International Journal of Electrical and Electronics Research ISSN 2348-6988 (online)
Vol. 3, Issue 4, pp: (219-222), Month: October - December 2015, Available at: www.researchpublish.com

Parameters of Soil Fertility (As a Part of Project on Soil Parameters Monitoring With Automatic Irrigation System)

Swati Narsing Nandagawali*

*Electronics and Telecommunications Department Government College of Engineering, Chandrapur, India

Abstract: **Agriculture is the main occupation in India. About 70% population of country earn their living through farming. To save the water and to increase the yield of crop proper method of irrigation must be used. The conventional drip irrigation system is fully controlled and monitored by the farmer. Hence to maintain proper irrigation soil fertility considered to be important factor which affects various parameters such as Ph, temperature, moisture and humidity. pH of the soil is impor-tant factor to be considered as it affects the nutrient availability in the soil. Temperature and humidity are also important factor in irrigation system which affects fertility of soil. Automatic Drip Irrigation is a valuable tool for accurate soil moisture control in highly specialized greenhouse vegetable production. Along with water the other important resources to the crop are the nutrients. If the nutrients are available in the right amount for the growth of crops then the yield of the crops also increases. Thus the productivity can be raised with the proper management of water resources and nutrients.**

Keywords: **soil fertility, Automatic Irrigation System.**

I. INTRODUCTION

In many agricultural cropping systems irrigation is neces-sary. The continuous extraction of water from earth is reducing the water level due to which lot of land is coming slowly in the zones of un-irrigated land. The demand for new water saving techniques in irrigation is increasing rapidly right now. These techniques are helpful in the regions where there is a scarcity of fresh water. In the modern drip irrigation systems, the most significant advantage is that water is supplied near the root zone of the plants drip by drip due to which a large quantity of water is saved. At the present era, the farmers have been using irrigation technique in India through the manual control in which the farmers irrigate the land from time to time. This process sometimes consumes more water or sometimes the water reaches late due to which the crops get dried. Water deficiency can be hazardous to plants before wilting becomes visible. This problem can be perfectly solved if automatic con-troller based drip irrigation system is used in which irrigation will take place only when there is intense requirement of water. Irrigation system uses relays to turn ON or OFF automatically.

The main objective of this paper is to design a automatic irrigation system and for this soil fertility parameters are the important factors. The system provides a real time feedback control system which monitors and controls all the activities of drip irrigation system efficiently. The system valves are turn ON or OFF automatically depending upon the moisture content. The system also provides the efficient information regarding the soil pH, humidity, pressure, temperature and soil nutrients along with the proper suggestions. Thus the system monitor, and control. Using this system, one can save man-power, water to improve production and ultimately increase profit. Soil fertility refers to the ability of a soil related to plants its ease of tillage, fitness of seedbed, and impedance to seedling emergence and root penetration by providing nutrients and suitable soil structure to support the plants/trees growth.

A fertile soil has the following properties:

1) It contains sufficient minerals (trace elements) for plant nutrition, including boron, chlorine, cobalt, copper, iron, manganese, magnesium, molybdenum, sulphur, and zinc.

2) It contains soil organic matter that improves soil struc-ture and soil moisture retention.

3) Soil pH is in the range 6.0 to 6.8 for most plants but some prefer acid or alkaline conditions.

4) Good soil structure, creating well drained soil, but some soils are wetter (as for producing rice) or drier (as for producing plants susceptible to fungi or rot, such as agave).

5) A range of microorganisms that support plant growth.

6) It often contains large amounts of topsoil.

In lands used for agriculture and other human activities, soil fertility typically arises from the use of soil conservation practices. The quality of irrigation water is very important to maintain soil fertility and tilth, and for using more soil depth by the plants.

1.1 Soil PH:

At 25 C an aqueous solution that has a pH of 3.5 has 103.5 moles H+ per litre of solution. A pH of 7, defined as neutral, has 107 moles hydrogen ions per litre of solution and also 107 moles of OH per litre; since the two concentrations are equal, they are said to neutralise each other. A pH of 9.5 has 109.5 moles hydrogen ions per litre of solution. A pH of 3.5 has one million times more hydrogen ions per litre than a solution with pH of 9.5 and is more acidic. The effect of pH on a soil is to remove from the soil or to make available certain ions. Soils with high acidity tend to have toxic amounts of aluminum and manganese. Plants which need calcium need moderate alkalinity, but most minerals are more soluble in acid soils. Soil organisms are hindered by high acidity, and most agricultural crops do best with mineral soils of pH 6.5 and organic soils of pH 5.5. In high rainfall areas, soils tend to acidity as the basic cations are forced off the soil colloids by the mass action of hydrogen ions from the rain as those attach to the colloids. High rainfall rates can then wash the nutrients out, leaving the soil sterile. Once the colloids are saturated with H+, the addition of any more hydrogen ions or aluminum hydroxyl cations drives the pH even lower as the soil has been left with no buffering capacity. In areas of extreme rainfall and high temperatures, the clay and humus may be washed out, further reducing the buffering capacity of the soil. In low rainfall areas, unleached calcium pushes pH to 8.5 and with the addition of exchangeable sodium, soils may reach pH 10. Beyond a pH of 9, plant growth is reduced. High pH results in low micro-nutrient mobility, but water-soluble chelates of those nutrients can supply the deficit. Sodium can be reduced by the addition of gypsum as calcium adheres to clay more tightly than does sodium causing sodium to be pushed into the soil water solution where it can be washed out by an abundance of water.

1.2 Soil temperature:

Soil temperature is the measure of how hot or cold the soil is.Considering the soil parameter monitoring system, its the detection of the internal energy of the soil, or its heat. Temperature a very important soil physical property and it controls many chemical and biological processes within the soil. When a farmer plants, he waits for the temperature to rise above a certain value so that his seeds will germinate. If the temperature gets too high, it kills things that live in the soil, like plant roots and other organisms. Likewise, chemical reactions that arent mediated by soil organisms tend to go faster as the temperature increases. Some interesting happenings in soil involving temperature are: the flow of heat and how soils heat upin other words, the amount of heat they must absorb to increase the soil temperature. In the first case, heat in the soil flows from places of high temperature to low temperature.so heat can move into the deeper layers of the soil profile. Interestingly, because of the time it takes for heat to move, there is a depth in soils at which the highest temperature is in the winter and the lowest temperature is in the summer. How fast a soil will heat up depends on the soils components. The more water a soil has, the slower it will heat up because water needs to absorb lots of energy to increase its temperature. Dry sand can heat up quickly. Soil has a temperature range between -20 to 60 C. Soil temperature regulates seed germination, plant and root growth and the availability of nutrients. Below 50 cm, soil temperature seldom changes and can be approximated by adding 1.8 C to the mean annual air temperature. Soil temperature has important seasonal, monthly and daily variations. Fluctuations in soil temperature are much lower with increasing soil depth.

Soil temperature is important for the survival and early growth of seedlings. Soil temperatures affect the anatomical and morphological character of root systems. All physical, chemical, and biological processes in soil and roots are af-fected in particular because of the increased viscosities of water at low temperatures. In general, climates that do not preclude survival and growth of white spruce above ground are sufficiently benign to provide soil temperatures able to maintain white spruce root systems. In some northwestern parts of the range, white spruce occurs on permafrost sites and Optimum temperatures for tree root growth range between 10 C and 25 C in general and for spruce in particular. However, whereas strong positive relationships between soil temperature 5 C to 25 C and growth have been found in white and other spruce species have shown little or no changes in growth with increasing soil temperature.

1.3 Humidity:

Monitoring the soils nature, estimating its relative humidity and controlling it to the necessity, proposes a potential solution to landsite irrigation management and thus, to treat fields along with receiving the correct amount of water and light, moisture in the air in the form of water vapor greatly affects plant health. Water vapor is the gaseous, invisible state of water in the air known as humidity. Like soil moisture, some plants have evolved and acclimated to very dry, arid air with little or no humidity. Many of these plants are low moisture plants with thick, waxy leaves and other adaptations for water retention.

These water vapours in the atmosphere contain latent en-ergy.During transpiration,the latent heat is removed from the surface liquid,cooling the earths surface. Other plant types, particularly high moisture plants prefer higher humidity due to their environmental adaptations. Ferns, particularly Nephrolep-sis are notorious for requiring higher levels of humidity. In lower humidity, susceptible ferns will excessively drop leaves, creating a mess. Most palm types, Ficus,bamboo, and Schefflera, and others thrive in higher humidity. Most other non-succulent plants benefit from higher humidity because it reduces transpiration, leaf tipping, and can discourage mite pests. Unlike soil moisture, its often difficult or unpractical to raise the humidity in a building. Plant selection is often the most practical method of ensuring adequate humidity.If plants are to be placed in a space with low humidity, selecting plants tolerant of these conditions is advised. Site selection involves seeking ideal locations for a plant based on its needs. Locations such as pools and water features such as ponds, water fountains, water falls, etc. tend to have higher humidity levels. Plant and site selection can be summarized as Right Plant, Right Place.

If humidifiers are available, they should be used where plants are located, particularly in winter months when hu-midity is lowest in most climates. Another method of raising humidity is to group plants close together in a cluster. When plants transpire, they become miniature humidifiers. when grouped together the relative humidity is increased, benefiting all plants around. Green walls often have an advantage of higher humidity due to many plants together in close prox-imity. Grouping plants together can be beneficial; however, if pests or disease are prevalent, plants should be spaced properly to allow air flow. Misting plants is sometimes practiced to raise humidity. Although the humidity can be raised through misting, the effect is very short-lived and may only last 10-15 minutes. However, misting typically has a more significant impact on controlling.

1.4 Soil moisture:

Soil moisture is a content of water in a material.It is a key variable in controlling the exchange of water and heat energy between the land surfaceand the atmosphere through evaporation and plant transpiration.When the soil moisture content is optimal for plant growth, the water in the large and intermediate size pores can move about in the soil and be easily used by plants. The amount of water remaining in a soil drained to field capacity and the amount that is available are functions of the soil type. Sandy soil will retain very little water, while clay will hold the maximum amount. The time required to drain a field from flooded condition for a clay loam that begins at 43% water by weight to a field capacity of 21.5% is six days, whereas a sand loam that is flooded to its maximum of 22% water will take two days to reach field capacity of 11.3% water. The available water for the clay loam might be 11.3% whereas for the sand loam it might be only 7.9% by weight.

If the moisture content of soil is very low and the tem-perature is very high then there is need of irrigation forplants, but the time for which irrigation will be provided is different for different temperature range. Because if the temperature is very high then the evaporation rate is also very high and hence we have to provide water for more time in order to attain the proper moisture level in the soil. Hence for different temperature range and moisture content level in the soil the land will be irrigated for different time interval. pH of the soil is also important factor which will affect the plant growth. Acidic or basic nature of the soil will affect the nutrient availability in the soil.As a result,soil moisture plays an important role in the development of weather patterns and production of precipitation.The amount of water remaining in a soil drained to field capacity and the amount that is available are the functions of the soil types.

1.5 Nutrients:

Soil nutrients i.e. macronutrients or micronutrients are helpful for plant growth and there availability depends on the pH of the soil. Hence there is need to measure soil pH. Depending upon the measured pH of the soil, suggestions can be given to the farmer to add various chemicals in order to achieve the desired pH of the soil for good plant growth. Sixteen nutrients are essential for plant growth and reproduction.Theyare carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, sulfur, calcium, magnesium, iron,boron, manganese, copper, zinc, molybdenum, and chlorine. As there is no sensor available for measuring such nutrients the soil samples are taken into the laboratory and then it is measured by some chemical process. As nutrients affects soil fertility it is also an important parameter of soil fertility.

II. CONCLUSION

The main objective of this paper is to design a fully automated drip irrigation system. The system provides a real time feedback control system which monitors and controls all the activities of drip irrigation system efficiently. The system also provides the efficient information regarding the soil pH and soil nutrients. Temperature and humidity of soil which are the important parameters of soil fertility including the irrigation system are studied in this paper. Using this system, one can save manpower and water to improve production and ultimately increase profit.

ACKNOWLEDGEMENT

I am extremely grateful and remain indebted to our guide Dr. D.V. Rojatkar for being a source of inspiration and for his constant support. I am thankful to him for his constant constructive criticism and invaluable suggestions, which ben-efited me a lot while developing the project on ”Soil Parameter Monitoring With Automatic Irrigation System”. He has been a constant source of inspiration and motivation for hard work. He has been very co-operative throughout the project work. Through this column, it would be my utmost pleasure to express my thanks to him for his encouragement, co-operative and consent without I might not able to accomplish this project. I also express my gratitude to him for providing me the infrastructure to carry out the project and to all staff members who were directly or indirectly instrument in enabling me to stay committed for the project.

REFERENCES

[1] Mahir Dursun and Semih Ozden, A wireless application of drip irrigation automation supported by soil moisture sensors, Scientific Research and Essays Vol. 6(7), pp. 1573-1582, 4 April, 2011.

[2] Gracon H. E. L. de Lima, Lenardo C. e Silva, Pedro F. R. Neto Mestrado em Ciłncia da Computao, WSN as a Tool for Supporting Agriculture in the Precision Irrigation, 2010 Sixth International Conference on Networking and Services, pp.137-142, 2010.

[3] K.Prathyusha1, M. Chaitanya Suman2, Design of embedded systems for the automation of drip irrigation, IJAIEM Volume 1, Issue 2, October 2012.

[4] Article on Strategic Issues in Indian Irrigation: Overview of the Pro-ceedings by Upali A. Amarasinghe and Stefanos Xenarios.

[5] Article on Strategic Issues in Indian Irrigation: Overview of the Pro-ceedings by Upali A. Amarasinghe and Stefanos Xenarios.

[6] Article from Technical digest issues 6-IRRIGATION DEVELOPMENT - PROBLEMS AND STRATEGIES S. M. Mendhekar and M. L. Cha-lakh.

[7] Inltration of meltwater from frozenn saline water located on the soil can result in reclamation of a coastal saline soil by Kai guo, Xiaojing Liu.

[8] J. Baker (1997)Common Property Resource Theory and the Kuhl Irri-gation Systems of Himachal Pradesh , India.Human organization: sum-mer 1997, vol. 56 no. 2, pp. 99- 208.

[9] Paper on Septic arthritis of the knee: presentation of a novel irrigation suction system tested in a cadaver study by atesch ateschrang , dirk albretch , steen schroter, bernhard hirt , kuno weise and jurgen h dolderer.