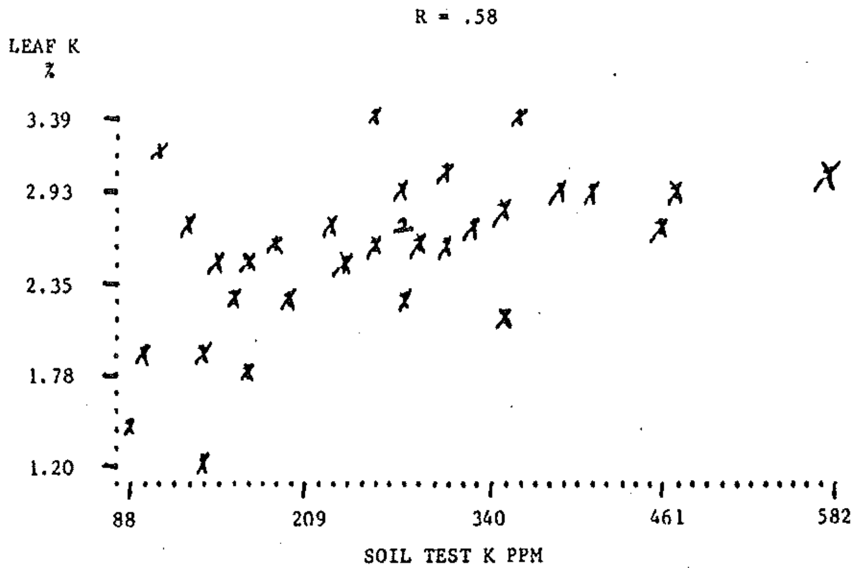

Figure 1. RELATIONSHIP BETWEEN LEAF K AND SOIL TEST K
Third leaf sampled when plants 20" high.
Planting May 1-10, 1978 Sweet Corn Survey.

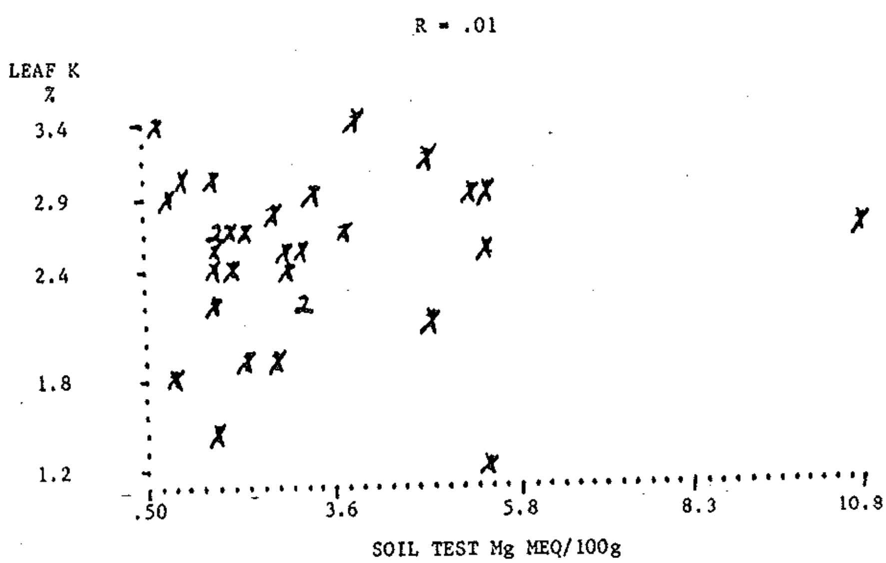

Figure 2. RELATIONSHIP BETWEEN LEAF K AND SOIL TEST Mg.
Third leaf sampled when plants 20" high.
Planting May 1-10, 1978 Sweet Corn Survey.

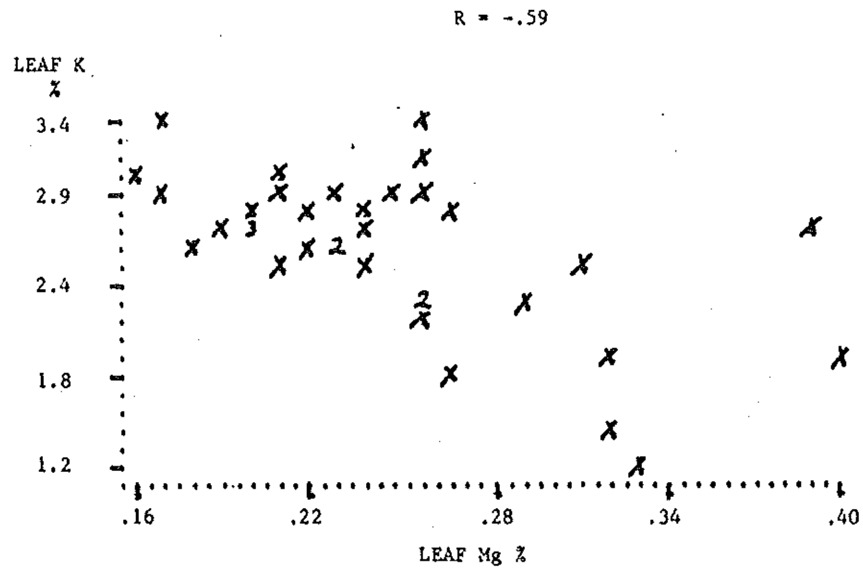

Figure 3: RELATIONSHIP BETWEEN LEAF K AND Mg.
Third leaf sampled when plants 20" high.
Planting May 1-10, 1978 Sweet Corn Survey.

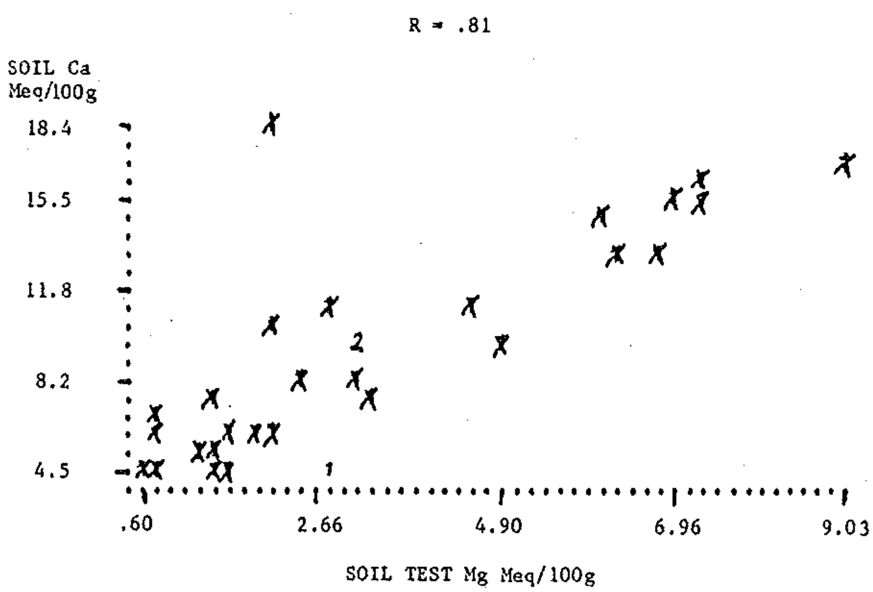

Figure 4. RELATIONSHIP BETWEEN SOIL Ca and Mg.
Planting May 10-25, 1978 Sweet Corn Survey.

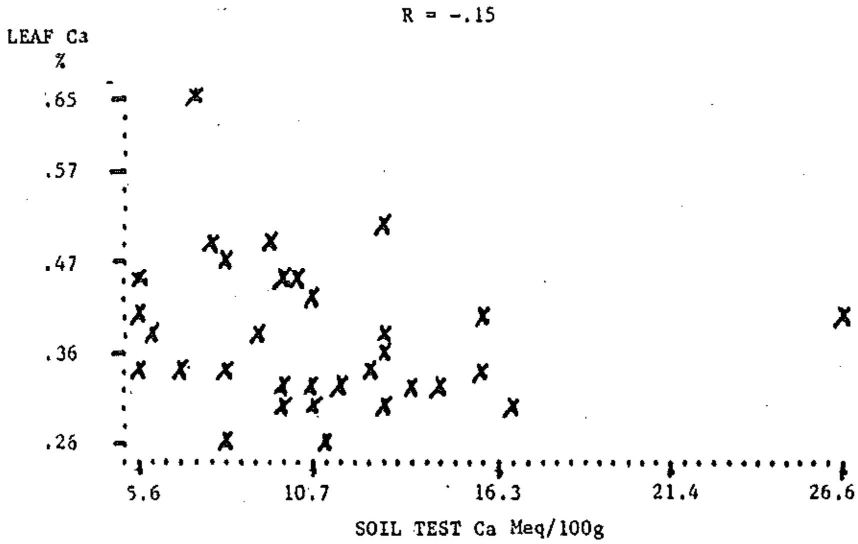

Figure 5. RELATIONSHIP BETWEEN LEAF Ca AND SOIL TEST Ca.
Third leaf sampled when plants 20" high.
Planting May 1-10, 1978 Sweet Corn Survey.

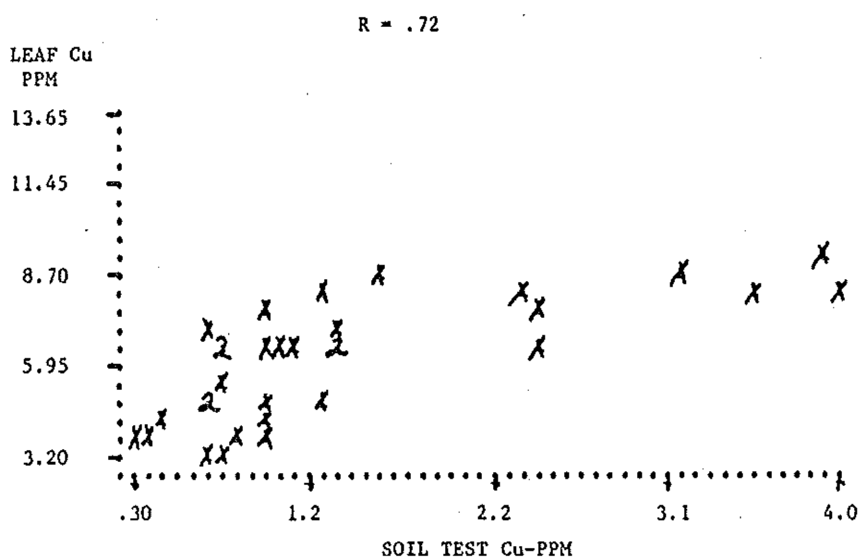

Figure 6. RELATIONSHIP BETWEEN Cu (PPM) IN CORN LEAVES AND Cu SOIL TEST VALUES.
Third leaf sampled when plants 20" high.
Planting May 1-10, 1978 Sweet Corn Survey.

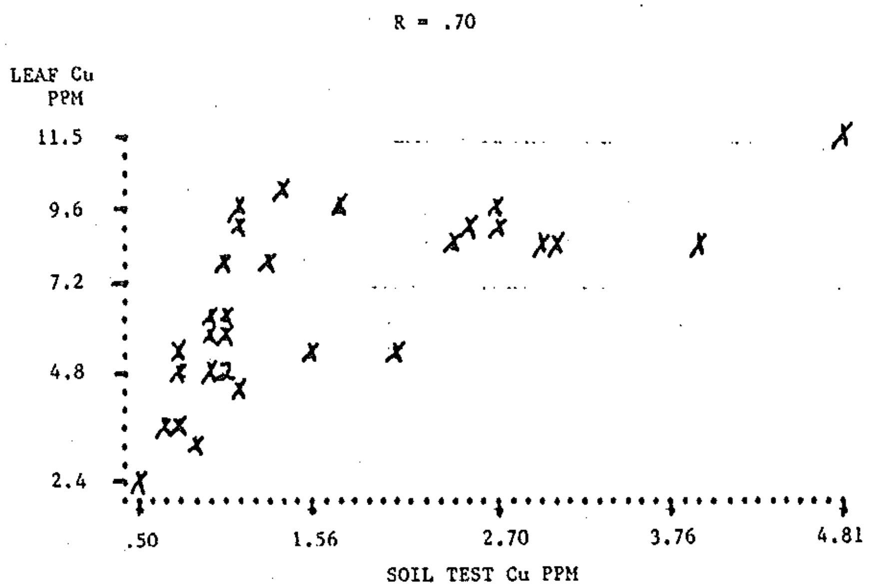

Figure 7: RELATIONSHIP BETWEEN LEAF Cu AND SOIL TEST Cu. Third leaf sampled when plants 20" high. Planting May 10-25, 1978 Sweet Corn Survey.

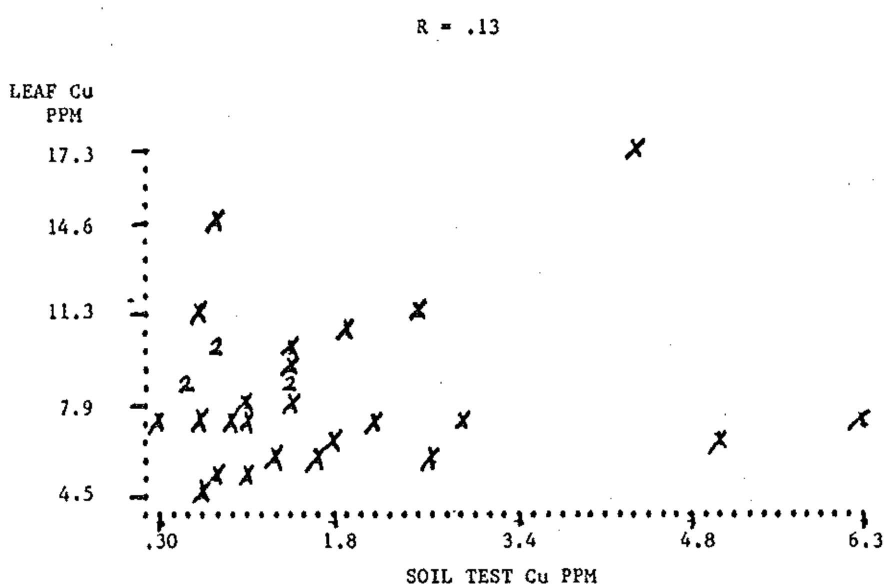

Figure 8. RELATIONSHIP BETWEEN LEAF Cu AND SOIL TEST Cu. Third leaf sampled when plants 20" high. Planting May 25+, 1978 Sweet Corn Survey.

R = .74

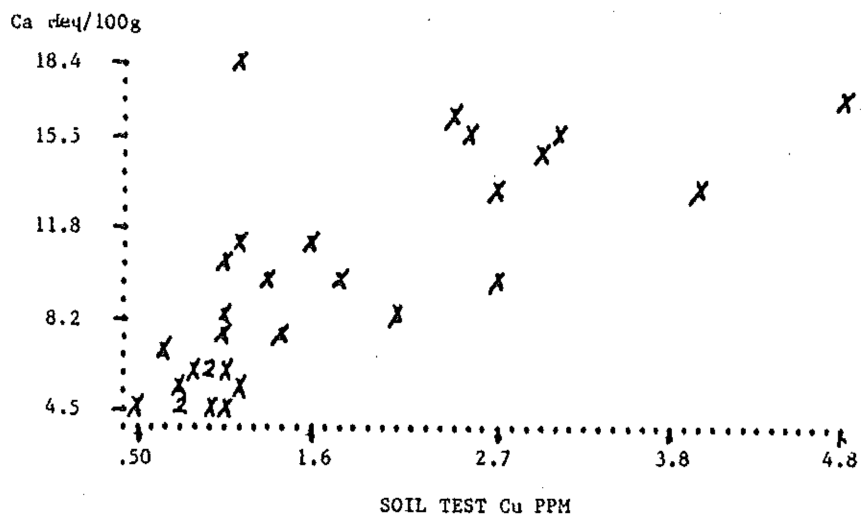

Figure 9. RELATIONSHIP BETWEEN Cu AND Ca IN SOIL SAMPLES.
Planted May 10-25, 1978 Sweet Corn Survey.

R = .90

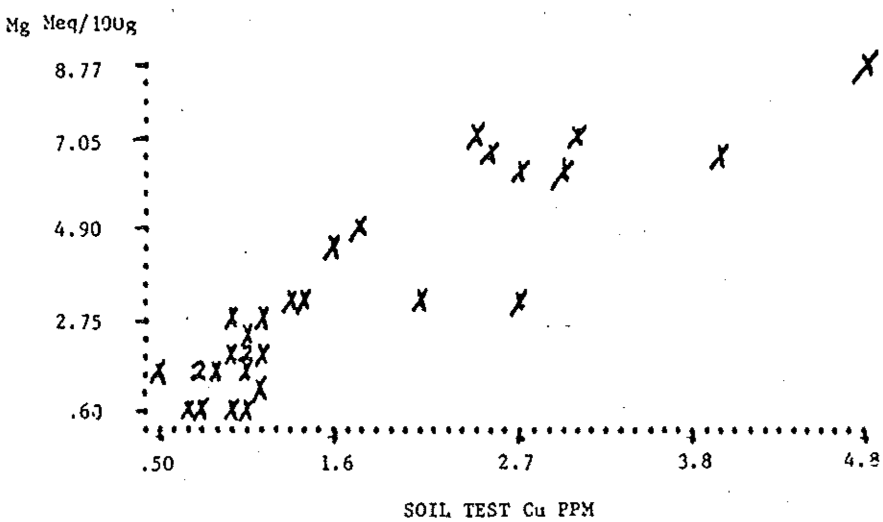

Figure 10. RELATIONSHIP BETWEEN Cu AND Mg IN SOIL SAMPLES.
Planted May 10-25, 1978 Sweet Corn Survey.

R = -.04

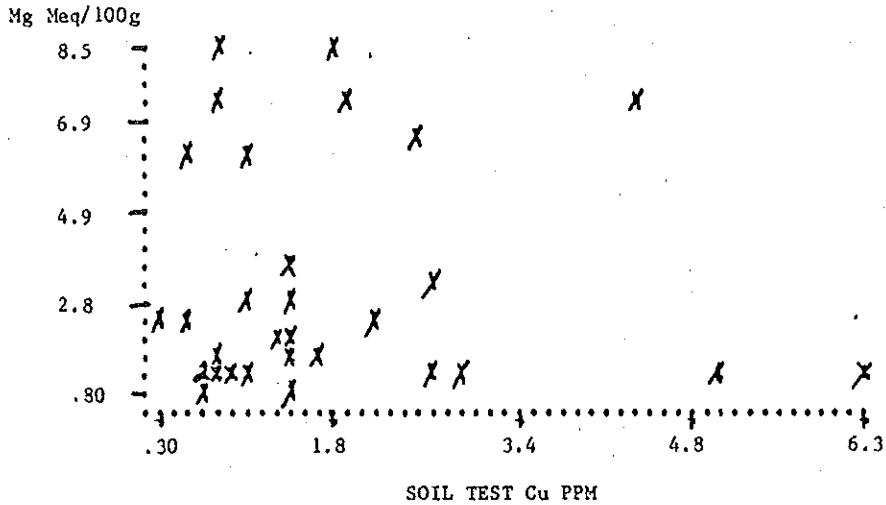

Figure 11. RELATIONSHIP BETWEEN Cu AND Mg in SOIL SAMPLES. Planted May 25+, 1978 Sweet Corn Survey.

R = .70

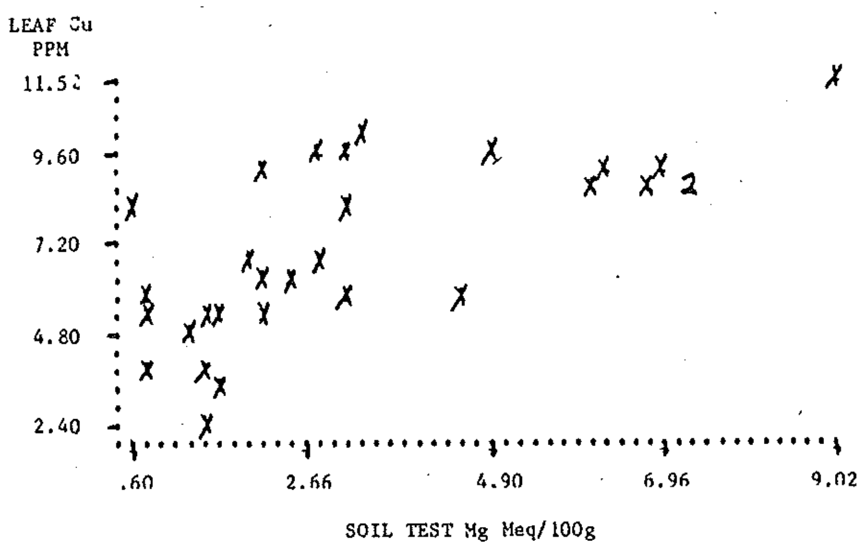

Figure 12. RELATIONSHIP BETWEEN LEAF Cu AND SOIL TEST Mg. Third leaf sampled when plants 20" high. Planting May 10-25, 1978 Sweet Corn Survey.

R = .11

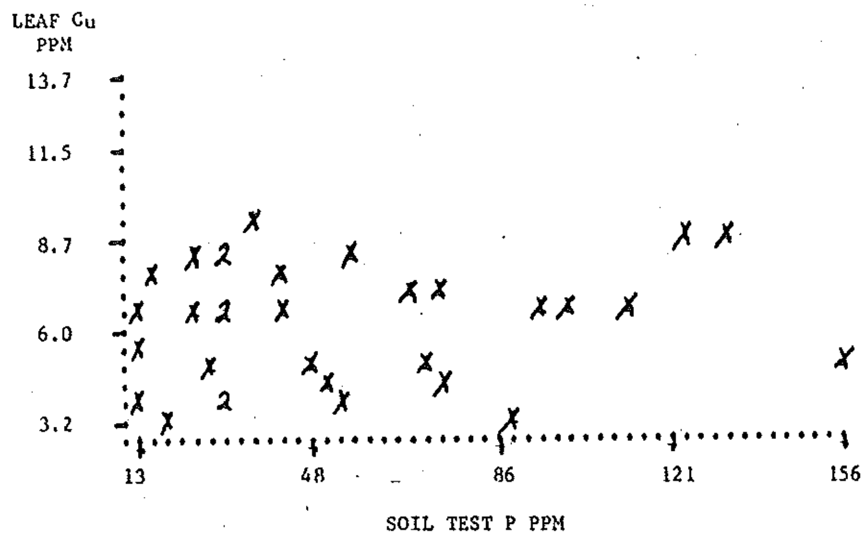

Figure 13. RELATIONSHIP BETWEEN LEAF Cu AND SOIL TEST P. Third leaf sampled when plants 20" high. Planting May 1-10, 1978 Sweet Corn Survey.

R = -.43

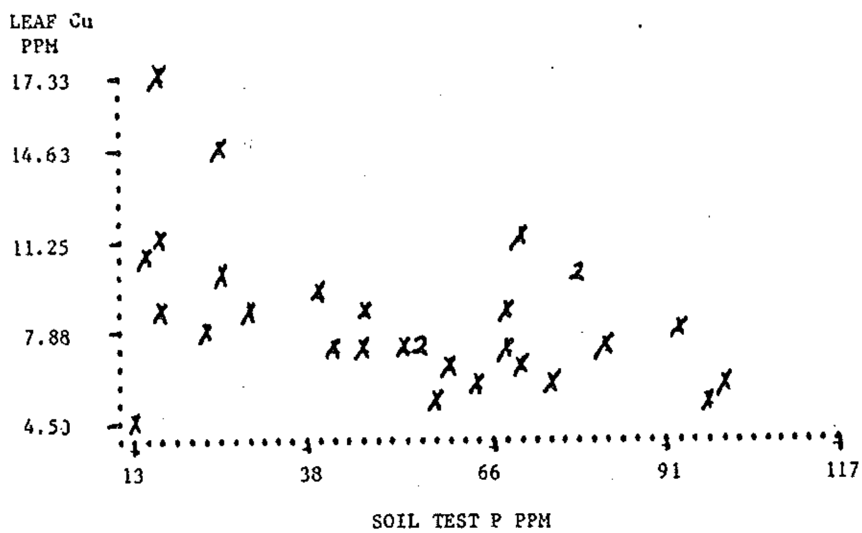

Figure 14. RELATIONSHIP BETWEEN LEAF CU AND SOIL TEST P. Third leaf sampled when plants 20" high. Planting May 25+, 1978 Sweet Corn Survey.

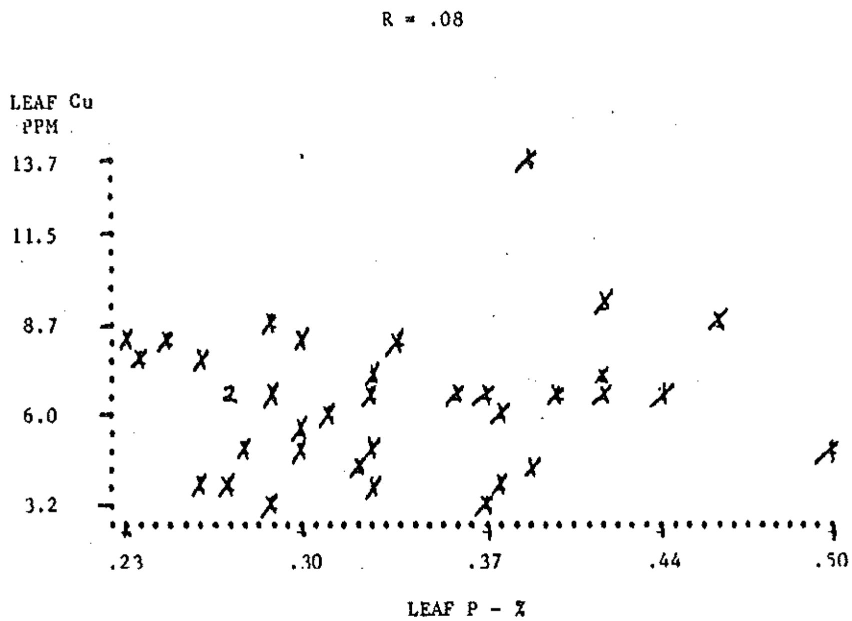

Figure 15. RELATIONSHIP BETWEEN LEAF Cu AND P.
Third leaf sampled when plants 20" high.
Planting May 1-10, 1978 Sweet Corn Survey.

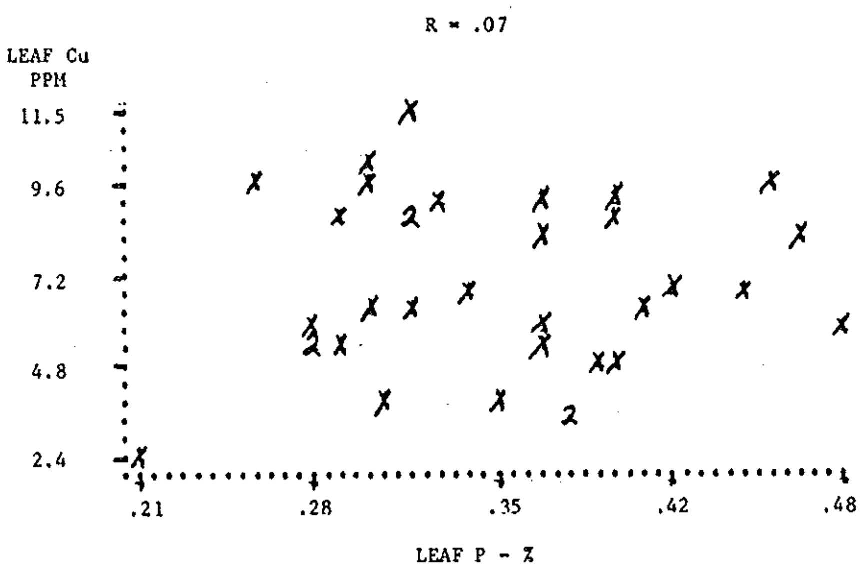

Figure 16. RELATIONSHIP BETWEEN LEAF Cu AND P.
Third leaf sampled when plants 20" high.
Planting May 10-25, 1978 Sweet Corn Survey.

R =

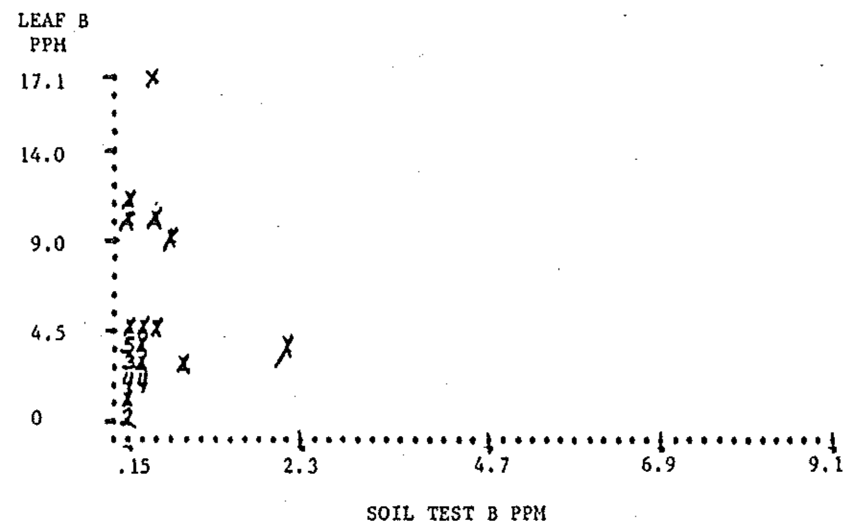

Figure 17. RELATIONSHIP BETWEEN LEAF B AND SOIL TEST B.
Third leaf sampled when plants 20" high.
Planting May 1-10, 1978 Sweet Corn Survey.

R =

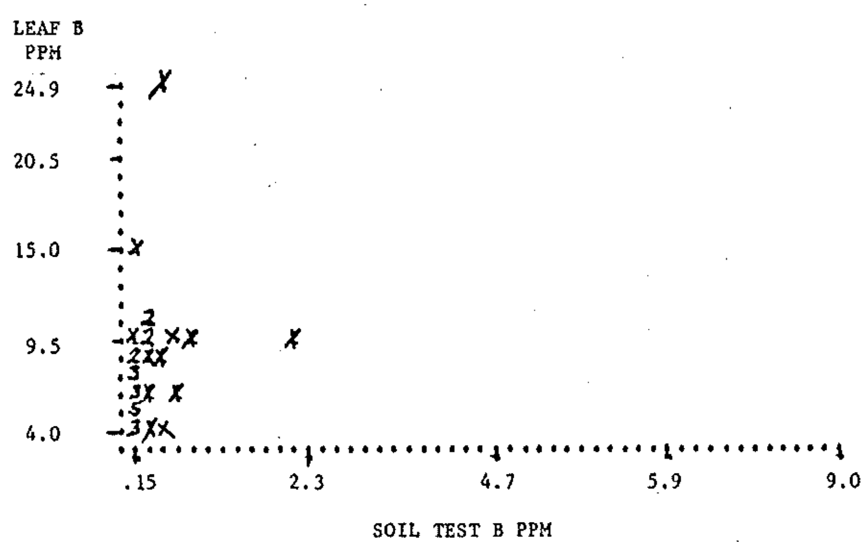

Figure 18. RELATIONSHIP BETWEEN LEAF B AND SOIL TEST B.
Ear leaf sampled at tassel.
Planting May 1-10, 1978 Sweet Corn Survey.

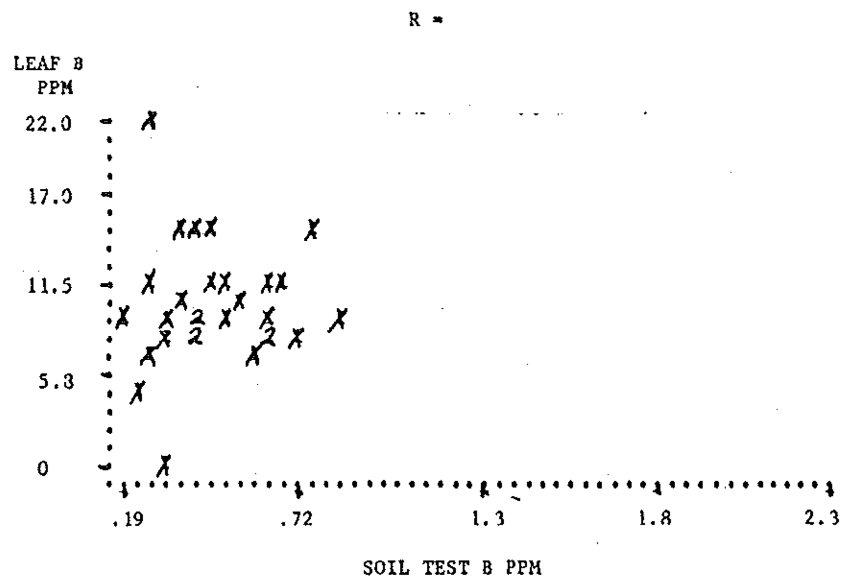

Figure 19. RELATIONSHIP BETWEEN LEAF B AND SOIL TEST B.
Third leaf sampled when plants 20" high.
Planting May 25+, 1978 Sweet Corn Survey.

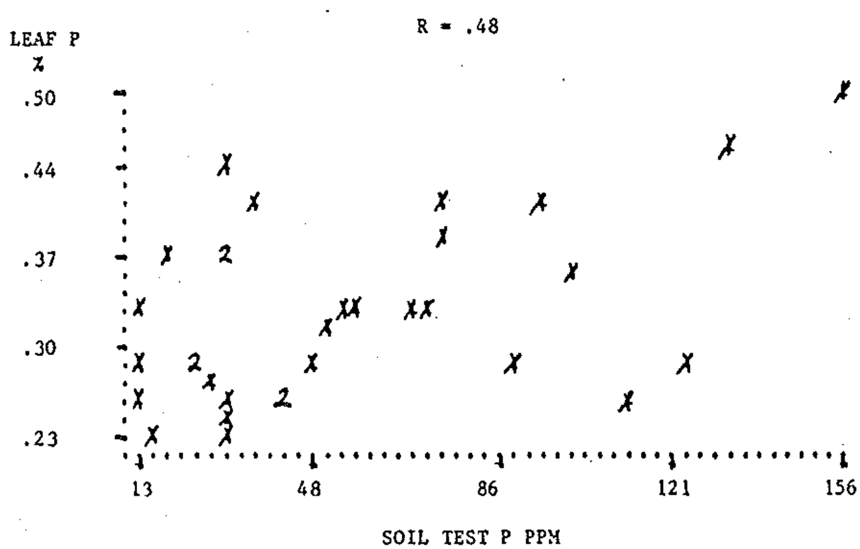

Figure 20. RELATIONSHIP BETWEEN LEAF P AND SOIL TEST P
Third leaf sampled when plants 20" high.
Planting May 1-10, 1978 Sweet Corn Survey.

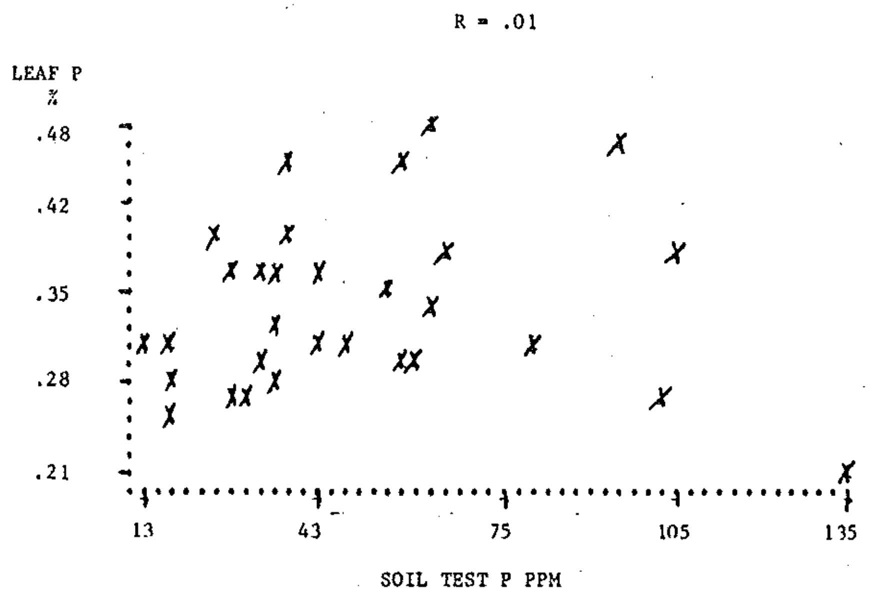

Figure 21. RELATIONSHIP BETWEEN LEAF P AND SOIL TEST P.
Third leaf sampled when plants 20" high.
Planting May 10-25, 1978 Sweet Corn Survey.

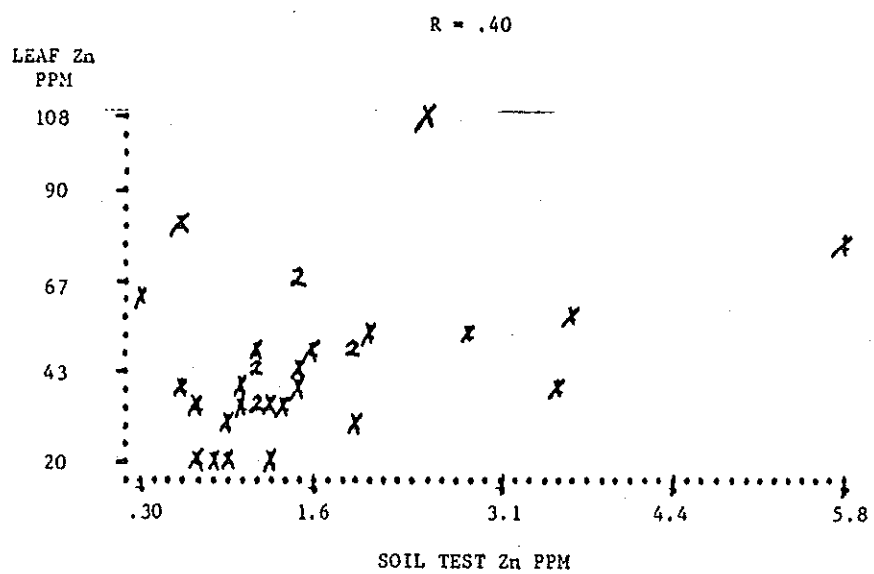

Figure 22. RELATIONSHIP BETWEEN LEAF Zn AND SOIL TEST Zn.
Third leaf sampled when plants 20" high.
Planting May 1-10, 1978 Sweet Corn Survey.