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Comparison of Different Plant Digestion Methods (Di-acid & Microwave) for Phosphorus Determination Content of Potato Leaf Using Spectrometry Grown in Erzurum: Pasinler and Oltu District Agricultural Soils

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***Abstract*- The purpose of this investigation,was to comparison of different plant digestion methods (Di-acid & Microwave) for used to determine phosphorus (P) content of potato leaf grown in of Pasinler and Oltu District Agricultural Soils . Representative 74 leaf samples were collected from potato grown in different soil locations. In order to comparison were used two different digestion methods. Using the microwave and di acid (HNO_3 +$HCLO_4$) digestion technique, P contents in potato leaf were determined, and , spectrometry was used for the determination of P in leaf samples in Erzurum, Oltu,Pasinler, Turkey. The results of the statistical analyses indicated that , did not show any significant differences between the two digestion systems of P nutrient . This result indicates that these systems can be used for the digestion of plant P content in Erzurum, Pasinler and Oltu district agricultural soils either by using concentrated di acid (nitric-perchloric acid) or microwave digestion methods.**

***Keywords*- Digestion Extraction Methods, plant, potato, leaf**

I. INTRODUCTION

Goodall and Gregory (1947) reviewed the early research, concluding that much of the work done prior to 1947 could be grouped into one of four categories: 1. Investigations of nutritional disorder made manifest by definite symptoms 2. Interpretation of the results of field trials 3. Development of rapid testing methods for use in advisory work 4. Use of plant analysis as a method of nutritional survey.

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These categories are still applicable today in terms of research as well as plant analysis utilization in crop production decision-making. Bear (1948) also presented a Western historical perspective of the development of the mineral nutrition of crops that relates to the principles of the plant analysis technique.

Plant analysis, sometimes referred to as leaf analysis, is the technique for determining the elemental content of tissue of a particular plant part. Plant analysis can play a major role when diagnosing mineral nutrition problems, whether for research purposes or for solving practical field problems.

The concentration of the essential elements in plants is expressed on a dry-matter basis as either percent or grams per kilogram (glkg) for the major elements, and either parts per million (ppm) or milligrams per kilogram (mglkg) for the micronutrients, the units selected depending on the system of use. The elemental concentrations will of course vary with nutrient availability, plant species, growing conditions, and time of sampling (Munson, 1998)

Zasoski and Buran (1977) provide details on digestion in a mixture of HNO3 and HClO4, and a digestion mixture of H2SO4 and HClO4 for the determination of N, P, K, Ca, and Mg is given by Cresser and Parsons (1979). The use of HClO4 requires special precautions as described by Horwitz (1980).

Wet-acid digestion (wet ashing) ;Numerous wet-acid digestion procedures have been proposed, but they all make use of some combination of three acids — nitric (HNO3), sulfuric (H2SO4), and perchloric acids (HClO4) — with or without 30% hydrogen peroxide (H2O2) as described by Tolg (1974). Zasoski and Burau (1977) and Miller (1998c) provide details on digestion in a mixture of HNO3 and HClO4,and a digestion mixture of H2SO4 and HClO4 for the determination of N, P, K, Ca, and Mg is given by Cresser and Parsons (1979). The use of HClO4 requires special precautions as described by Horwitz (1980)

Electromagnetic radiation of frequencies of 100 to 100,000 megacycles per second is commonly referred to as microwave radiation. Samples are heated by the oscillating electromagnetic field. Radiation passes through glass or plastic and does not couple with the

container material (as is the case with conventional heating). Because the radiation energy is applied directly to the digestion mixture, it provides extremely rapid heating and better control of power and time in the digestion of plant material by acid oxidation (White and Douthit, 1985).

II. MATERIAL AND METHOD

Representative 74 leaf samples were collected from potato grown in different soil locations (Erzurum, Oltu, Pasinler district). Leaf tissue was oven dried at 68 °C for 48 hours and ground to pass through a 1 mm mesh screen. The potato plant leaf sampled in start flowering from the 4th leaf plant leaf sample was taken June 2010 (Yildiz and Dizikisa, 2016)

Using the microwave (Microwaev Speed wave MWS-2 Bergrof) and di acid (HNO3 +HCLO4) digestion technique, P contents in potato leaf were determined. And , spectrometry (Spektrophometre (uv) Therma Electron Corporation. AQUAMATE) was used for the determination of Phosphorus in leaf samples .

1. Weigh 0.5 g dried (80°C; 176°F), 0.84-mm (20-mesh screened) plant tissue into a beaker or digestion tube.
2. Add 2.5 mL concentrated HNO3. Cover the beaker with a watch glass or place a funnel into the mouth of the digestion tube. Let stand overnight.
3. Place covered beaker on a hot plate or digestion tube into a port of a digestion

block and digest at 80°C (176°F) for 1 h. Remove beaker or digestion tube from hot plate or block, and let cool.
4. Add 2.5 mL HClO4, replace watch glass or funnel, and heat at 180 to 200°C (356 to 392°F) for 2 to 3 h, or until digest is clear.
5. Remove watch glass or funnel, lower heat to 100°C (212°F) until fumes of HClO4 dissipate. If digest is not colorless at this point, repeat Step 4.
6. Remove from hot plate or digestion block and let cool.
7. Add pure water to digest to bring to 10 mL or other appropriate volume. Digest is ready for elemental assay.

A commercially available laboratory microwave dryingldigestion oven, such as Model MDS-81 DTM (CEM Corp., Indian Trail, NC)
2. Teflon digestion vessels (with Teflon screw caps) of 120-mL capacity (CEM Corp., Indian Trail, NC).
3. Brinkrnann dispensette acid dispensers, adjustable from 0 to 10 mL, for nitric acid (FINO3) and hydrochloric acid (HC1).
4. Auto-pipette for hydrogen peroxide (H-,O-,).
5. Filter funnels.
6. Whatman No. 42 filter paper.

Reagents

1. Nitric acid [70% HNO-; (specific gravity 1.42)], concentrated.
2. Hydrochloric acid [37% HC1 (specific gravity 1.18)], concentrated.
3. Hydrogen peroxide (H202), 30%.

Procedure

1. Transfer 0.30 to 0.40 g (0.01 g accuracy) plant tissue sample (20-mesh)

into the microwave digestion vessel. Add 10 mL HNO-; and swirl the vessel gently so that all the tissue comes in contact with the acid.
2. Screw on the cap. Do not use an insert in the cap. Load digestion vessels on the turntable and put the turntable in the oven. Make sure that center wheel of turntable sits inside the tabs on the drive lugs. Switch on the turntable and check to ensure that assembly rotates smoothly.

Enter in time (30 minutes) and power (90%), press START, making sure that the exhaust is on FULL power and fumehood is on FAST function. At the end of the digestion cycle, stop the turntable rotation. Leave the digestion vessels in the microwave oven for about 5 minutes to exhaust fumes. Take digestion vessels out of microwave oven, carefully remove the cap under a fumehood, and slowly add 1.0 mL H202, and let stand for about 5 minutes.

Place the digestion vessels back into the microwave oven, start the tumtable, and digest at 90% power for 15 minutes. After cooling for about 5 minutes, remove the digestion vessel from themicrowave oven, remove the cap under a fumehood, add 2.0 mL HC1, and let sit for about 5 minutes.Place the digestion vessels back into the microwave oven, start the turntable,digest at 30% power for 10 minutes. Remove the digestion vessels from the microwave oven, remove the cap (in a fumehood), and rinse with water. Rinse down sides of container.Filter sample solutions (using Whatman No. 42 filter paper) into 100-Ml volumetric flasks (in a fumehood). Rinse digestion vessels three times to ensure that material is quantitatively transferred to funnels (make sure that it has filtered before second and third additions). Make up to 100 mL with deionized water. After thorough mixing, transfer an aliquot into a 60-mL Nalgene bottle for determination of calcium (Ca), magnesium (Mg), potassium (K), sodium (Na), manganese (Mn), iron (Fe), aluminum (Al), phosphorus (P), and sulfur (S) by inductively coupled plasma atomic emission spectrometry (ICP-AES).

The statistical analysis was done using IBM-SPSS statistics 20, Nonparametric test.

III. RESULTS AND DISCUSSION

The statistical analysis of this experiment did not show any significant differences between the two digestion systems of some total essential plant nutrient elements as on Table 1. This result indicates that these systems can be used for the digestion of some total essential plant nutrient in Erzurum, Pasinler and Oltu district agricultural soils either by using concentrated nitric-perchloric acid or microwave digestion methods (DA). (Table 4).

IV. CONCLUSION

The microwave digestion technique is recommended for routine analysis of plant leaf samples since it is more

reliable, less time- consuming and cheaper (especially for Oltu district).

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APPENDIX

Table 1. Content of P(%) in Potato leaf grown in Erzurum district soil samples

Sample No.	EP	ME
1	0.11	0.15
2	0.10	0.15
3	0.09	0.14
4	0.09	0.18
5	0.09	0.22
6	0.13	0.18
7	0.17	0.21
8	0.14	0.23
9	0.11	0.20
10	0.09	0.21
11	0.14	0.22
12	0.13	0.25
13	0.14	0.19
14	0.10	0.19
15	0.00	0.17
16	0.09	0.16
17	0.10	0.16
18	0.12	0.14
19	0.13	0.17

Table 2. Content of P(%) in Potato leaf grown in Oltu district soil samples

Sample No.	OP	OM
1	0.24	0.15
2	0.28	0.19
3	0.29	0.13
4	0.28	0.14
5	0.22	0.12
6	0.23	0.14
7	0.29	0.13
8	0.15	0.12
9	0.22	0.20
10	0.29	0.14
11	0.30	0.12
12	0.23	0.14
13	0.27	0.15

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Table 3. Content of P(%) in Potato leaf grown Pasinler district soil samples

Sample No.	PP	MP
1	0.26	0.16
2	0.14	0.23
3	0.13	0.19
4	0.13	012
5	0.17	0.15
6	0.17	0.18
7	0.11	0.14
8	0.17	0.15
9	0.14	0.17
10	0.13	0.18
11	0.13	0.15
12	0.18	0.11
13	0.17	0.14
14	0.14	0.14
15	0.14	0.15
16	0.14	0.18
17	0.16	0.15
18	0.19	0.14
19	0.17	0.20
20	0.18	0.10
21	0.14	0.10
22	0.12	0.16
23	0.00	0.14
24	0.11	0.20
25	0.14	0.25
26	0.13	0.26
27	0.18	0.23
28	0.16	0.29
29	0.14	0.28
30	0.13	0.35
31	0.13	0.35
32	0.14	0.34
33	0.19	0.23
34	0.16	0.35
35	0.16	0.32
36	0.20	0.30
37	0.17	0.28
38	0.19	0.21
39	0.17	0.28
40	0.20	0.31
41	0.21	0.34
42	0.21	0.26

Table 4. Treatments df Asymp. Sig.

	EP	**ME**	**OP**	**OM**	**PP**
Treatments	0.11	0.18	0.27	0.14	0.16
df	18	18	12	12	41
Asymp. Sig.	0.46	0.46	0.45	0.45	0.47

a. Kruskal Wallis Test
b. Grouping Variable: Sample

EP, OP and PP ; The results Potato leaf P content of Erzurum,Oltu and Pasinler Disrict with Di acid degistion method

ME, OM and MP : The results Potato leaf P content of Erzurum,Oltu and Pasinler Disrict with Microwave Digestion method