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Effects of long-term storage of soil sample on some chemical properties on vertisol

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Abstract
Effects of sample storage methods on the P^H, Total Nitrogen and available phosphorus are done for 24 month/two years. As well as the interaction between sample storage time and storage material done. The highest average concentration of PH is Month 18 (6.204) and the lowest average concentration is moth 24(6.090). The highest mean concentration of Total Nitrogen on month 1 (0.0875%) and lowest mean concentration on month 12(0.0633%) table. This result indicates Total Nitrogen has decreased from months 1-24. The highest mean concentration of available phosphorus on month 3(5.6726 mg/kg) and lowest mean concentration on month 24(3.3385 mg/kg). The availability of phosphorus in stored soil sample is increased from months 1- 6, but decreased from month 12-24.Soil sample storage has an effect on PH, total Nitrogen and available phosphorus.

Keywords: available phosphorus, P^H, storage and total nitrogen

Introduction
The effect of sample storage methods on soil properties being studied is an important issue that needsto be considered before planning an experiment. Although research suggests that soil samples should be analyzed immediately after sampling Zelles, L. *et al.* (1991) [13]. Sample storage is not avoidable in many cases for reasons of time limitation or long-distance sample shipping. In such cases, soil samples are commonly air-dried for storage Mc Dowell, W. H. *et al.* (2006) [8] or frozen-stored at − 20 °C or lower in a freezer Erhagen, B. *et al.*, (2013) [4].

A common method to preserve soil samples for future analyses has been to store them air-dried in plastic bags in unheated storage rooms. This will probably induce some fluctuations in soil moisture during storage and temperature may vary substantially. There is little knowledge of effects of time and storage conditions on the chemical properties of the soil as most studies have been made on drying effects over short periods, from a few days to some weeks, while the actual storage time may be several years. There are indications that changes occur both during the drying process and on rewetting prior to analysis. The mineralization of nitrogen and carbon increases (Birch 1958, 1960) [2], possibly because of the breaking of hydrogen bonds within the soil organic matter and increased microbial activity. Hydrolysis of water associated with exchangeable cations increases the adsorption capacity and proton-donating ability of the soil (Haynes and Swift 1985) [7].

A higher drying temperature seems to accentuate these effects. Extractable (Mehlich-1) P, Fe and Mn increased considerably with temperature, also in the air-dried soil as compared to the moist soil. The changes in base cationcon centrations (Ca, Mg, K, Zn) were not consistent and were probably dependent on initial soil properties, such as organic matter content and clay mineralogy (Payne and Rechcigl 1989) [11]. In some peat soils, on the other hand, extractable Fe (NH4Ac-EDTA) decreased with higher temperature while P (NH4Ac) increased and changes in other nutrient concentrations (K, Ca, Mg, Mn, Cu, Zn, Mo) were negligible (Saarinen 1989) [12].

The effect of storage time, studied over 16 wk, was a continuous change towards an increase in surface acidity, exchangeable Mn, solubility and oxidizability of organic matter (Bartlett and James 1980) [1]. pH usually decreased as an immediate effect of drying and then continued to decrease over a period of 4-12 months. The decrease was most pronounced during the first two months for pH (H20) while changes in pH(CaCl2) were small (Daveyand Conyers 1988). According to Laura *et al.* 18, drying would result in the breakdown of organic matter. Air-drying of soil samples has been found to enhance the mineralization of

organic Matter as air-drying increases the solubilization of organic matter and disrupts soil aggregates 19. pH usually decreased as an immediate effect of drying and then continued to decrease over a period of 4-12 months. The decrease was most pronounced during the first two months for pH (H_20) while changes in pH ($CaCl_2$) were small (Davey and Conyers 1988) [3].

The aim of this paper is to determine the effects of long term storage of soil on Soil Chemical Properties of repeated chemical analyses of p^H, Total Nitrogen and available P in soils which had been stored air-dried for 2 yr.

Materials and Methods

Location of the Study Areas: The trial site was located on Ginch,

Experimental Design and Treatments: The experiments were conducted in 2018 and 2019 for two years. The storage soil sample materials were Plastic, Plastic with Carton, Carton, and bottle. Each material was done with three replications.The first analysis was made within one months of sampling. Determination of pH, TN and available P was repeated withthree, six, twelve, eighteen and twenty four months starting from sample collection.

The first analysis was done in one month after sample collected.

The second analysis was done after three month

The fourth analysis was done after nine month

The fifth analysis was done after one year and two month

The sixth analysis was done after two year.

Sample collection and preparations

Forty-six soil samples were collected at the depth of 0-25 cm using soil auger systematic sampling technique method from Ginchfarmlands. Thus samples were brought to one for composite. Soil samples taken from areas were separately labeled and transferred into air tight polythene bags and brought to Holeta research center for laboratory analysis. Before it's transported to the research laboratory, care was taken, to the extent possible; to ensure that there was no other sources of contamination at the site of investigation. The air dried soil was grinded using mortar, pestle and sieved through a < 2 mm sieve to remove coarse particles and stored at ambient temperature prior to analysis. The composited soil sample was divided in to storage soil sample materials such as Plastic, Plastic with Carton, Carton, and bottle.

Determination of some chemical parameters of the soil Samples

Soil samples were analyzed for the following chemical parameters such as pH, total Nitrogen and available Phosphorus.

pH of soil sample

The pH of the soil samples were measured in water suspension (1:2.5) soil to water ratio as described by (Jackson, 1967) [6]. Air dried soil of 20 g was taken in a beaker and 50 ml of distilled water was added. The mixture was stirred with glass rod for 10 min and allowed to stand for 30 min. The pH meter (HI9017, HANNA) was calibrated using standard buffer solution of pH 4.0, and 7.0. Then electrode of the pH meter was inserted in to the supernatant solution and the pH reading was taken.

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Total Nitrogen

Total N was determined using Kjeldahl method Jackson, M.L., (1958) [5] and calculated using the following formula.

$$\%N = \frac{(V - B)\ N \times Eq.\ weight\ of\ N \times 100}{1000 \times W}$$

Where

V = volume of titrant B = blank W = weight of sample

Phosphorus

Available phosphorus determined using Olsen method (Olsen et al., 1954) [10] and Calculate soil P (mg/ kg) follows

Soil P (mg/kg) = [(A x B x C)/E]

Where

A = Sample extract reading (mg l-1)

B = Extract volume (ml)

C = Dilution, if performed

E = Sample weight (g)

Data analysis

All the results of analysis were reported as mean of triplicate measurements. The data was computed using SAS statistic for nutrient analysis. The recorded data was subjected to analysis of variance (ANOVA), to assess the effect of soil sample storage on PH, total Nitrogen and available phosphorus. The interaction between soil sample storage time and materials also seen.Two-way ANOVA was used to test the existence of significant difference between means. In all statistical analyses, confidence level was held at $p>0.05$.

Results and Discussion

Effects of long term soil sample storage on Soil physicochemical Properties.

The laboratory analysis results of soil-chemical properties such as pH, TN and Available Pwere presented in following tables 1, 2 and 3 respectively.

Table 1: Effect of Long-term storage soil sample on pH (1:2.5) Soil water ratio and there Interaction between time and storage material on vertisoil at Ginch

Months	Materias				
	P	PC	C	BP	Mean
1	6.2633ABC	6.070FGHIJK	6.133CDEFGHIJ	6.250ABCD	6.1792AB AB
3	6.3467A	6.2167ABCDEF	6.033HIJK	6.060GHIJK	6.1642ABC ABC
6	5.993JK	6.163CDEFGHI	6.1267CDEFGHIJ	6.120CDEFGHIJ	6.1008C C
12	6.113DEFGHIJK	6.173BCDEFGH	5.9667K	6.220ABCDE	6.1183BC BC
18	6.190BCDEFG	6.3133AB	6.080EFGHIJK	6.233ABCD	6.2042A
24	6.030HIJK	6.1233CDEFGHIJ	6.0167IJK	6.1933BCDEFG	6.0908C C
Mean	6.1561A	6.1767A	6.0594B	6.1794A	
Lsd (0.05)	0.1478				
Cv%	1.46				

-P plastic, PC plastic with carton, C carton, BP bottle with plastic. Letters indicated for significant difference at $p<0.05$.

Table 2: Effect of long-term storage on Total Nitrogen (%) and there Interaction between time and storage material on vertisoil at Ginch

Months	Materias				
	P	PC	C	BP	Mean
1	0.0767CDE	0.0800BCD	0.0967A	0.0967A	0.0875A
3	0.0733DEF	0.0800BCD	0.0967A	0.0967A	0.0872A
6	0.0833BCD	0.0767CDE	0.0900AB	0.0900AB	0.0867A
12	0.0767CDE	0.0867ABC	0.0800BCD	0.0900AB	0.0850A
18	0.0767CDE	0.0633FGH	0.0733DEF	0.080BCD	0.0733B
24	0.0767CDE	0.0867 ABC	0.0567GH	0.0900AB	0.0633C
Mean	0.0772BC	0.0733C	0.0800B	0.0867A	
Lsd(0.05)	0.0132				
Cv%	9.99				

Table 3: Effect of long-term storage on phosphorus (mg/kg) and there Interaction between time and storage material on vertisoil at Ginch

Months	Materias				
	P	PC	C	BP	Mean
1	4.115DEFG	4.1973DEF	4.1927DEF	4.299DE	4.2011B BB
3	5.5133AB	5.423AB	6.1013A	5.6527AB	5.6726A
6	5.6793AB	5.1857BC	5.3007B	5.286B	5.3629A
12	3.4147GHI	3.369HI	3.96DEFGH	4.4743CD	3.8045C
18	3.4043GHI	3.558EFGHI	3.7347DEFGHI	3.670EFGHI	3.5918CD
24	3.3863GHI	3.3243HI	3.1610I	3.4823FGHI	3.3385D
Mean	4.2522A	4.1763A	4.4084A	4.4774A	
Lsd(0.05)	0.7411				
Cv%	10.42				

-P plastic, PC plastic with carton, C carton, BP bottle with plastic. Letters indicated for significant difference at $p<0.05$.

In a study of dried soils stored for two years PH, TN, and Available P were analyzed six within two years. pH increases gradually over time, the increases being insignificant during the twelve month or first years (Table 1).

The mean concentration of metals in soil in descending order at Ginch on vertisol of month (18 > 1 >3 > 12 > 6 > 24).As can be seen from Table 1. The highest average concentration of PH is Month 18 (6.204) and the lowest average concentration is moth 24(6.090). This result indicated the mean concentration of PH is reduced from month 1 to 12 and increased at month 18. This study is agreed to (Bartlett and James 1980) [1] pH usually decreased as an immediate effect of drying and then continued to decrease over a period of 4-12 months. The effect of storage time, studied over 16 weeks, was a continuous change towards an increase in surface acidity, exchangeable Mn, solubility and oxidiz ability of organic matter (Bartlett and James 1980) [1]. Long term soil sample storage on PH has significant difference at P>0.05.

The highest mean concentration of Total Nitrogen on month 1 (0.0875) and lowest mean concentration on month 12(0.0633) table 2. This result indicates Total Nitrogen has decreased from months1-24. Form table 2. Total Nitrogen numerically decreased from month 1-12 but, has no significant difference at p>0.05. However, total Nitrogen has significant difference on months 18 and 24. Therefore, according to this study soil sample storage for total nitrogen is until months12. After 18 months the mean concentration of total nitrogen decreased significantly.

The highest mean concentration of available phosphorus on month 3(5.6726) and lowest mean concentration on month 24(3.3385). The availability of phosphorus in stored soil sample is increased from months 1- 6, but decreased from month 12-24. The effect of storage of soil sample on availability of phosphorus has significant difference among

a month. The effect of storage material on available phosphorus has no significant differences between the materials.

Conclusions

The mean concentration of a month of pH in soil samples was increased until 18 month but decrease at 12 month. Soil sample storage has an effect on PH of soil. The highest mean concentration of Total Nitrogen on month 1 (0.0875)and lowest mean concentration on month 12(0.0633).Therefore, according to this study soil sample storage for total nitrogen is until months12. After 18 months the mean concentration of total nitrogen decreased significantly. The availability of phosphorus in stored soil sample is increased from months 1- 6, but decreased from month 12-24. The effect of storage of soil sample on availability of phosphorus has significant difference among a month.

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