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An Overview of Microwave Dielectric Behaviour of Vegetable Based Soil

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Abstract:
In this paper an attempt has been made to study overview of microwave dielectric behaviour of vegetable-based soil of Chhattisgarh.Soils are complex mixture of minerals, air, organic matter, and countless organisms. The properties of soil such as physical properties, chemical properties, geographical properties are really important in production of vegetables. Moisture content is very important parameters for the production of vegetable. Dielectric constant depends upon the percentage of moisture content in the soil. Humid climates sufficient for growing of vegetables crops. Optimum vegetables can produce in well-drained sandy loam soil.

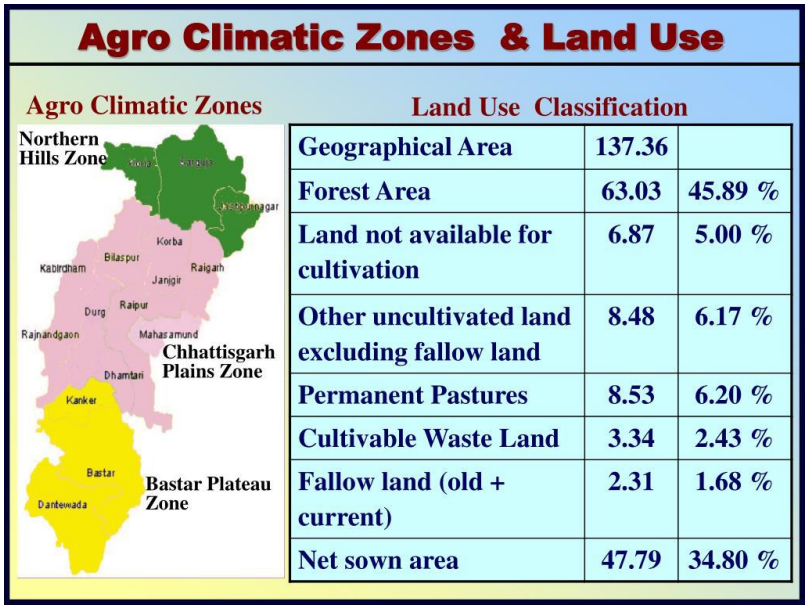
Keywords: Microwave, Dielectric, soil, minerals, vegetable-based**.**

Introduction-Soil science deals with soil as an important medium for crop growth. Soil science divided in to four categories- 1**. Soil geology**- The study of geological materials from which the soil is derived and study the process of formation. 2. **Soil Chemistry**- The study of chemical components of the soil. 3. **Soil Physics**- Study of physical and chemical properties of soil. 4. **Soil** Biology- The study of the effect of plants, animals and soil micro- organism on the chemical composition of the soil. The soil's physical, chemical, and biological properties affect plant growth. The physical properties of a soil largely determine the ways in which it can be used. The size, shape, and arrangement of the primary soil particles are known as the physical properties of soil. The proportions of the four major components of soils, inorganic particles, organic materials, water, and air, can vary greatly from place to place and with depth. The amount of water and air in a soil can also fluctuate widely from season to season. However, the physical characteristics of the solid components, inorganic and organic particles, are essentially unchanging. Chemical properties of soils are important in that, along with their physical and biological properties, they regulate the nutrient supplies to the plant. Without these nutrients supplied by the soil or applied as inorganic fertilizers, organically by manures, and other vegetative materials, plant growth would cease. The biological properties of the soil are dictated by the macro-organisms and microorganisms. Good physical and chemical properties supply the right environment and sufficient nutrients to the organisms for optimal biological activity. Soil plays pivotal role in agriculture. The dielectric characterization applications in agriculture have been collected along with their techniques and measurements.

2. An Overview of Vegetables in Chhattisgarh(indifferent season)

s.no.	Name of vegetables	Season availability
1.	Onion (white)	Summer season, commercial crop
2.	Bottle guard	Summer season
3.	cabbage	Summer season
4.	Apple guard	Summer season
5.	beans	Summer season
6.	cucumber	Summer season
7.	Pumpkin	Summer season
8.	Bitter gourd	Summer season
9.	capsicum	Summer season
10.	Beetroot	Summer season
11.	Bhindi (okra)	Summer season
12.	brinjal	Summer season
13.	Cowpeas (lobia)	Summer season
14.	Green chillies	Whole year
15.	tomato	Whole year
16.	potato	Whole year
17.	carrot	Whole year
18.	cauliflower	Whole year
19.	radish	Whole year
20.	peas	Winter season

Agro Climate Zones of Chhattisgarh



1. Cabbage- Cabbage is leafy vegetables. In Hindi it is called Bundhghobhi or Pattaghobhi. Annual production of cabbage in Chhattisgarh is about 320567 MT. Main areas of cultivation of cabbage in Chhattisgarh is Durg, Kondagoan, Balod, Bemetara, Raipur, Korba. Cabbage is grown on soils ranging from loam to clay. Soil pH requirement from 5.5 to 6.5 for higher production of cabbage. Soil for Cabbage is rich in organic matter and good drainage.

2. Brinjal – Brinjal was born in INDIA. Brinjal is most consumed vegetable after potato. Annual production of brinjal in Chhattisgarh is Durg, Kondagoun, Raipur, Kabirdham, Bemetara, Rajnandgaon, Balod,. The brinjal plants grown in soil varying from light sandy to heavy clay and Well drained soil. Soil pH for brinjal plant is 6.5-7.5. Season of sowing for brinjal seeds is December- January and May- June.
3. Tomato- Tomato is warm season crop, it required a warm and cool climate. Mineral soils are requirement for cultivation of tomato. The upper layer of soil should be porous with little sand and good clay in the subsoil. Soil pH 5.5-6.8 is required.

4. Cluster bean- Cluster bean is most famous vegetable, popularly known as "guar" in India.Cluster bean grows on drained sandy loam soils. Soil pH range 7.0- 8.0 required for the production of cluster beans. Cluster bean farming is done during monsoon (June-July) early Guar crop is sown from February to March.
5. Radish- Radish is root vegetable. It is quick growing vegetable and biannual herb. Radish can be grown on all type of soils, but radish grown on sandy loam soil and not on compact soils. Ideal pH of soil for radish grown is 5.5- 6.8.
6. Okra (Bhindi)- Okra is delicious vegetable. The ideal soil pH for Okra should be 6.0- 6.5.Ideal soil for okra cultivation is sandy loam to clay loam with rich organic matter and better drainage. Okra is notCultivated in alkaline, saline soils also in poor drainage capacity soils.
7. Potato- Potato is root vegetable crop. India is second largest country for production of potatoes around 50.19 million metric tonnes. Potatoes can Grown in any kind of soils. Well drained, loamy soil having soil pH 4.8- 6.0 is ideal for potatoes farming.Potato is cool weather crop. Average temperature required for potato growth is about 24 Degree Celsius. For better growth required temp. is about 20 Degree Celsius.
8. Onion- Onion crop is commercial crop. Onions can be cultivated in sandy loam to clay loam. For better growth of onions required soil having soil pH would be 6.5-7.5. Temperature range required for vegetative stage of onions become 16-21 Degree Celsius.and 16-21 Degree Celsius for building stage and 30-35 degree Celsius at the matuarity stage.
9. Bottle gourd (Lauki)- Bottle gourd is most important vegetable crop in India. Local name of bottle gourd is Lauki, Dudhi, etc. Bottle gourd required a hot and moist climate for cultivation. Soils required for the growth of bottle gourd is sandy loam soils and soil pH should be from 6.5- 7.5.This vegetable requires good drainage. Bottle gourd seed is sown from June to July for rainy season in plains and April in the hills and January to February for summer crops.
10. Beans- Beans plants Cultivated through out India. Local name for beans are Kamal kakdi in Hindi. Beans grow in loamy, silty loam and clay loam soils and good drainage. The soil pH range 5.5- 6.0 with a cool climate condition is required for beans farming. Rich organic matter in the soil is required for beans farming.
11. Pumpkin- Pumpkin is most popular rainy season vegetable crop in India. It is grown during monsoon season and summer season. Local Hindi name of Pumpkin is Kaddu. Sandy loam soil with good organic matter is required for pumpkin farming. Soil with the pH range 6-7 and good drainage is ideal for pumpkin cultivation. Pumpkin can be grown during the time period of January to March and September to December.

12. Bitter Gourd (karela)- Local name of Bitter gourd is Karela. Bitter gourd also known as Bitter Melon on other parts of world. Bitter Gourd is most delicious vegetable in India. Bitter Gourd is warm season climber plant, they grow hot and humid climate. Fertile, well drained soil with pH from 5.5-6.6 is basic requirement of bitter gourd production. Sandy loam soil is basic requirement of Karela crop, but it is also grown in poorer soils.
13. Beetroot- Beetroot is root vegetable. It is also known as garden beet. Local name of Beetroot in Hindi isChukander. Loam and sandy soil is basis requirement of Beetroot cultivation. Soil pH range between 6.3-7.5 is most appropriate for cultivation of beetroot. Mid July is the ideal time for sowing the beetroot. Beetroot grows under cool condition.
14. Cowpeas- Cowpeas grows in warm season. Sandy and sandy loam soils are basic requirement for the cultivation of cowpeas.
15. Cauliflower- Cauliflower is winter vegetable. Cauliflower is cultivated on clay to loamy soil, but deep loamy soilis most effective.

Conclusion-

Chhattisgarh state is divided in to five Agro-Climate zones which are suitable for variety of vegetables crop. Dielectric properties can be used to predict the soil fertility and health. Dielectric constant of soil are strongly dependent on soil moisture and soil texture. Productivity of vegetables strongly dependent on physical, chemical, and electrical properties of soil.

REFERENCES

1. AhireVidya D., Ahire D.V., Chaudhary P.R. (2015), "Effect of Chemical Fertilizers on Dielectric Properties of Soils at Microwave Frequency'', International Journal of Scientific Research Publications. Vol 5(5), PP 1-7.
2. Chandan Naresh Kant &ShrivastavaSidhatri Kumar (2015), "Measurement of Dielectric Constant of Soil Near Berhampur District of Orissa state at X-Band frequency'', J. Inst. Engg. India Ser. B, Springer, DOI: 10.1007/s40031-014-0179-8.
3. Chaudhary H.C. (2015), "Dielectric Study of Soils with Varied Organic Matter at Microwave Frequency'', IJCPS, Vol, 4, No. 3.
4. Chaudhary H.C. (2015), "Dielectric Properties of Soils with Organic and Inorganic Matter At J-Band Microwave Frequency'', International Journal of Remote Sensing & Geosciences, Vol. 4, Issue3, PP 14-19.
5. Chaudhary H.C. (2015), "Dielectric Study of Soils with Varied Organic Matter at Microwave Frequency'', International Journal of Chemical and Physical Sciences, vol.4, No.3, PP 45-53.
6. Chaudhary P.R. *et al.* (2015), "Effect of Chemical Fertilizers on Dielectric Properties of Soils at Microwave Frequency'', International Journal of Scientific and Research Publications Vol.5, Issue 5, PP 1-7.
7. Das Kaushik and Paul (2015), "Present Status of Soil Moisture Estimation by Microwave Remote Sensing Cogent Geo Informatics'', Review Articles,1 :1084669, PP 1-21.
8. Dhiware M.D., Nahire S.B. and Deshmukh (2015), "Physicochemical and Dielectric Properties of Soil Samples at X-band Microwave Frequency of Nasik Region'', Bio Nano Frontier, vol.8(3), http://www.researchgate.net/publications/339817269].

9. Dhiware M.D., S. B. Nahire, S. B. Deshmukh (2018), "Relationship Between Dielectric Constant and Water Content of Soil from Western Ghat Of Maharashtra, India'', Int. Res. J. Of Science & Engineering A2: 76- 82.
10. DhiwareManisha*et al*., (2018), "Dielectric Study of Soil at X-band Microwave Frequency and Physic-chemical Properties", International Journal of Engineering and Techniques, Vol 4, issue 1, PP 381-392.
11. Gadani D.H, F.M.Modi, Rana V.A., (2020), " Estimation Of Sea Water Salinity From Dielectric Measurements: Effect Of Temperature'' , Indian Journal Of Pure & Applied Physics, Vol. 58, June, PP-455-464.
12. GharecelouSaeid, TateishiRyntaro and Johnson A. Brin (2020), "Mineral Soil Texture Land Cover Depending on Microwave Dielectric Models''. In An Arid Environment Land, MDPI, PP. 1-13 Doi: 10.3390/ Land 9020039].
13. ItolikarAshish B, Joshi Anand, DeshpandeSantosh and Kurtadikar (2021), IEEE India Geoscience and remote sensing symposium, Publisher: IEEE, DOI: 10.1109/InGARSS48198.20209358944.
14. Jain Amar Kumar (2018), "Response of Organic Manure, Zinc, And Iron on Soil Properties, Yield and Nutrient Uptake by Pearlmillet Crop Grown in Inceptisol'', IJPAB, 6(1): 426-435**.**
15. JaiswalShweta, Patel Lakhpati, Paul A.C., & Shrivastava A.K. (2019), "Correlations of Environmental Soil and Dielectric Constant with Microwave Remote Sensing'', OIIRJ, Vol. 9, April Special Issue (01).
16. Kabir Humayun, Khan Mohammad Jamal, Brodie Graham, Gupta Dorin, Pang Alexis, And Jacob Mohan V., (2020), Measurement and Modelling of Soil Dielectric Properties as a Function of Soil Class and Moisture Content, Journal of Microwave Power and Electromagnetic Energy, Vol. 54, Issue 1, PP- 3-18.
17. Kapre A.K. *Et Al*, (2015), " Dielectric Properties of Black Soil with Chemical Fertilizers At X-Band", India Journal of Radio & Space Physics, Val 44. PP. 102-105.
18. Klotysche A et al., "Measuring Soil Water Content with Ground Penetrating Radar: A decade of Progress, Vadose Zone Journal Advancing Critical Zone Science'', PP-2-9 DOI: 10.2136/viz 2018.03.0052 (2018).
19. Kumar Rajeev and Sharma Anupam deep (2015), "Variation in Dielectric Behaviour of Soil of Indo-Gangetic Region of Haryana (India) with fertilizers at 5 GHz''. 6th International Conference an "Recent Trends in Applied Physical, Chemical Sciences, Mathematical / Statistical and Environmental Dynamics", ISBN: 978-81-930585-8-9, PP 43-47.
20. Kumar Shashi Ranjan et al., (2018), "Review and analysis of microwave remote sensing behaviour of soil in India'', IJRAT, 6(11): 2972-2975.
21. Kumar Virendra, Patel N., Chaudhary Prahalad D., Rana Vipin A. And Deepak Gadani H., (2021), Research Article, Current Science, Vol. 120, No. 2.
22. Liu Jing, Liu Qinhuo Li Hua, Du Yongminge, Cao Bio [2018], "An improved microwave semiempirical model for the dielectric behaviour of moist soils''. This article has been accepted for induction in a future issue of this journal content is final as presented, with the exception of pagination, IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING.
23. Meena Mohan C. Mena Ramontor "Modified Ulaby model on Backscattering as a function of salinity, frequency and soil moisture", Indian general of agriculture research volume 533, issuer 6 - 646-654, DOI: 10.8805? IJAREA- 5282.

24. Mohan Rajesh et al. (2015), "Measurement of Soil Moisture Content at Microwave Frequencies", Science Direct, Procedia Computer Science 46 PP 1238-1245.
25. Mohan Rajesh et al. (2015), "Study and Analysis of Dielectric Behaviour of Fertilised Soil at Microwave Frequency'', EJAET, 2(2): PP 73-79.
26. Moradizadeh Mina et al. (2018), "Estimation of Improved Resolution Soil Moisture in Vegetated Areas Using Passive AMSR-E Data'', Indian Academy of Sciences, Cross Mark, J. Earth, Syst. Sci. 127: 24.
27. Nahire S.B. *et.al*. (2015) Physicochemical and Dielectric properties of Soil Samples at X-Band Microwave Frequency of Nasik region, Bio nano Frontier, Vol. 8(3)
28. Navarkhele V.V., (2016), "Study of Two Indian Soils'', Journal of Chemical and Pharmaceutical Research, 8(1): 153:160.
29. Navarkhele V.V., Kapre A.K., & Shaikh A.A. (2015), "Dielectric Properties of Black Soil with Chemical Fertilizers at X-band'', Indian Journal of Radio & Space Physics, vol. 44, PP 102-105.
30. Navarkhele V.V. (2016), Study of two Indian Soils, JOCPR, 8(1) :153-160.
31. Nishat S.R., (2017) "A Brief Review: Dielectric Properties of Soil at Various Bands of Microwave Frequencies'', Journal of Medicinal Chemistry on Drug Discovery, issue 03, Vol.02, PP 1-12.
32. Pillai Sonali, Pandey Ashutosh, Shrivastava A.K. (2017), "Role of Water Content In Dielectric Constant of Soil With Reference To Northern Chhattisgarh'', Journal Of Pure Applied And Industrial Physics, Volume 75, No. 5, May, PP-197-200.
33. Pandey Ashutosh, Shrivastava A.K. (2017), "Study of Fundamental Concept of Microwave Remote Sensing''. In Relation to Characterization, Applied Science Periodical, Volume XIX, No. 1, February, PP-24-31.
34. Pandey Ashutosh, Shrivastava A.K. (2018), "Review and Analysis of Microwave Remote Sensing Behaviour of Soil in India'', IJRAT, Volume 6, No. 11, November, PP-2972-2975.
35. Patel Lakhpati (2021). "Microwave Remote Sensing Dielectric Behaviour of Soil and Utilization in Agriculture'', Scrip own Publication, ISBN: 978-93-90833-85-6.
36. Patel Lakhpati et al., (2018) "Role of Moisture Content and Dielectric Constant In soil'', International Journal of Research in Advent Technology, Vol. 6, No. 11, PP-3288-3293.
37. Patel Lakhpati et al., "Significance of Dielectric Behaviour of Flood Affected Soil in Agriculture, with Special Reference to Bihar and Chhattisgarh'', International Disciplinary Research Journal, Vol-09, issue 01 PP 67-72 (2019). Nitesh Kumar, et al., J. Pure Appl. & Ind. Phys. Vol.9 (5), 40-55 (2019) 53
38. Patel Virendra Kumar N. (2018), "Variation of Electrical Parameters of Soil with Moisture and Salinity Over Frequency Range From 20Hz to 2 MHz, International Journal of Scientific Research Aand Reviews, 7(1), 457-471.
39. Paul Binu, R.Rajesh Mohan, Mridula S.,Mohanan P. (2015), "Measurement of Soil Moisture Content At Microwave Frequencies'', Science Direct, Science 46,Elsevier PP 1238-1245.
40. PithoriSuryaraj (2018), "Remote Sensing Techniques in Agriculture'', Pacific Books International, ISBN: 978-93-86655-84-4.
41. Pltaprachi, pankaj pram, Kaurprabhdeep and Mann singhkuldip (2020), "Dielectric properties of soil of Moga region (Punjab) at X-band frequency 9.08 GHz'', Chemical physics reviews: https://doi.org/10.1063/5.000810:]

42. R. Rajesh Mohan et al., (2015) "Measurement of soil Moisture Content at Microwave frequencies" Science Direct, Proceedings Computer Science 46 PP 1238-1245.
43. R. Rajesh Mohan et al., (2015) "Study and Analysis of Dielectric Behaviour of Fertilized Soil at Microwave Frequency, European Journal of Advances in Engineering and Technology, 2(2) :73-79.
44. Rajesh Mohan *et Al.* (2015)," Measurement of Soil Moisture Content at Microwave Frequency'' Elsevier, PCS 46 1238- 124.
45. Rathore Yogeshwar (2017), "Dielectric Properties Of Soil At Frequency Range 8-12 GHz In East Chhattisgarh'', Dissertation, DR. C.V. Raman University, Kota, Bilaspur, Chhattisgarh, India.
46. Rawat Deepak (2015), "Microwave Attenuation Studies Impacted by Rain for Communication Links Operating at Tropical REGION: A Survey''. IJATCSE, Vol. 4, No. 1, PP 05-14.
47. Sahu Vijay (2018), "Role of Dielectric Behaviour of Soil in Agriculture with Reference to Pond Area'', Journal of Pure Applied and Industrial Physics, Vol. 8(6), PP 62-65.
48. Sharma, Anupam Deep and Kumar Rajeev (2015), ''Variation in (India) With Fertilizer At 5 GHz'',6th International Conference on "Recent Trends in Applied Physical, Chemical Sciences, Mathematical/Statistical And Environmental Dynamics''. ISBN: 978; 81930585-8-9 PP 43-47.
49. Shrivastava A.K. (2021), Microwave Dielectric Parameter of Soil Texture, Scrip own Publication, ISBN: 978-93-90833-31-3.
50. Shrivastava Rajesh et al (2018). "Study of Microwave Dielectric Characteristics of Soil in North East Chhattisgarh'', Journal of Pure applied And Industrial Physics, vol. 8(12) PP 214-218.
51. Shrivastava Rajesh et al. "Study of Microwave Dielectric Characteristics of Soil in North East Chhattisgarh'', Journal of Pure applied And Industrial Physics, vol. 8(12) PP 214-218 (2018).
52. SyedaRuhiNishat et al. (2017), A brief Review: "Dielectric Properties of Soil at various bands of Microwave Frequencies'', JMCDD, Issue 03, Vol. 02. PP 01-12.
53. Tale Ku. Samita and Ingole DR. Sangita (2018), "A review on Role of Physicochemical Properties in Soil Quality'', Chemical Science Review and letters 4(13), PP 57-56.
54. Tan Xiao et al., (2017), "Design of A New TDR Probe to Measure Water Content and Electrical Conductivity In Highly Saline Soils, J. Soils Sediments, Cross Mark, DOI 10.1007/S 11368-017-1838-6.
55. Tiwari Manoj Kumar, Bajpai DR. Samir &Dewangan DR. U.K. (2015), "An Analytical Study Heavy Metal Concentration in Soil of an Industrial Region of Chhattisgarh'', Central India, International Journal of Scientific and Research Publication, vol 5(7), PP-1-8.