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ASSESSMENT OF SOIL ZINC AND COPPER AS REFLECTED BY THE LEAF COMPOSITION OF PEPPER (*PIPER NIGRUM* L.)

C.K. RAJAGOPAL and A.K. SADANANDAN

ABSTRACT

The youngest matured and the next matured leaves of the lower one-third, the middle one-third and the upper one-third portions of 10 year old pepper vines growing in an alfisol were analysed for zinc and copper and the values related to the zinc-copper extractable by DTPA in the soil. Zinc and copper in the youngest matured leaf of the middle one-third portion of the vine was found to have the highest correlation with the soil available zinc ($r = 0.892^{**}$) and copper ($r = 0.766^{**}$) respectively, thus showing the possibility of using the youngest matured leaf as the indicator leaf of pepper for these nutrients.

INTRODUCTION

Early detection of nutritional disorders is very essential for proper crop husbandry of pepper. It has been established that the youngest matured leaf could be used as the Indicator Leaf of pepper for major plant nutrients (Waard, 1969). The present investigation is aimed at finding out the portion of the vine and the position of the leaf thereon, which could indicate correctly the status of zinc and copper in the soil.

MATERIALS AND METHODS

Ten year old Panniyur-I pepper vines trained on *Erythrina* standard in a homogenous tract in the District Agricultural Farm at Koothali (Calicut district, Kerala) where uniform physiological condition of the vines existed, were selected at random and used in this investigation. Soil sampling to a depth of 30 cm was done using aluminium soil samples at four spots around the vine 30 cm away the base of each vine (Anonymous, 1982). One composite sample was made from the four samplings. In this way 20 composite soil samples were collected from the base of the vines. The samples were dried under shade, sieved through a 2 mm plastic sieve and used for analysis.

Leaf samples (including petioles) were collected during the forenoon, from two positions of the lateral branches (designated as the youngest-matured and 'the next matured' leaf by Waard, 1969). The whole vine was divided into three portions covering the lower one-third, the middle one-third and the upper one-third of the vine. Leaves from the two positions, referred to above, collected from all the three portions of the vine. Eight leaves were sampled representing all the four sides of the vine and taken as one composite sample. Thus there were 120 leaf samples from 20 vines.

The soil was extracted with DTPA extractant in the ratio 1 : 2 (Lindsay and Norvell, 1969) and the contents of copper and zinc in the extract were determined using the Varian techtron atomic absorption spectrophotometer.

RESULTS AND DISCUSSION

The DTPA extractable zinc in the soil ranged between 0.9 ppm and 3.5 ppm and copper between 0.9 ppm and 6.3 ppm. As per the classification of Viets and Lindsay (1973) the zinc value ranked between marginal and high category whereas all the copper values were of the high category.

The high range of values for zinc and copper in the soil could be attributed to the effect of intensive spraying with zinc and copper, containing pesticides on the vines and the continuous drip into the soil of these pesticides, which resulted in the incorporation of these compounds into the organic and inorganic

colloids of the soil. The wide heterogenity in the status of zinc and copper in the soil could be due to the undulating nature of the terrain, where, during rains, the dissolved chemicals got transported to the depressions in the land, thereby registering higher values for soils collected from such locations, compared to the soil taken from the other (elevated) locations. Such high values have been reported by Sim (1973) in Sarawak soils.

Table 1. Mean zinc and copper contents of pepper leaves in different portions of vine (values in parentheses denote the range)

Portion of vine	Zinc ppm		Copper ppm	
	Youngest matured leaf	Next matured leaf	Youngest matured leaf	Next matured leaf
Lower 1/3rd	43 (15–69)	45 (15–84)	77 (15–164)	83 (17–156)
Middle 1/3rd	55 (23–129)	52 (22–100)	61 (17–163)	78 (19–167)
Upper 1/3rd	53 (13–111)	55 (15–125)	87 (20–206)	85 (34–163)

The content of zinc in the leaf varied from 13 to 12 ppm, and copper from 15 to 206 ppm (Table 1). The highly abnormal values obtained in certain cases could be attributed to the high amount absorbed by the leaf through pesticide sprays and also absorption from the spots in the soil having a high level of zinc and copper.

Soil-plant nutrient relationship

Correlations worked out between soil zinc and copper and the corresponding leaf zinc and copper of the three different portions of vine for the two specific leaf portions are given in Table 2. The high correlations obtained in the case of both these elements establish the fact that the leaf content of zinc and copper is a very good reflection of the status of these elements in the soil. Statistical significance of a high order has been obtained in almost all cases. The greatest degree of correlation was obtained between soil zinc and copper and the contents of these in the youngest-matured leaf of the middle one-third por-

tion of the vine. ($r = 0.892^{**}$ and 0.766^{**} for zinc and copper respectively.)

Table 2. Simple correlation coefficiently between zinc and copper in soil and those in pepper leaf

Portion of vine	'r' value leaf Zn vs soil Zn		'r' value leaf Cu vs soil Cu	
	Youngest matured leaf	Next matured leaf	Youngest matured leaf	Next matured leaf
Lower 1/3rd	0.523**	0.592**	0.720**	0.635**
Middle 1/3rd	0.892**	0.600**	0.766**	0.570**
Upper 1/3rd	0.380	0.530**	0.588**	0.578**

**1 per cent level of significance.
*5 per cent level of significance.

The leaves in the upper one-third portion of the vine registered a lower degree of correlation for these elements. This is a clear indication that leaves in different portions of the vine are not similar in reflecting the status of soil nutrients and emphasise the necessity for pin pointing the specific leaf to be considered as the Indicator Leaf. The study has also revealed that as in the case of major nutrients, in micro-nutrients also the youngest matured leaf could be chosen as the Indicator Leaf for assessing soil zinc and copper levels.

ACKNOWLEDGEMENTS

The authors are thankful to the Superintendent, District Agricultural Farm, Koothali for making available the plantation for the study. The authors also record their indebtedness to the Director, CPCRI, Kasaragod, the Joint Director, CPCRI (RS), Calicut and the Head, Department of Soil Science, CPCRI, Kasaragod, for their keen interest in the study and for providing facilities.

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DISCUSSION

Q : Have you studied the correlation between Cu and Zn levels in leaves with yield?

Ans: Not in the present study.

Q : You have attributed high values for soil Cu and Zn to the terrain. Have you any data to show that these nutrients were more in the soil collected from the depressions.

Ans: The explanation given by me is based on observations.

Q : Were the bushes (sprayed with uniform dose of pesticides containing the nutrients under study.

Ans: No. The abnormal values are attributed to high amount of these pesticides absorbed by the leaves.