

# The suitability of the blade, vein and petiole for determination of nutrients in the banana sucker.

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L'ADEQUATION DU LIMBE, DE LA NERVURE CENTRALE ET DU PETIOLE A LA DETERMINATION DES ELEMENTS NUTRITIFS DANS LE PLANT DE BANANIER

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RESUME - L'échantillonnage du limbe en position III et du pétiole en position VII sur les bananiers d'un essai d'engrais a montré qu'il est préférable de ne pas déterminer tous les éléments dans un seul tissu. N, Cl, B, Fe et peut-être Ca devraient être analysés dans le limbe, alors que P, Mg et Mn devraient l'être dans le pétiole. On n'a pas trouvé de différences de valeur entre les deux organes pour K, Na et Zn. Des coefficients de régression élevés ont été obtenus entre les teneurs en N, P, K, Ca, Mg, Cl, Mn, et le rendement. On n'a pas trouvé d'avantage à échantillonner la nervure III plutôt que le pétiole VII. L'écart-type était plus élevé dans ces deux organes que dans le limbe ; il est donc recommandé d'augmenter le nombre d'échantillons dans leur cas.

## INTRODUCTION

For some years there has been a marked difference of opinion among investigators concerning the suitable organ to sample for determinations of the nutritional status of the banana sucker. An international working group has been set up, the goal of which is to standardize the sampling technique (5). So far, the group has met twice (in the Canary Islands in 1975, and in Australia in 1978) to compare the various methods in use and to suggest directions for future research (4). In consequence of this international cooperation, the number of sampling methods has already been reduced and presently only three organs are being used :

the central part of the blade of the leaf in position III (counting down from the top of the plant), the central part of the leaf vein III, and the petiole of the leaf VII (fig. 1). Nutritional research in Israel is accompanied by concurrent sampling of the blade, the petiole and sometimes the vein.

An experiment was carried out to evaluate organic manure and poly-feed in a drip-irrigated banana plantation (2). Concurrently, the effect of the fertilizer and the manure on the composition of the blade, petiole and vein was determined (3). In the present report a comparison is made of the suitability of the various organs for sampling and of their efficacy with regard to the various elements analyzed.

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## METHODS

The experimental technique and the fertilizer treatments have been outlined in previous papers (2, 3). Sampling of

TABLE 1 - A comparison of the blade III and the petiole VII as sampling organs (4 year avg.)

TABLEAU 1 - Une comparaison entre le limbe III et le pétiole VII en tant qu'organes d'échantillonnage (moy. de 4 années)

CUADRO 1 - Una comparación entre el limbo III y el pecíolo VII como órganos de muestreo (prom. de 4 años).

Element	Average $\pm$ S.E. Moyenne $\pm$ écart-type Promedio $\pm$ desviación estandar		F values (I) and significance		Correlation coefficient (r) with following yield avec le rendement suivant con el rendimiento siguiente	
	blade III	petiole VII	blade III	pétiole VII	blade III	pétiole VII
	% of d.w. - % de m.s.					
N	2.90 $\pm$ 0.035	0.51 $\pm$ 0.156	33.95**	22.43**	0.736**	0.461
P	0.23 $\pm$ 0.015	0.17 $\pm$ 0.027	5.23**	10.29**	-0.739***	-0.737**
K	3.17 $\pm$ 0.079	1.79 $\pm$ 0.17	15.74**	14.04**	0.642*	0.575*
Ca	1.23 $\pm$ 0.056	2.35 $\pm$ 0.097	7.51**	1.16	-0.392	-0.509*
Mg	0.47 $\pm$ 0.018	0.69 $\pm$ 0.037	5.22**	8.94**	-0.324	-0.735**
Na	0.012 $\pm$ 0.001	0.015 $\pm$ 0.001	0.96	1.85	0.443	0.454
Cl	1.06 $\pm$ 0.029	1.37 $\pm$ 0.077	21.28**	3.88**	-0.758**	-0.527*
	ppm of d.w. - ppm de m.s.					
B	22 $\pm$ 1	12 $\pm$ 0.44	3.20**	0.83	0.252	-0.302
Fe	97 $\pm$ 3	48 $\pm$ 6.8	2.82**	1.43	0.474	0.347
Zn	19 $\pm$ 0.6	14 $\pm$ 0.7	2.77**	2.17*	0.347	0.390
Mn	304 $\pm$ 31	315 $\pm$ 29	1.69	2.90**	0.503	-0.515*

\* - P = 0.05    \*\* P = 0.01

(1) The F value expresses the treatment effect as compared with the experimental error. The higher the F value, the higher the sensitivity of the sampled organ for determining the differences between treatments.

La valeur F exprime l'effet des traitements en comparaison avec l'erreur expérimentale. Plus elle est élevée plus l'organe échantillonné est sensible pour déterminer les différences entre traitements.

El valor F expresa el efecto de los tratamientos comparativamente al error experimental. Cuanto más alto ese valor tanto mayor la sensibilidad del órgano muestreado para la determinación de diferencias entre tratamientos.

TABLE 2 - A comparison of the blade III, the vein III and the petiole VII as sampling organs (sampling, autumn 1975).

TABLEAU 2 - Une comparaison entre le limbe III, la nervure III et le pétiole VII en tant qu'organes d'échantillonnage (échantillonnage : automne 1975).

CUADRO 2 - Una comparación entre el limbo III, el nervio III y el pecíolo VII como órganos de muestreo (muestreo : otoño 1975).

Element	Average $\pm$ S.E. Moyenne $\pm$ écart-type Promedio $\pm$ desviación estandar			F values (I) and significance			Correlation coefficient (r) with yield (1976-77) avec rendement 1976-1977 con rendimiento 1976-1977		
	blade III	vein III	petiole VII	blade III	vein III	pétiole VII	blade III	vein III	petiole VII
	% of d.w. - % de m.s.								
N	2.61 $\pm$ 0.066	0.68 $\pm$ 0.033	0.63 $\pm$ 0.039	6.39**	2.41**	7.27**	0.619**	0.528	0.622**
P	0.23 $\pm$ 0.021	0.21 $\pm$ 0.026	0.16 $\pm$ 0.034	4.92**	6.27**	7.59**	-0.815**	-0.810**	-0.868**
K	3.39 $\pm$ 0.148	3.32 $\pm$ 0.235	1.25 $\pm$ 0.173	3.93**	3.92**	2.40*	0.664**	0.256	0.459
Ca	1.14 $\pm$ 0.115	1.24 $\pm$ 0.1	2.26 $\pm$ 0.138	4.16**	3.33**	2.23*	-0.543*	-0.812**	-0.732**
Mg	0.46 $\pm$ 0.028	0.43 $\pm$ 0.027	0.56 $\pm$ 0.048	2.86**	7.72**	3.47**	-0.586*	-0.872**	-0.839**
Na	0.011 $\pm$ 0.0018	0.013 $\pm$ 0.0015	0.016 $\pm$ 0.0023	1.16	1.60	0.87	0.526	-0.075	0.493
Cl	0.93 $\pm$ 0.062	0.79 $\pm$ 0.077	0.80 $\pm$ 0.135	7.83**	7.30**	3.58**	-0.897**	-0.879**	-0.786**
	ppm of d.w. - ppm de m.s.								
B	13.8 $\pm$ 0.73	10.6 $\pm$ 0.51	12.6 $\pm$ 0.69	1.46	1.77	1.31	0.442	0.292	-0.406
Fe	100 $\pm$ 6.1	52 $\pm$ 10.4	60 $\pm$ 9.2	3.24**	1.61	1.44	-0.072	-0.136	0.341
Zn	18.0 $\pm$ 1.24	12.1 $\pm$ 1.46	14.6 $\pm$ 1.55	3.00**	1.00	1.84	0.020	-0.667**	0.536*
Mn	352 $\pm$ 54	266 $\pm$ 34	738 $\pm$ 95	0.97	2.34*	3.61**	-0.069	0.109	0.512

\* P = 0.05    \*\* P = 0.01

(1) see footnote to table 1. Voir note au bas du tableau 1. Ver nota de pie del cuadro 1.

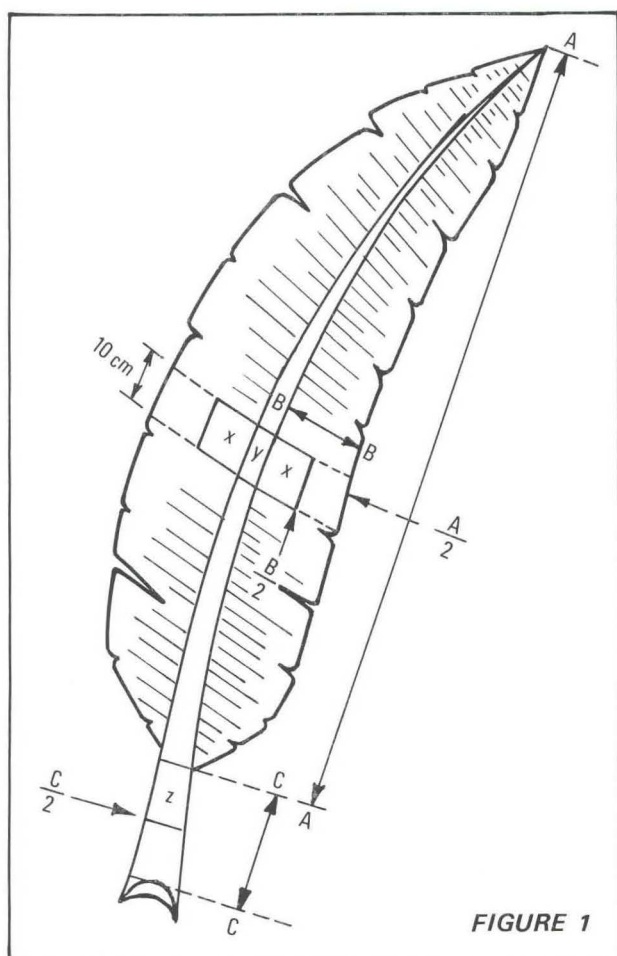


FIGURE 1

**Banana organs sampled for mineral analyses.**  
**Organes du bananier échantillonnés pour analyses minérales.**  
**Órganos del platanero muestreados por las análisis minérales.**

- x = blade of leaf in position III.  
 limbe de la feuille en position III.  
 limbo de la hoja en posición III.  
 y = vein of leaf in position III.  
 nervure de la feuille en position III.  
 nervio de la hoja en posición III.  
 z = petiole of leaf in position VII.  
 pétiole de la feuille en position VII.  
 pecíolo de la hoja en posición VII.

the suckers was carried out yearly, in the autumn. The blade of the leaf III and the petiole VII were sampled. In accordance with the proposed international sampling method, in the autumn of 1975 the vein of the leaf III was also sampled (4).

After determining the ash and 11 elements, the correlation coefficients between the elements in the tissues and the yield were calculated yearly.

## RESULTS AND DISCUSSION

The evaluation of the third leaf blade and the seventh leaf petiole as sampling organs was carried out by a statistical analysis of the influence of treatments and by comparing the correlation coefficients between the mineral content in the tissues and the ensuing yield. This information is summarized in Table 1. Correlation coefficients between the mineral content and the current yield were somewhat low, compared with those of the ensuing crop and therefore the latter only have been presented herein. High and positive correlation coefficients were found between yield and the contents of N and K, while negative values were registered between yield and P, Ca, Mg and Cl.

Based on these findings, it appears that blade sampling is preferable for the determination of N, Cl, B, Fe and possibly Ca, while petiole sampling is preferable for the determination of P, Mg and Mn. No difference were found between sampling sites for K, Na and Zn. This supports the view that it is impossible to analyse all the elements in only one tissue of the banana sucker. The present work confirmed that petiole sampling is advantageous for the determination of P and Mg level in the sucker (1). However, no differences were detected between determinations of K in the blade and the petiole.

A sampling trial conducted in 1975, comparing the third blade, the third vein and the seventh petiole, showed the contents of N, P, K, Cl, Zn, B and Fe to be higher in the blade than in the conducting tissues (Table 2). Although the vein is also a conducting tissue between the petiole and the blade, no gradual change in element level from blade to vein to petiole was noted. The content of some elements (N, Cl, Fe, Zn) in the vein was similar to that in the petiole, while with others (P, K, Ca, Mg) the similarity was with the blade. A comparison of sampling these three organs failed to show any advantage of the vein over the petiole, with the possible exception of Mg.

Generally, the standard errors were smaller in the blade vs. vein, and in the veins vs. petiole. These differences were particularly noticeable with N, P, K, Mg and Cl, and sometimes with Fe and Zn. This necessitates increasing the number of vein or petiole samplings.

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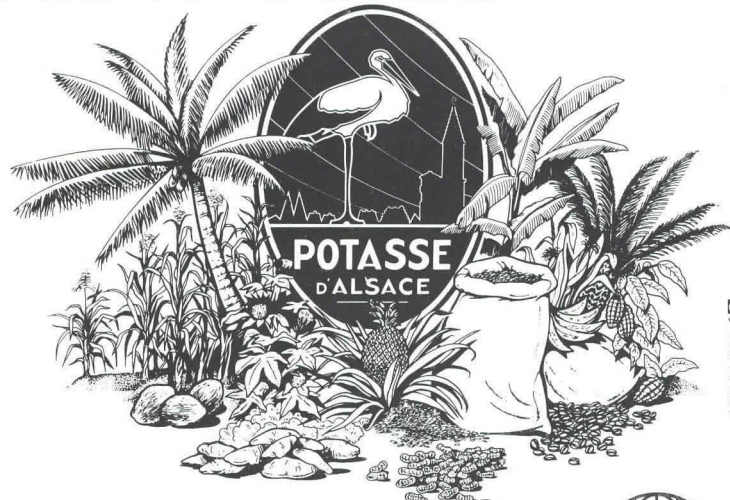
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