Reprinted from Curr. Sci., October 5, 1971, 40, No. 19, 518-519

A RAPID METHOD FOR DETERMINATION OF TISSUE POTASSIUM IN ARECANUT

ABSTRACT

The efficiency of different extractants which included cold water, hot water, salt solutions, chelate and dilute acid to extract potassium from areca leaf was compared with the wet oxidation procedure. Amongst the various extractants employed, hot water gave the best result. Hot water also eliminates the possibility of contamination from impure chemicals. The method is rapid, handy, accurate and inexpensive.

EXTRACTION of potassium from plant tissue is usually made by wet oxidation, dry ashing and direct leaching with ammonium acetate. The element extracted is estimated either by flame photometry or conventional cobaltinitrite method. There are certain serious drawbacks associated with these two procedures of ashing. Loss of considerable amount of potassium takes place at the temperature range of 550°–600° C while dry ashing. Although the same could be avoided at lower temperature of 400°–450° C, the method is time-consuming. The wet ashing procedure requires special fume exhaustion arrangements for carrying out the digestion. In view of these difficulties, it is desirable to choose the leaching method of extraction. This would enlarge the scope of handling more number of samples per day.

Jackson[1] proposed the use of 2 *N* NH_4 OAc + 0·2 *N* Mg $(OAc)_2$ as the solution for extraction of potassium from plant tissue. We in this laboratory attempted to evaluate the potassium extracting abilities of several extractants namely, water, hot water, acidified water of pH 4·5, 2 *N* NH_4OAc, 2 *N* Mg $(OAc)_2$, 2 *N* NH_4 OAc + 0·2 *N* Mg $(OAc)_2$, 0·02 *M* di-sodium EDTA, 0·1 *N* HCl from tissue samples in relation to the wet oxidation method which was considered as the standard. The ratio of tissue to extraction solution employed was 1 : 200. The leaf samples used in the present study were collected from the NPK manurial experimental area of the Institute, oven-dried and ground by a rotary mill. A 0·5 g of the tissue sample was treated with 100 ml of the extractant solution and shaken for 1 hr. In the case of wet ashing method, the same weight of the leaf material was pre-digested with nitric acid over a water-bath and subsequently treated with 10 ml of 1 : 1 nitric to perchloric acid mixture till the content was clear and just moist (Perur, personal communication). In all the cases, from an aliquot potassium was read by Systronix flame photometer.

The results of the study are summarized in Table I along with the statistical constants. Potassium extracted by water and hot water did not differ significantly from that of wet oxidation method. However, when the paired 't' values were compared, out of all hot water was found to be the most suitable extractant.

TABLE I

Comparison of different extraction procedures for potassium in areca leaf

(Results expressed on oven dry basis as percentage of K)

Sample No.	Wet oxidation	Water	Hot water	Water pH 4·5	2*N* NH_4OAc	2*N* $Mg(OAc)_2$	2 *N* NH_4OAc + 0·2 *N* $Mg(OAc)_2$	0·02*M* EDTA	0·1*N* HCl
1	0·79	0·75	0·76	0·69	0·68	0·60	0·65	0·66	0·79
2	0·76	0·78	0·70	0·71	0·71	0·64	0·66	0·70	0·61
3	0·52	0·50	0·48	0·44	0·44	0·40	0·44	0·49	0·41
4	0·52	0·51	0·53	0·47	0·48	0·42	0·48	0·46	0·44
5	0·98	0·92	0·96	0·91	0·85	0·82	0·87	0·85	0·79
6	0·79	0·72	0·79	0·74	0·66	0·63	0·71	0·71	0·62
7	0·68	0·64	0·66	0·63	0·61	0·56	0·61	0·61	0·51
8	0·98	0·94	0·98	0·89	0·85	0·81	0·90	0·88	0·81
9	1·16	0·98	1·04	1·06	0·96	0·90	1·02	1·02	0·94
10	0·50	0·42	0·49	0·44	0·48	0·42	0·44	0·44	0·40
11	1·21	1·13	1·26	1·17	1·11	1·04	1·15	1·15	1·08
12	1·10	0·98	1·09	1·04	0·98	0·94	1·01	1·00	0·93
't' value:		4·140 NS	1·733 NS	10·941*	6·920‡	10·951*	9·798*	8·573*	8·086*

* Significant at 0·1% level of probability, NS = Non-significant.

The efficiency of water to extract potassium from plant sample is an established fact. Potash-free ash is obtained when the plant tissue is extracted with cold water[2]. This is possible because the potassium in plant cell is mostly present in the form of inorganic compounds

and salts of organic acids. The superior performance of hot water over cold appears to be due to the greater solvent property of the former. Besides, hot water may expand the cell walls of the tissue and make them more permeable. The proposed method is simple, handy, rapid and may be useful for the routine analysis when problems exclusively relating to potassium nutrition of crops are involved.

Thanks are due to Mr. K. Shama Bhat, Arecanut Specialist and Mr. K. V. Ahamed Bavappa, Director of the Central Plantation Crops Research Institute, for providing necessary facilities and encouragement.

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May 7, 1971.

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