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Impact of decomposition of different manures on soil resistivity in rainy season

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ABSTRACT : Knowledge of soil resistivity act as important parameter for designing earthing installations as well as fordeciding the type, coating of Underground pipes. Electrical resistivity is an intrinsic property that quantifies how strongly a given soil oppose the flow of electric current . In this paper we have focus to study the impact of decomposition of different manures like animal manures, plant manures on resistivity of soil in rainy season. We had assumed that there is negligible effect of change in temperature and moisture of soil on resistivity and resistivity decreases during decomposition of material. We have dig 7 different pits of same dimensions, inserted different manures in each pit,dipped electrodes at fixed distance and connected Multimeter to measured resistivity in botanical garden of C.K.Thakur A.C.S college, Panvel. It is witnessed that resistivity of soil increases initially for few days then decreases slowly also in rainy season. We also found that decomposition of cooked rice lowers the soil resistivity in rainy season also which is helpful to drain out leakage current through earthing process and direct us to use Plastic PVC Underground pipes in such soil.

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Key Words :
Earthing installation, Electrical resistivity; Intrinsic property; manures, Deposition

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For designing of ground system for new installation and fitting of underground pipes, soil resistivity plays significant role. What is soil resistivity?

Soil resistivity is a measure of how a soil resists the flow of electricity. Its unit is Ohm-cm. Its property aredependent on soil type, moisture, temperature (Mazanabdul-Salam *et al.*, 2000). Moisture content changes seasonally, varies according to nature of sub layers of earth and depth of permanent watertable, so it is recommended to have ground rods should be inserted deep in soil. Referring to one of research paper, it is commented that soil resistivity can be evaluated with rods for wet soil and without rod for dry soil (Salam *et al.*, 2017). For wet soil, there are different methods to determine soil resistivity like Wenner array, Schlumberger Array and simple method two pole (El-Sharkawi, 2014).

Wenner array requires the longest cable layout, largest electrode spreads, four electrodes. Outer electrodes are current electrodes and inner two are potential electrodes. Here potential electrode spacing increases as current electrode spacing increases. Less sensitive voltmeters are required. But all electrodes has to be moved for each reading which appears tedious.

The Schlumberger Arrayrequires four collinear electrodes (Bendi and Carpena, 2005). Here potential electrode spacing is small as compared to current electrode

spacing. And as potential electrodes remain in fixed locations, to note readings become convenient. Its advantages are that fewer electrodes need to be moved for each sounding and cable length is shorter for potential electrodes. It gives better resolution, greater probing depth and less time consuming field deployment than wenner array but instruments needs to be very sensitive.

In simple method, only two electrodes are used. These two electrodes are separated by fixed distance. Simple multimeter (DMM) is used to note readings.

Soil resistivity appears as material specific constant of propornality given by (Salam and Quazi, 2016).

Soil resistivity ° = R A / L

where,

R = Resistance between two poles which are inserted in soil

A= Cross-sectional area through which current flow

L= Length between two poles which are inserted in soil

The location of Earth pit depends on soil resistivity. Soil resistivity is relevant in designing system that rely on passing current through earth surface.If soil resistance is high, earth resistance of electrode will be also high. In other words, more current flows if soil resistance is less (Parmar, 2014). Apart from solving earthing issues, soil resistivity also influences the corrosion of metals installed underground and serve as an indicator of soil corrosiveness. Soil resistivity plays role for type, coating of underground pipes. Underground pipes must be fully protected against corrosion. Lower the soil resistivity, the higher corrosivity (Sing *et al.*, 2013). If soil resistivity is greater than 5000 ohm-cm, 500-5000 ohm-cm, less than 500 ohm-cm, steel pipes, ductile iron pipe, plastic PVC pipe should be used, respectively (Frank, 2014). Talking related to coating protection,Class A protection is required for soil having resistivity of 1500Ohm-cm or less. Class B coating shall be provided for pipe having soil resistivity greater than 1500 Ohm-cm (Davis, 1979).

Soil resistivity is used also for locating shallow water tables and for drawing maps of salinity (Megger, 2004).

Decomposition is first stage in recycling of nutrients that have been used by an organism. It is process whereby the dead tissues breakdown and are converted into simpler organic forms (*http://tresforlife.org.uk/forest/forest-ecology/decompositio-and-decay*). The rate of decay is determined by the material *i.e.* the wetter it is faster it breaks down (*http://tresforlife.org.uk/forest/forest-ecology/decompositio-and-decay*).

With these points, we endeavored to study soil resistivity in rainy season as well as to study the impact of decomposition of manures on soil resistivity.

EXPERIMENTAL METHODOLOGY

Objectives :

The investigation focued on three purposes.

– To study soil resistivity without any manures in rainy reason

– To study soil resistivity due to decomposition of animal manures like earthworm, cow waste, Dry fish plant manures like dry leaves, cooked rice and urea, coal and salt.

– Comparison of soil resistivity with plant, animal manures, without manures and urea.

The research work was done in Botanical garden of Changu Kana Thakur A.C.S. College, Panvel, Maharashtra, India which is located at 19.0020° N, 73.1125° E. Soil deposited in field area is sandstone. Sandstone is classic sedimentary rock composed mainly of sand sized minerals or rock grains (*Sandstone.https://en.wikipedia.org/wiki/sandstone*).

Fig. A : Location map

For our convenience we have categoriesed manures in three types:

– Animal manures like cow dung, earthworm, dry fish .

– Plant manures like dry grass, dry leaves, cooked rice

– With coal and salt, urea fertilizers.

Following steps were followed.

Step 1:

8 different pit of dimensions 30 x 30 x 15 cm^3 in botanical garden of our College was dig as shown in Fig B.

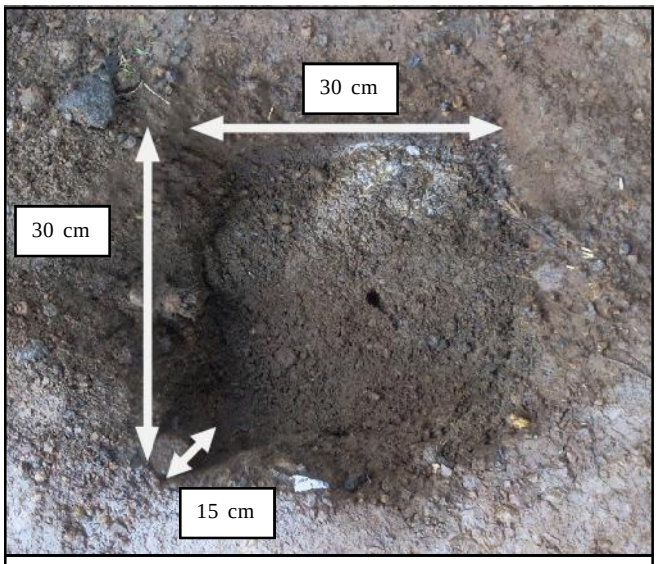

Fig. B : Empty pit

Step 2:

Pit was filled by inserting manures like cooked rice, dry leaves, earthworm, cow waste, dry fish, urea, coal salt as lower layer upto 5cm and then soil was put above manures upto 10 cm as shown Fig. C and Fig. D.

Fig. C : Filled pit with manure

Fig. D : Deposition of soil over manures

Step 3:

Distance between two electrodes was 10 cm and it was inserted 12 cm deep in soil as shown Fig E.

Fig. E : Placement of electrodes

Step 4 :

Reading of resistance of soil was taken by using DMM of kusam-meco 801-l from month of June -2016 to August-2016 (Rainy Season).

EXPERIMENTAL FINDINGS AND DISCUSSION

From the study, we got values of soil resistivity which varies between 50 to 6000ohm-cm indicating that soil is humus, leaf mold which verifies that there is deposition of animal and plant manures (*Soil- Resistivity http:// www.engineeringtoolbox.com/soil-resistivity-d_1865. html*).

From Fig 1, it was found that soil resistivity increases with rainfall noted by us (*Climate: Mumbai,https://*

en.climate-data.org/location/29/) which implies that soil conductivity decreases (Legros, 2006). Observation of increase in rainfall soil resistivity increases which resembles same as noted Hechuan country of Chongqing sounds bad (lianfu *et al*., 2010). It means during rainy season the chances of facing issues of electrical hazards due to less flow of leakage current is more.

We made an effort to study impact of decomposition of various manures (animals and plants) on soil resistivity in rainy seasonand compare it with soil without manures.

Fig. 1 reflects soil resistivity do vary due to decomposition of animal manures due to rainfall. From Fig. 2, it is witnessed that soil resistivity of dry fish manure, cow dung manure, earthworm manure, dry fish follows same pattern as thatof soil without manure. On comparison of its soil resistivity, it is observed that soil resistivity of dry fish increases more to that of rest of animal manures. It reveals that due to decomposition of dry fish manures (Chandra, 2005), less calcium content released in soil which allow the less flow of current inside the soil which indicates resistance is more. Whereas by using earthworm manures, there is less soil resistance which indicates that there is increase in calcium content on its decomposition (Alboulkacem *et al.*, 2014).

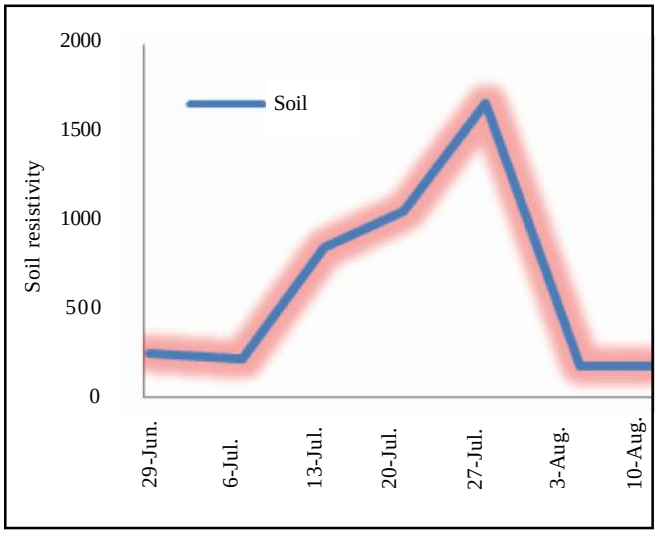

Fig. 1 : Soil resistivity in rainy season

On same aspect we have tried to study soil resistivity due to decomposition of plant manure. It is seen that due to decomposition of cooked rice, soil resistivity decreases more in spite of rainfall as shown in Fig 3. This is favorable to deposit cooked rice around

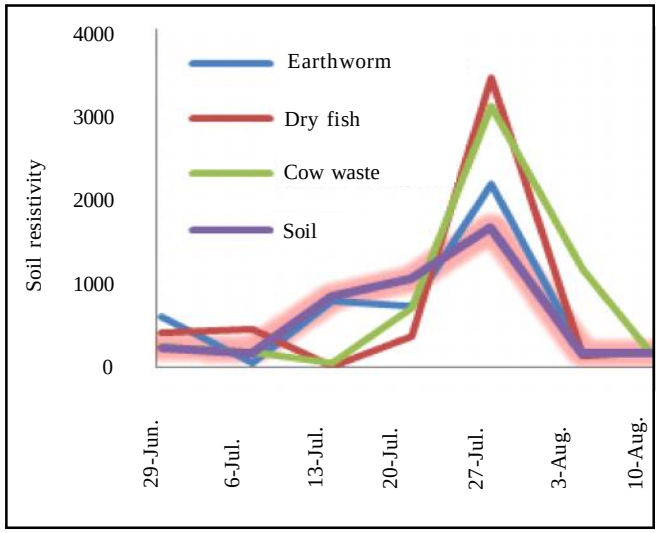

Fig. 2 : Impact of animal manure on soil resistivity

earthing pit to pass more current to pass leakage current to ground to avoid electrical accidents (Peshin and Chaturvedi (2005) and Electric Shock and Leakage of current, *http://www.gharexpert.com/tips/articles/Construction/1831/Wiring-Electric-fitting-1831-Electric-Shock-Leakage-Current_0*).

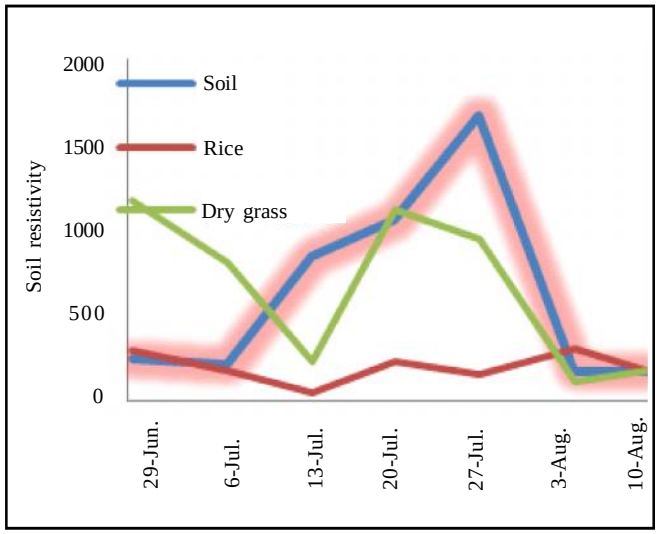

Fig. 3 : Impact of plant manure on soil resistivity

In scenario with decomposition of urea fertilizer, coal and salt , it is observed that coal and salt decomposition do also decreases soil resistivity from Fig. 4.

From Fig. 5, it can be commented that soil resistivity decreases more by decomposition of cooked rice rather

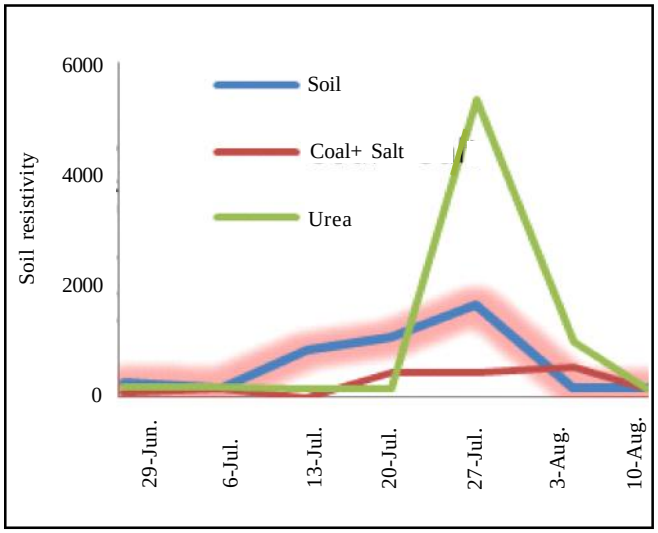

Fig. 4 : Impact of coal and salt, urea on soil resistivity

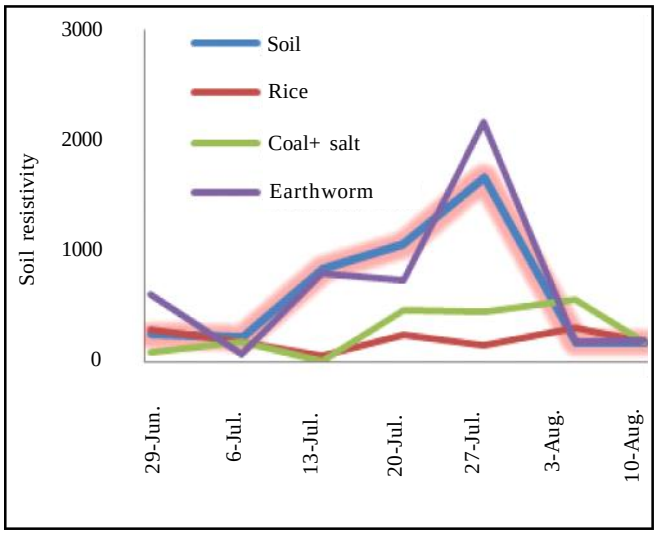

Fig. 5 : Comparison study of soil resistivity

than using other animal manures and other plant manures.

Conclusion:

It is convinced with that soil resistivity is maximum when rainfall is more which give us signal about precaution to be taken to avoid electrical shocks. From investigation, it is concluded that in rainy season, soil resistivity do decreases by deposition of cooked rice around earthing pit.

Plastic PVC pipes which are cheaper than steel ones in cost wise, not get rusted as compared to steel one (GI pipes *et al.*, 2016), should be used as undergrounding drainage pipes where wasted cooked rice are thrown out.

It is suggested to dig cooked waste rice near earthing area to decrease soil resistivity inspite of maximum rainfall.

REFERENCES

Alboulkacem, Lemtin, Gilles, Colinet, Taofic, Alabi, Daniel, Cluzeau, Lara, Zirbes, Eric, Haubruge and Frederic, Francis (2014). Base, Impact of earthworms on soil components and dynamics. A review, **18** : 121-133.

Bendi, Javier Alware and Carpena, Rafael Monoz (2005). *Soil water-solute process characterization: An integrated Approach*, pp. 326, CRC Press, Florida.

Chandra, Krishan (2005). *Organic manure*, pp. 7, Regional Director, Bangalore.

Davis, R.M. (1979). *Irrigation water conveyance*, National Handbook of Conservation Practices, pp. 429.

Frank, R. Spellman (2014). *Corrion control, handbook of water and wastewater treatment plant operations*, 3rd Ed,CRC Press, Florida, pp.631.

Legros, Jeans-Paul (2006). *Problems of practical organization, mapping of soil*, Science Publishers,USA pp. 93.

Lianfu, L., Hang, L., Xiang, Bo and Qin, Binquan (2010). Influence of precipitation on determination of proper time for soil resistivity measurement. *J. Meteorological Res.*, **24** : (2) : 259-268.

Mazanabdul-Salam, Hussein Anis, Ahdab El-Morshedy, Roshdy, Radwan (2000). High voltage Engerinering, pp. 416, Marcel Dekker Inc.

Megger, Jeff Jowett (2004). Measuring soil resistivity, *Neta World J.*,**26** (2) : 51.

Mohamed, A. and El-Sharkawi (2014). *Electric safety Pratice & Standards*, pp. 91, CRC Press, LONDON, UNITED KINGDOM.

Parmar, Jigesh (2014). *Electrical Notes*, **1**,World Press, India, pp. 250-230.

Peshin, Kuldip and Chaturvedi, Pradeep (2005). *Let us prevent electrical accidents managing safety* : Challenges Ahead, **1**,Concept Publishing Company, New Delhi, pp. 40.

Salam, Md.Abdus, Rahman, Quazi M. (2016). *Power systems grounding*, Soil resistivity, pp. 203, Springer- Singapore.

Salam, Md. Abdus, Quazi, Mehbubar Rahman, Swee Peng Ang and Fushuan Wen (2017). Soil Resistivity and ground resistance for dry and wet soil, *J. Modern Power Syst. & Clean*

Enrgy,**5** (2) : 290-297.

Sing, Lim Kar, NordinYahaya, Siti Rabeah Othman, Siti Nor Fariza and Norhazlan Md Noor (2013). The relationship between soil resistivity and corrosion growth in tropical region, *J. Corossion Sci. & Engg.*, **16** : 54.

WEBLIOGRAPHY

Climate: Mumbai, https://en.climate-data.org/location/29/

Decomposition and decay, *http://treesforlife.org.uk/forest/forest-ecology/decomposition-and-decay/.*

Electric Shock and Leakage of current, *http://www.gharexpert.com/tips/articles/Construction/1831/Wiring-Electric-fitting-1831-Electric-Shock-Leakage-Current_0* .

GI pipes vs PVC Pipes Vs CPVC pipes (2016). *https://www.materialtree.com/blog/gi-pipes-vs-pvc-pipes-vs-cpvc-pipes/.*

Sandstone.https://en.wikipedia.org/wiki/Sandstone

Soil- Resistivity http://www.engineeringtoolbox.com/soil-resistivity-d_1865.html.