

REFERENCES

- Aderonke, D.O. and Gbadegesin, G.A. 2013. Spatial variability in soil properties of a continuously cultivated land. *African Journal of Agricultural Research* **8** (5) : 475 - 483
- Adornado, H. A. and Yoshida, M. 2008. Crop suitability and soil fertility mapping using geographic information system (GIS). *Agricultural Information Research* **17** (2) : 60 - 68
- Aitken, R. L., Dickson, T., Hailes, K. J. and Moody, P.W. 1999. Response of field grown maize to applied magnesium in acidic soils in northeastern Australia. *Journal of Agricultural Research* **50** : 191-198.
- Ali, J. and Lakhan, R. 2013. Micronutrient status of alluvial soils and their relationship with soil characteristics. *Annals of Plant and Soil Research* **15** (1) : 79-80
- Amacher, M.C., O'Neill, K.P. and Perry, C.H. 2007. Soil vital signs: A new soil quality index (SQI) for assessing forest soil health. *USDA Forest Service Research Paper RMRS-RP-65WWW*. Rocky Mountain Research Station, 240 West Prospect Road, Fort Collins, 1-12
- Anonymous. 2001. Project report on Soil Test Crop Response. *Indian society of soil science*, New Delhi. 118
- Arokiaraj, A., Vijayakumar, R. and Devaprasth, M. P. 2011. Assessment of the status of micronutrients in Nagapattinam district, Tamil Nadu. *Journal of Chemical and Pharmaceutical Research* **3**(4) : 10 -16
- Awanish, K., Mishra, V.N. and Srivastava, L.K. 2015. Evaluation of soil fertility status of available N, P and K in Inceptisol of Raipur district of Chhattisgarh. *International Journal of Interdisciplinary and Multidisciplinary Studies* **2** (6) : 98-104
- Baruah, B. K., Das, B., Medhi, C. and Misra, A. K. 2013. Fertility status of soil in the tea garden belts of Golaghat district, Assam, India. *Journal of Chemistry* : 1-6
- Basso, B., Ritchie, J.T., Pierce, F. J., Braga, R. P. and Jones, J.W. 2001. Spatial validation of crop models for precision agriculture. *Agricultural Systems* **68** : 97–112

- Bastin, B., Beena, V. I., Sreelatha, A. K. and Dey, P. 2014. *GPS and GIS Based Model Soil Fertility Maps for Precise Fertilizer Recommendations to the Farmers of Kerala*. Kerala Agriculture University, Thrissur, Kearala : 161p
- Behera, S. K., Singh, M.V., Singh, K. N., Todwal, S. 2011. Distribution variability of total and extractable zinc and their relationship with some selected soil properties. *Geoderma* **162** : 242-250
- Belachew, T. and Abera, Y. 2010. Assessment of soil fertility status with depth in wheat growing highlands of southeast Ethiopia. *World Journal of Agricultural Sciences* **6** (5) : 525-531
- Belurkar, R. S. and Yadawe, M. S. 2011. A Survey of soil fertility status of cashewnut gardens of South Goa, India. *International Journal of Applied Biology and Pharmaceutical Technology* (online at www.ijabpt.com) **2** (3) : 494-497
- Ben-Asher, J., Warrick, A. and Matthias, A. 1998. Bare-soil evaporation determined in situ by infrared thermometry. *Journal of Hydrology* **69**: 325–334
- Bhan, S. K., Saha, S. K., Pande, L. M. and Prasad, J. 2010. Use of remote sensing and GIS technology in sustainable agricultural management and development Indian experience. Indian Institute of Remote sensing, NRSA, Dehradun
- Bhat, Z. A., Akther, F. A., Padder, S. A., Rehman, H. U. and Ganaie, A. Q. 2017. Nutrient status of grape orchard soils of Jammu and Kashmir, India. *International Journal of Agricultural Science and Research (IJASR)* **7(2)**: 363-372
- Binitha, N. K., Dasog, G. S. and Patil, P. L. 2008. Soil fertility mapping in Ghataprabha left bank canal command area of North Karnataka by geographic information system technique. *Karnataka Journal of Agricultural Sciences* **22**(1) : 73-76
- Black, C. A. and Evans, D. D. 1965. Method of soil analysis. *American Society of Agronomy*, Madison, Wisconsin, USA. p131-137
- Blackmore, S., Godwin, R. J., Taylor, J. C., Cosser, N. D., Wood, G. A., Earl, R. and Knight, S. 1998 Understanding variability in four fields in the U.K. In *Proceedings of the 4th International Conference on Precision Agriculture*. Ed. P. C Robert, R. H Rust and W. Larson. ASA, CSSA, SSSA, Madison, WI. p 3-18

- Bobade, S.V., Bhaskar, B. P., Gaikwad, M. S., Raja, P., Gaikwad, S. S., Anantwar, S. G., Patil, S.V., Singh, S. R. and Maji, A. K. 2010. A GIS-based land use suitability assessment in Seoni district, Madhya Pradesh, India. *Tropical Ecology* **51**(1): 41-54
- Bocchi, S., Castrignano, A., Fornaro, F. and Maggiore, T. 2000. Application of factorial kriging for mapping soil variation at field scale. *European Journal of Agronomy* **13**: 295–308
- Bouma, J. and Finke, P. 1993. Origin and nature of soil resource variability. In: Robert, P.C., Rust, R.H., Larson, W.F. (Eds.) *Soil specific crop management*. ASA, CSSA, SSSA, Madison. p 3-14
- Bulta, A. L., Assefa, T. M., Woldeyohannes, W. H. and Desta, H. S. 2016. Soil micronutrients status assessment, mapping and spatial distribution of Damboya, Kedida Gamela and Kecha Bira Districts, Kambata Tambaro zone, Southern Ethiopia. *African Journal of Agricultural Research* **11** (44) : 4504 - 4516
- Burrough, P. A. and Mc Donnell, R. A. 1998. Principles of geographic information systems. Oxford Univ. Press, New York
- Cambardella, C. A. and Karlen, D. K. 1999. Spatial analysis of soil fertility parameters. *Precision Agriculture* **1** : 5 - 14
- Cambardella, C. A., Moorman, T. B., Novak, J. M., Parkin, T. B., Karlen, D. K., Turco, R. F. and Konopka, A. E. 1994. Field-scale variability of soil properties in central Iowa soils. *Soil Science Society of American Journal* **58** : 1501 - 1511
- Cerria, C. E. P., Bernoux, M., Chaplot, V., Volkoff, B., Victoria, R. L., Melillo, K., Paustian, J. M. and Cerria, C. C. 2004. Assessment of soil property spatial variation in an Amazon pasture: Basis for selecting an agronomic experimental area. *Geoderma* **123** : 51 - 68
- Chamuanah, G. S., Borthakur, H. P., Walia, C. S., Nair, K. M. and Phukan, B. N. 1989. Assessment of soil survey information in crop response to applied nutrients. *Journal of the Indian Society of Soil Science* **37**: 87-91
- Chesin, L. and Yien, C.H. 1951. Turbidimetric determination of available sulphate. *Soil Science Society of America Proceeding* **15** : 149-151

- Choudhury, B.U., Mohapatra, K.P., Das, A. and Das, P.T., Nongkhlaw, L., Fiyaz, R.A., Ngachan, S.V., Hazarika, S., Rajkhowa, D.J. and Munda, D.C. 2013. Spatial variability in distribution of organic carbon stocks in the soils of North East India. *Current Science* **104** (5) : 604-614
- Chouhan, N., Sharma, G. D., Khamparia, R. S. and Sahu, R. K. 2012. Status of sulphur and micronutrients in medium black soils of Dewas district, Madhya Pradesh. *Agropedology* **22** (1) : 66 - 68
- Cruz-gárdenas, G., López-Mata, L., Solorio, C. A. O., Villaseñor, J. L., Ortiz, E., Silva, T. J. and Estrada-Godoy, F. 2014. Interpolation of Mexican soil properties at a scale of 1:1,000,000. *Geoderma*, **213** : 29-35
- Dar, K. A., Sahaf, K. A., Kamili, A. S., Ahmad, L., Malik, M. A. and Ganaie, N. A. 2016. Soil nutrient status under different agro-climatic zones of Kashmir and Ladakh, India. *Current World Environment* **11**(1) : 96-100
- Denis, A. M. K., Patil, P. L., Kamara, A. M. and Saidu, D. H. 2016. Assessment of soil fertility status using nutrient index approach. *International Journal of Food, Agriculture and Veterinary Sciences* (Online - <http://www.cibtech.org/jfav.htm>) **6** (3) : 1-15
- Deshmukh, K. K. 2012. Evaluation of soil fertility status from Sangamner area, Ahmednagar district, Maharashtra, India. *Rasayan Journal of Chemistry* **5** (3) : 398 - 406
- Dinesh, R., Srinivasan, V., Hamza, S. and Anandaraj, M. 2014. Massive phosphorus accumulation in soils: Kerala's continuing conundrum. *Current Science* **106** (3): 10
- Doberman, A. and Oberthur, T. 1997. Fuzzy mapping of soil fertility - a case study on irrigated rice land in the Philippines. *Geoderma* **77** : 317- 339
- Domsch, H. and Wendroth, O. 1997 On-site diagnosis of soil structure for site specific management. In *Proceedings of the 1st European Conference on Precision Agriculture*. Ed. J V Stafford. BIOS Scientific Publishers Ltd, Warwick, UK. p 95 -102

- Fathi, H., Fathi, H. and Moradi, H. 2014. Spatial variability of soil characteristic for evaluation of agricultural potential in Iran. *Merit Research Journal of Agricultural Science and Soil Sciences* **2** (2) : 24-31
- Gajbhiye, K. S. and Mandal, C. 2006 Agro-ecological zones, their soil resource and cropping systems. *Status of Farm Mechanization in India*, National Bureau of Soil Survey and Land Use Planning, Nagpur
- Gary, C., Jones, J.W. and Tchamitchian, M. 1998. Crop modeling in horticulture: state of the art. *Scientia Horticulturae* **74** : 3–20
- Geypens, M., Vanongeval, L., Vogels, N. and Meykens, J. 1999. Spatial variability of agricultural soil fertility parameters in a gleyic podzol of Belgium. *Precision Agriculture* **1** : 319 - 326
- Ghosh, A. B and Hasan, R. 1979. Available phosphorus status of Indian soils. *Bulletin of Indian Society of Soil Science* **12** : 1-4
- Ghosh, A. B. and Hasan, R. 1976. Available potassium status of Indian soils. *Bulletin of Indian Society of Soil Science* **10** : 1-5
- Ghosh, A. B. and Hasan, R. 1980. Nitrogen fertility status of soils of India. *Fertilizer News* **25** (11) : 19-24
- Ghosh, S. 2015. Spatial variation of soil pH and soil phosphorous and their interrelationship in the plateau area of West Bengal, India. *International Journal of Recent Scientific Research* **6**(3) : 3208-3212
- Goovaerts, P. 1997. *Geostatistics for natural resources evaluation*. Oxford University Press, New York : 483 p
- Gunaga, R. P., Kanfade. A. H. and Vasudeva, R. 2011. Soil fertility status of 20 seed production areas of *Tectona grandis* Linn. f. in Karnataka, India. *Journal of Forest Sciences* **57** (11) : 483-490
- Gupta, R. D. and Tripathi, B. R. 1989. Morphological, physico-chemical, mineralogical properties and pedogenesis of some rice growing soil profiles occurring in Kangra district of Himachal Pradesh (India). *Oryza* **26** : 263-272

- Gupta, R. D. and Tripathi, B. R. 1996. Mineralogy, genesis and classification of soils of North-West Himalayas developed on different parent materials and variable topography. *Journal of the Indian Society of Soil Science* **44** : 705-712
- Gupta, U. C. 1967. A simplified method for determining hot water soluble boron in podzol soils. *Soil Science* **103** : 424-428
- Hailu, H., Mamo, T., Keskinen, R., Karlton, E., Gebrekidan, H. and Bekele, T. 2015. Soil fertility status and wheat nutrient content in Vertisol cropping systems of central highlands of Ethiopia. *Agriculture and Food Security* **4**:19
- Haque, I. and Lupwayi, N. Z. 2003. Soil nutrients in agroecological units of Swaziland. *African Crop Science Journal* **11** (4) : 245 - 257
- Hasan, R. 1996. Phosphorus status of soils in India. *Better Crops International* **10**(2) : 4-5
- Hasan, R. 2002. Potassium status of soils in India. *Better Crops International* **16**(2) : 3-5
- Hassan, M., Ahmed, A.A.S., Hassan, M.A., Nasrin, R., Rayhan, A.B.M.S., Musfiq-Ussalehin,S. and Rahman, M.K. 2017. Changes of soil fertility status in some soil series of Tista Floodplain soils of Bangladesh. *Asian Research Journal of Agriculture* **5** (3): 1-9
- Heisel, T., Ersbøll, A. K. and Andersen, C. 1999. Weed mapping with co-kriging using soil properties. *Precision Agriculture* **1** : 39-52
- ICAR, Information Bulletin. 2011. Indian Council of Agricultural Research, Krishi Anusandhan Bhavan II, Pusa, New Delhi
- Iftikar, W., Chattopadhyay, G. N., Majumdar, K., Sulewski, G. D. 2010. Use of village-level soil fertility maps as a fertilizer decision support tool in the red and lateritic soil zone of India. *Better Crops* **94** (3) : 10 -12
- Isaaks, E. H. and Srivastava, R. M. 1989. *An Introduction to Applied Geostatistics*. Oxford University Press, New York : 561 p.
- Jabro, J. D., Stevens, W. B., Evans,R. G. and Iversen, W. M. 2010. Spatial variability and correlation of selected soil properties in the AP horizon of a crp grassland. *American Society of Agricultural and Biological Engineers* **26**(3) : 419 - 428

Jackson, M. L. 1958. *Soil Chemical Analysis* by Prentice Hall of India Pvt. Ltd. New Delhi.

Jalali, M., 2007. Spatial variability in potassium release among calcareous soils of western Iran. *Geoderma* **140** : 42-51

Jayaprakash, R., Shetty, Y. V., Punitha, B. C. and Shilpasree, V. M. 2012. Status of macro nutrients in non-traditional arecanut growing soils. *Indian Journal of Fundamental and Applied Life Sciences* **2** (1) : 59 - 62

Jemo, M., Jayeoba, O. J., Alabi, T. and Montes, A. I. 2014. Geostatistical mapping of soil fertility constraints for yam based cropping systems of North-central and Southeast Nigeria. *Geoderma* **2** (3) : 102-109

Jenny, H. 1941. *Factors of Soil Formation : A System of Quantitative Pedology*. McGraw - Hill, Newyork

Jing, L., Quigwen, M., Wenhua, L., Yanying, B., Bijaya, D. G. C. and Zheng, Y. 2014. Spatial variability analysis of soil nutrients based on GIS and Geostatistics : A case study of Yisa Township, Yunnan, China. *Journal of Resources and Ecology* **5** (4) : 348-355

Kaistha, B. P and Gupta, R. D. 1993. Morphology, mineralogy, genesis and classification of soils of the sub - humid temperate high lands of the central Himalayas. *Journal of the Indian Society of Soil Science* **41** : 120-124

Kanwar, J. S. 2000. Soil and Water Resources Management for Sustainable Agriculture - Imperatives from India. In: Development and Conservation. Int. Conf. Agricultural Production in 21st Century : 17-37

Karl, J.W. and Muarer, B.A. 2010. Spatial dependency of predictions from image segmentation: a variogram-based method to determine appropriate scales for producing land-management information. *Ecological Informatics* **5** : 194-202

Kebede, F. and Yamoah, C. 2009. Soil fertility status and Numass fertilizer recommendation of Typic Haplusterts in the Northern Highlands of Ethiopia. *World Applied Science Journal* **6** (11) : 1473-1480

- Kerry, R. and Oliver, M. A. 2007 The analysis of ranked observations of soil structure using indicator geostatistics. *Geoderma* **140** : 397-416
- Khadka, D., Lamichhane, S., Khan, S., Joshi, S. and Pant, B. B. 2016. Assessment of soil fertility status of agriculture research station, Belachapi, Dhanusha, Nepal. *Journal of Maize Research and Development* **2** (1) : 43-57
- Khan, A. I., Uranw, N. L., Yadav, R. N., Singh, Y. V., Patel, D. and Yadav, R. 2017. Evaluation of soil fertility status from Kanchanpur district, far-western development region of Nepal. *International Journal of Current Microbiology and Applied Science* **6** (3) : 961-968
- Kilic, K., Kilic, S. and Kocyigit, R. 2012. Assessment of spatial variability of soil properties in areas under different land uses. *Bulgarian Journal of Agricultural Science* **18** : 722-732
- Korikanthimath, V. S., Gaddy, A. V. and Ankegowda, S. J. 2000. Status of major nutrients in soils of cardamum (*Elettaria cardamomum* Maton) plantations in Kodagu District, Karnataka, India. *Journal of Spices and Aromatic Crops* **9** (2) : 117-122
- Kravchenko, A. and Bullock, D. G. 1999. A comparative study of interpolation methods for mapping soil properties. *Agronomic Journal* **91** : 393-400
- Kumar, P., Kumar, A., Dyani, B. P., Kumar, P., Shahi, U. P., Singh, S. P., Kumar, R., Kumar, Y. and Raizada, S. 2013. Soil fertility status in some soils of Muzaffarnagar district of Uttar Pradesh, India, along with Ganga canal command area. *African Journal of Agricultural Research* **8** (14) : 1209-1217
- Larson, W.E. and Robert, P.C. (1991). *Farming by Soil*. p 103 -112. In: Lal, R. and Prerce, J. (Ed). Soil Management for Sustainability, Soil and Water Conservation Society, Ankeny, IA
- Li, C., Chen, G., Zeng, G. and Ye, J. 2016. The study of soil fertility spatial variation feature based on GIS and data mining. HAL Id: hal-01348234, <https://hal.inria.fr/hal-01348234>
- Lindsay, W. L., Norwell, A. 1978. Development of DTPA soil test for Zn, Fe, Mn and Cu. *Society of American Journal* **42** : 421-428

- Linsley, C. M. and Bouer, F. C. 1929. Test your soil for acidity. *Circular 346*. College of Agricultural Experiment Station, University of Illinois, Champaign, IL
- Liu, Z., Zhou, W., Shen, J., He, P., Lei, Q. and Liang, G. 2014. A simple assessment of spatial variability of rice yield and selected soil chemical properties of paddy fields in South China. *Geoderma* **235** : 39-47
- Lopez - Granados, F., Jurade - Exposito, M., Atenciano, S., Gracia - Ferrer, A., De la Orden, M.S. and Garcia - Torres, L. 2002. Spatial variability of agricultural soil parameters in Southern Spain. *Plant Soil* **246** : 97-105
- Mahajan, T. S. 2001. Status and distribution of micronutrients in relation to the properties of lateritic soils under mango orchards in South Konkan. M. Sc. Thesis submitted to Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra
- Mini, V., Mathew, U. and Indira, M. 2015. Nutrient use strategies for coconut based cropping system in Onattukara sandy tract, Kerala. *IOSR Journal of Agriculture and Veterinary Science* **8** (3): p 11-15 www.iosrjournals.org
- Misra, A., Pattnaik, T., Das, D. and Das, M. 2014. Soil fertility maps preparation using GPS and GIS in Dhenkanal district, Odisha, India. *International Journal of Plant & Soil Science* (Article no. IJPSS.2014.8.005) **3** (8) : 986-994
- Mohan, A. and Sreelatha, A. K. 2016. Nutrient dynamics in pokkali soils. *International Journal of Applied and Pure Science and Agriculture* **2** (9) : 119 - 123
- Motsara, M. R. 2002. Fertility status of Indian soils. *Fertilizer News* **47** (8) : 15-22
- Naidu, L. G. K., Gajbhiye, K. S., Verma, K. S. and Jain, S. P. 1988. Evaluation of dominant soil series of Delhi territory for wheat production. *Journal of the Indian Society of Soil Science* **36** : 571-575
- Naidu, L. K. G., Ramamurthy, V., Sidhu, G. S. and Sarkar, S. 2011. Deficiency of potassium in soils and crops of India. *Karnataka Journal of Agricultural Science* **24** (1) : 12-19
- Nayanaka, V. G. D., Vitharana, W. A. U and Mapa, R. B. 2010. Geostatistical analysis of soil properties to support spatial sampling in a paddy growing Alfisol. *Tropical Agricultural Research* **22** (1) : 34 - 44

- Nazif, W., Perveen, S. and Saleem, I. 2006. Status of micronutrients in soils of district Bhimber (Azad Jammu and Kashmir). *Journal of Agriculture and Biological Science* **1**(2) : 35-40
- Nigam, G. K., Pandey, V. K., Tripathi, M. P. and Sinha, J. 2014. Assessment of macro and micro nutrients of soil in a small agricultural watershed. *International Journal of ChemTech Research* **6** (7) : 3658-3664
- Noor, Y., Subhanullah and Shah, Z. 2013. Spatial variability of micronutrients in citrus orchard of North Western Pakistan. *Sarhad Journal of Agriculture* **29** (3) : 387-394
- Odoi, O., Armah, F. A., and Luginaah, L. 2011. Assessment of spatial variability of heavy metals in soils under the influence of industrial soap and detergent waste water discharge. *IJRRA* **9** (2) : 322-329
- Oyinlola, E.Y. and Chude, V.O. 2010. Status of available micronutrients of the basement complex rock-derived alfisols in Northern Nigeria savanna. *Tropical and Subtropical Agroforestry Systems* **12** : 229-237
- Panchbhai, D.M., Mahorkar,V.K., Jogdande,N.D., Patil, M.N. and Katkar, R.N. 2006. Studies on soil nutrient status of acid lime orchards in Western Vidarbha. *International Journal of Agricultural Sciences* **2**(2): p 573-576
- Pandiaraj, T., Srivastava, P. P., Das, S. and Sinha, A. K. 2017. Evaluation of soil fertility status for soil health card in various tasar growing fields of Bihar and Jharkhand States, India. *International journal of Current Microbiology and Applied Sciences* **6**(4) : 1685-1693
- Papadopoulos, A., Papadopoulos ,F., Tziachris, P., Metaxa, I. and Iatrou, M. 2014. Site specific agricultural soil management with the use of new technologies. *Global NEST Journal* **16** (1) : 59 - 67
- Parker, F.W., Nelson, W. L., Eric, W. and Miller, L. E. 1951. The broad interpretation of soil test informations. *Agronomy Journal* **43** : 105-112
- Pathak, H. 2010. Trend of fertility status of Indian soils. *Current Advances in Agricultural Sciences* **2**(1) : 10 - 12
- Patil, S. S., Patil, V. C., Al-Gaadi, K. A., 2011. Spatial variability in fertility status of surface predicting soil properties from sample information. *Journal of Soil Science* **41** : 473-490

- Pierce, F. J. and Nowak, P. 1999. Aspects of Precision Agriculture. *Advanced Agronomy* **67** : 1-85
- Prabhavati, K., Dasog, G. S., Patil, P. L., Sahrawa, K. L. and. Wani, S. P. 2015. Soil fertility mapping using GIS in three agro-climatic zones of Belgaum district, Karnataka. *Indian Society of Soil Science* **63** (2) : 173-180
- Prado, R. B., Melo Benites, V.D., Polidoro, J.C., Gonçalves, C. E. and Naumov , A. 2012. Mapping soil fertility at different scales to support sustainable brazilian agriculture. *Journal of Agricultural and Biosystems Engineering* **6** (9) : 769 - 852
- Pujar, K. G., Yadawe, M. S., Pujeri, U. S., Pujari, K. G. and Hiremath, S. C. 2010. Assessment of soil fertility of grape field at Bijapur district, Karnataka, India. *E-Journal of Chemistry* 7(4) : 1304-1307
- Pulakeshi, H. B. P., Patil, P. L., Dasog, G. S., Radde, B. M., Bidari, B. I. and Mansur, C. P. 2012. Mapping of nutrient status by geographic information system (GIS) in Mantagani village under northern transition zone of Karnataka. *Karnataka Journal of Agricultural Science* **25**(3) : 332-335
- Qiu, W., Curtin, D. and Beare, M. 2011. *Spatial Variability of available nutrients & soil carbon under arable cropping in Canterbury*. P 1-7
- Raghupathy, H. B. and Srinivas, S. 2014. Spatial variability studies in mango for identification of nutrient imbalance using GIS technique. *ISRS Proceeding Papers of Sort Interactive Session*, ISPRS TC VIII International Symposium on “Operational Remote Sensing Applications: Opportunities, Progress and Challenges”, Hyderabad, India, December 9 - 12
- Raina, J. N. 1988. Physico-chemical properties and available micronutrient status of citrus growing soils of Paonta valley in Himachal Pradesh. *Himachal Journal of Agriculture Research* **14** : 44-49
- Ramamurthy, B. and Bajaj, J. C. 1969. Available nitrogen, phosphorus and potassium status of Indian soils. *Fertilizer News* **14** : 25-36
- Ramamurthy, B. and Bajaj, J.C. 1969. Available nitrogen, phosphorous and potassium status of Indian soils. *Fertilizer News* **14**: 25-28

- Ravikumar, P. and Somashekhar, R. K. 2013. Spatial distribution of macronutrients in soils of Markandeya river basin, Belgaum, Karnataka, India. *Proceedings of the International Academy of Ecology and Environmental Sciences*, **4**(2) : 81-94
- Regmi, B. D. and Zoebisch, M. A. 2004. Soil fertility status of Bari and Khet land in a small watershed of middle hill region of Nepal. *Nepal Agriculture research Journal* **5** : 38-44
- Rehman, O. U., Sheikh, A. A. and Gill, K. H. 2000. Available phosphorus and pH status of attack soils. *Pakistan Journal Agricultural Science* **37**(1-2) : 74-76
- Reza, S. K., Baruah, U. and Sarkar, D. 2012. Spatial variability of soil properties in Brahmaputra plains of North - Eastern India : A geostatistical approach. *Journal of Indian Society of Soil Science* **60** (2) : 108
- Rossi, R. E., Mulla, D. J., Journel, A. G. and Franz, E. H. 1992. Geostatistical tool for modelling and interpreting ecological spatial dependence. *Ecological Monograph* **62** : 277-314
- Sahrawat, K. L., Shirisha, K., Murthy,K.V.S., Gajbhiye, P.N., Kundu,S., Wani, S.P. and Pardhasaradhi. G. 2012. Comparative evaluation of inductively coupled plasma-atomic emission spectroscopy and colorimetric methods for determining hot-water-extractable boron in soils. *Communications in Soil Science and Plant Analysis* **43** (6) : 948-57
- Sahrawat, K.L., Wani, S.P. Rego, T.J., Pardhasaradhi, G. and Murthy, K.V.S. 2007. Wide spread deficiencies of sulphur, boron and zinc in dry land soils of the Indian semi-arid tropics. *Current Science* **93** (10) : 1428 - 1432
- Saikh, H., Varadachari, C. and Ghosh, K. 1998. Effects of deforestation and cultivation on soil CEC and contents of exchangeable bases. A case study in Simplipal National Park, India. *Plant Soil* **204** : 67-75
- Saleem, M., Khanif, Y. M., Fauziah, C. I., Samuri, A.W and Hafeez, B. 2010. Boron status of Paddy soils in the states of Kedah and Kelantan, Malasia. *Malasian Journal of Soil Science* **1** : 83 - 94

- Sannappa, B. and Manjunath, K. G. 2013. Fertility status of soils in the selected regions of the Western Ghats of Karnataka, India. *Scholars Academic Journal of Biosciences* **1**(5) : 200-208
- Santra, P., Chropra, V. K., Chakraborty, D., 2008. Spatial variability of soil properties and its application in predicting surface map of hydraulic parameters in an agricultural farm. *Current Science* **95** (7) : 937-945
- Satish, A., Ramachandrappa, B. K., Devaraja, K., Savitha, M. S., Gowda, M. N. T. and Prashanth, K. M. 2017. Assessment of spatial variability in fertility status and nutrient recommendation in Alanatha cluster villages, Kanakapura taluk, Ramanagara district, Karnataka using GIS techniques. *International Journal of Current Microbiology and Applied Sciences* **6**(5) : 211-224
- Sawant, R. S., Jadhav, S. D. and Godghate, A. G. 2013. Spatial variation in soil fertility along the bank of Hiranyakeshi river from Gadhwad Taluk with reference to sugar cane field. *International Journal of Current Environment and Technology* **2**(4) : 765 - 771
- Sekhon, G. S., Brar, M. S., Rao, S. A and Maheshwari, R. K. 1985. Soil series as a basis for making potassium recommendations. *PRII research Review Series* **4** : 11-124
- Sen, P., Majumdar, K. and Sulewski, G. 2007. Importance of spatial nutrient variability mapping to facilitate SSNM in small land holding systems. *Indian Journal of Fertilizer* **4**(11) : 43-50
- Sharma, V. K. and Kumar, A. 2003. Soil fertility of Maul Khad catchment in wet-temperate zone of Himachal Pradesh. *Indian Journal of Soil Conservation* **31** : 89-97
- Sharma, V. K., Kaistha, B. P., Dubey, Y. P. and Sharma, R. P. 2002. Soil fertility ratings in Fatehpur block of Kangra district of Himachal Pradesh for growing medicinal and aromatic plants. *Himachal Journal of Agricultural Research* **28** : 20-25
- Shetty, Y.V., Reddy, A. L. A., Kumar, M. D., Vageesh, T. S. and Jayaprakash, S. M. 2008. Fertility status and nutrient index of maize growing areas of southern transition zone of Karnataka. *Karnataka Journal of Agricultural Science* **21**(4) : 580-582

- Shukla, A. K., Behera, S. K., Lanka, N. K., Tiwari, P. K., Prakash, C., Malik, R.S., Sinha, N. K., Singh, V. K., Patra, A. K. and Chaudhary, S. K. 2016. Spatial variability of soil micronutrients in intensively cultivated Trans - Gangetic plains of India. *Soil and Tillage Research* **163** : 282-289
- Singh, D. P. and Rathore, M. S. 2013. Available nutrient status and their relationship with soil properties of Aravalli mountain ranges and Malwa Plateau of Pratapgarh, Rajasthan, India. *African Journal of Agricultural Research* **8** (41) : 5096 - 5103
- Singh, G., Sharma, M., Manan, J. and Singh, G. 2016. Assessment of soil fertility status under different cropping sequences in district Kapurthala. *Journal of Krishi Vigyan* **5** (1) : 1-9
- Singh, M.V. 2004. Micronutrient deficiencies in Indian soils and field usable practices for their correction. IFA International Conference on Micronutrients, Feb. 23-24, 2004, New Delhi
- Singh, M.V., 2001. Evaluation of micronutrient status in different agro-ecological zones of India. *Fertilizer News* **46** (2) : 25 - 42
- Singh, R. P. and Mishra, S. K. 2012. Available macro nutrients (N, P, K and S) in the soils of Chiraigaon block of district Varanasi (U.P.) in relation to soil characteristics. 2012. Indian Journal of Scientific Research **3** (1) : 97 - 100
- Son, B., Zhoub, S. and Zhaoa, Q. 2003. Evaluation of spatial and temporal changes of soil quality based on geostatistical analysis in the hill region of subtropical China. *Geoderma* **115** : 85-99
- Srinivasan, K. and Poongothai, S. 2013. Macronutrients and micronutrients relation to soil characteristics of Wellington reservoir, Tamilnadu, India. *Journal of Chemistry and Chemical Science* **3** (3) : 107-116
- Srinivasarao, C. H., Indoria, A. K. Sharma, K. L. 2011. Long-term manuring and fertilizer effects on depletion of soil organic carbon stocks under pearl millet-cluster bean-castor rotation in western India. *Land Degradation Development* **25** : 173 -183

- Stoops, G. and Cheverry, C., 1992. New challenges for soil research in developing countries: A holistic approach. *Proceedings of the Workshops, funded by the European Community, Life Sciences and Technologies for Developing Countries (STD 3 programme)*. Rennes, 22 p.
- Stoorvogel, J.J., Smaling, E. M. A. and Janssen, B. H. 1993. Calculating soil nutrient balances in Africa at different scales. I. Supra-national scale. *Fert Res* 35: 227-235.
- Subbaiah, B.V. and Asija, G.L. 1956. A rapid procedure for the estimation of available nitrogen in soil. *Current Science* 25 : 259
- Sureshkumar, P., Bindu, P. S., Geetha, P. and Santhosh, C. 2013. *Soil Fertility Assessment and Information Management for Enhancing Crop Productivity in Kerala*. In : Chemistry of soils and plant nutrient dynamics (Eds.) P. Rajasekharan, K.M. Nair, G. Rajasree, P. Sureshkumar, M.C. Narayananakutty. Kerala State Planning Board, TVM. p 93-106
- Survase, M.N., Pore, A.V. and Pawar, C.T. 2011. A study of fertility status of soil and nutrients recommendations in panchganga basin (Maharashtra): a micro level analysis. *Indian Streams Research Journal* 1 (5) : 2230-7850
- Tagore, G.S., Bairagi, G. D., Sharma, R. and Verma, P. K. 2014. Spatial variability of soil nutrients using geospatial techniques: a case study in soils of sanwer tehsil of Indore district of Madhya Pradesh. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, Symposium, Hyderabad, 9-12 December ISPRS Technical Commission VIII
- Tandon H. L. S. 2004. Nutrient deficiencies in Indian soils. In: Fertilizers in Indian Agriculture from 20th to 21st century. Fertilizer Development and Consultation Organisation, New Delhi. p 45
- Thakur, P. C, Rajoo, R. K. and Dwivedi P. 1971. Nutrient indices, fertilizer requirements and recommendation for Mandi soils. *Himachal Journal of Agriculture Research* 1: 61-64
- Tiwary, P., Bhattacharyya, T., Mandal, C., Dasgupta, D. and Telapande, B. 2015. Pedometric mapping of soil organic carbon loss using soil erosion maps of Tripura. *Current science* 108 (7) : 1326 -1339

- Verhagen, A., Bootink, H. W. G., and Bouma, J. 1995. Site specific management: balancing production and environmental requirements at farm level. *Agricultural Systems* **49** : 369 - 384
- Verma, S. D., Kaistha, B. P. and Sharma, P. K. 1976. Soil toposequence studies on a landscape segment of temperate humid climate in Himachal Pradesh-I Characterization and classification. *Fertilizer Technology* **13** : 224-229
- Verma, S. D., Tripathi, B. R and Kanwar, B. S. 1985. Soils of Himachal Pradesh and their management. In: Soils of India and their management, pp. 149-163, Fertilizer Association of India, New Delhi
- Verma, T. S and Tripathi, B. R. 1982. Relationships of micronutrient elements in soils growing rice. *Journal of the Indian Society of Soil Science* **30** : 89-91
- Verma, V. K and Patel, L. B. 2005. Spatial distribution of macronutrients in soils of arid tracts of Punjab, India. Punjab Remote Sensing Centre, PAU Campus, Ludhiana
- Verma, V. K., Patel, L. B., Toor, G. S. and Sharma, P. K. 2005. Spatial distribution of macronutrients in soils of arid tract of Punjab, India. *International Journal of Agriculture and Biology* **7** (2) : 370 - 372
- Walkley, A. and Black, I. A. 1934. Estimation of soil organic carbon by chromic acid titration method. *Soil Science* **37** : 29-38
- Wantanabe, P. S. and Olsen, S. R. 1965. Test of an ascorbic acid method for determining phosphorous in water and NaHCO₃ extract from plant. *Proceedings of Soil Science Society of America* **29** : 677-678
- Wasiullah, A.U., Bhatti, F., Khan and Akmal, M. 2010. Spatial variability and geostatistics application for mapping of soil properties and nutrients in semi arid district Kohat of Khyber Pakhtunkhwa (Pakistan). *Soil and Environment* **29** (2) : 159-166
- Webster, R. and Oliver, M. A. 1992. Sample adequacy to estimate variograms of soil properties. *Journal of Soil Science* **43** : 177-192
- Zandi, S., Ghobakhloo, A. and Sallis, P. 2011. Evaluation of spatial interpolation techniques for mapping soil pH. 19th International Congress on Modelling and Simulation, Perth, Australia, 12-16 December