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STUDY ON SMART IRRIGATION SYSTEM IN CHIKKABALLAPUR TALUK, KARNATAKA, INDIA

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Abstract : Irrigation is the controlled application of water for agricultural purposes through manmade systems to supply water requirements that are not satisfied by the rainfall. Crop irrigation is vital throughout the world in order to provide the world's ever-growing populations with enough food. Many different irrigation methods from traditional to smart ones are used over worldwide, including: surface, sub-surface, sprinkler, drip, and advanced or smart to satisfy the plants thrust. In this paper efforts have been made to present the basics of different irrigation systems adapted by the Indian farmers to grow their crops.

Water management is the most important issue on which the growth of agriculture sector largely depends. Indian agriculture sector is in dire need of investment to meet the expenses. To fuel the capital needs of the agricultural economy and also to ensure that the benefits of growth percolate to bottom of the socio-economic pyramid, farming has to be projected as an avenue of investment for the urban population. The improvement in irrigation system using wireless network is a solution to achieve water conservation as well as improvement in irrigation practices. This irrigation system allows farmers to reduce runoff from over watering saturated soils, avoid irrigating at the wrong time of day and in effect improve the crop yield by ensuring adequate water supply when needed. Smart irrigation aims to minimize their environmental footprint through efficient water use, and must also run a profitable business. This allows them to reinvest in new and improved technologies which ensure sustainable and responsible irrigation over time.

IndexTerms – Smart irrigation, Groundwater, Chikkaballapur

I. INTRODUCTION

In India, where 60-70% economy depends on agriculture, there is a great need to modernize the conventional agricultural practices for the better productivity. Due to unplanned use of water the ground water level is decreasing day by day, lack of rains and scarcity of land water also results in decrement in volume of water on earth. Nowadays, water shortage is becoming one of the biggest problems in the world. We need water in each and every field. In our day-to-day life also, water is essential. Agriculture is one of fields where water is required in tremendous quantity. Wastage of water is the major problem in agriculture. Every time excess of water is given to the fields. There are many techniques to save or to control wastage of water in agriculture. The objective of the system is to:

a) conserve energy & water resources
b) handles the system manually and automatically
c) detects the level of water.

Due to the climatic changes and lack of precision, agriculture have resulted in poor yield as compared to population growth. Irrigation is mostly done using canal systems in which water is pumped into fields after regular interval of time without any feedback of water level in field. This type of irrigation affects crop health and produces a poor yield because some crops are too sensitive to water content in soil.

India has many rivers whose total catchment area is estimated to be 252.8 million ha (mha) Out of about 1869 km^3 of surface water resources, about 690 km^3 of water is available for different uses. The ultimate irrigation potential of the country has been estimated to be 139.5 mha. India has acquired an irrigation potential of about 84.9 mha against the ultimate irrigation potential. About 360 km^3 of groundwater is also available for irrigation. Water is the most critical input for enhancing agricultural productivity, and therefore expansion of irrigation has been a key strategy in the development of agriculture in the country If we analyse agricultural growth during the past four decades, we find that high-yielding varieties, irrigated area expansion and fertilizer use have been the major factors contributing to the achievement of green revolution in India. There has been a steady increase in the irrigation potential from groundwater. The contribution of groundwater to total food grain production of the country is significant, as more than 50 per cent of the irrigated area is using groundwater and in several

districts it is more than 80 percent .Overexploitation of groundwater resources has caused continuous decline in water level, decline of well yields, drying of shallow wells, deterioration of groundwater quality, seawater intrusion into coastal aquifers and increase in cost of energy required to lift water from a greater depth.

In the era of only traditional irrigation methods, there was no water scarcity as it was amply available with water table 3-5 m below the surface due to simple lifestyle for India's population of 350 million. As the population increases, the needs on the water increases for various purposes such as irrigation, domestic, hydro power, industrial, mining, recreation, etc. One of the main reasons for the low coverage of irrigation is the predominant use of traditional irrigation methods, which undergo low water use efficiency (WUE) of about 35-40% because of huge conveyance and distribution losses.

Therefore, to increase the WUE and gross cropped area, new technologies have been implemented to improve the traditional styles of irrigation India. One of the significant technological revolutions is by using poly vinyl chloride (PVC) pipes for creating a network on the farm for carrying water from the source to different places, which results in 2-3 crops per year by using the same water quantity in traditional irrigation methods. This modern or micro-irrigation (MI) has given a ray of hope to reduce total dependence on most undistributed, uneven, and un-certain rain to irrigate the farms economically (Sivanappan 1998). Under MI (drip and sprinkler), unlike traditional irrigation methods, water is supplied at a required number of intervals and quantity using pipe network, emitters, and nozzles. Therefore, the conveyance and distribution losses are reduced completely, which results in higher WUE. Unlike traditional irrigation methods, drip supplies water directly to the root zone of the crop, instead of land, and therefore, the water losses occurring through evaporation and distribution are completely absent (Prisilla, 2012).

Table 1: Freshwater use for various purposes in India (million ha-meters)

Use/year	**1985**	**2000**	**2025**
Irrigation	47.0	63.0	77.0
Domestic and live stock	1.7	3.3	4.6
Industries	1.0	3.0	12.6
Thermal power	0.3	0.3	0.4
Miscellaneous	4.0	5.4	11.0
Total	**54.0**	**75.0**	**105.0**

II. LOCATION

Chickkaballapur is the taluk and district headquarters, it is at a distance of 56 km. from Bengaluru. The taluk geographically lies between 77^{o} 35' 58''E & 77^{o} 52' 13''E East longitude and 13^{o} 19' 54''N & 13^{o}39' 57''N North latitude. (Survey of India Toposheet Nos. 57 G/10, 57 G/13). Chikkaballapur taluk possesses an area of 644 sq.km (64400 hectares). The taluk having a population of 1, 91,122 (as per the 2011 census). It is at a height of 917 feet with respect to mean sea level. It includes 3 hoblies and 223 villages and one town. Part of the taluk has clayey-loam soil. There are no perennial rivers in the taluk. However, Papaghni river which denotes a belief in the purifying efficacy of waters of the river rises on the Gundalaguski hills flows in this taluk. There are also many pickups and inundation channels irrigating the lands in Chikkaballapur by the river Northern Pinakini. Climate is dry and hot during summer in Chikkaballapur taluk. Its annual rainfall is 740.56 mm. The taluk receives rains on 66 days in a year. It is at a height of 917 feet with respect to mean sea level. The national highway NH7 passes through the study area and it is well connected by road and railway (Shivanna et al 2014, 2015, Narayanaswamy et al. 2014).

III. GEOLOGY OF THE AREA

The study area is an undulatory terrain and is composed of peninsular gneisses, pink/grey granites, lateritic hills and some basic dykes. The general trend of peninsular gneisses are NNW-SSE and NW-SE direction. They are highly migmatitic in nature. The granites occur as intrusive in the gneissic rocks and are varying in color, texture and structures. The area is traversed by different sets of basic and acidic intrusions. The rocks are highly jointed, sheet jointing parallel to the exposed surface particularly. These are favorable for occurrence and movement of groundwater. (Radhakrishna, 2006).

IV. HYDROGEOLOGY

The study basin is a part of hard rock terrain, where the rocks are crystalline, hard and massive which are devoid of primary porosity, but the presence of joints, fractures and fissures act as reservoir and conduits for groundwater percolation. The contact zones between gneiss and granite, granitic gneiss and laterites have proved to be more successful for groundwater occurrences in the study basin. Groundwater occurs unconfined conditions in the weathered and pegmatite veins. Also, in the jointed and fissured zones, groundwater will be present. The weathered granitic layers and fractured layers are two distinct aquifers and no connection exits with each other (Chandrashekar et al. 1975, Radhakrishna, et al.1975, Srinivasareddy 1998). Groundwater movement is controlled by lineaments, dykes and quartz veins. The lineaments serve as conduits for movement of groundwater, whereas dykes and quartz veins obstruct movement of groundwater. The yield of wells in the study basin depends on intensity of weathering and spacing of primary joints. The depth to bedrock ranges from 20 to 30 m. in granitic and gneissic terrain, 60 to 20 m in lateritic areas.

V. DRIP IRRIGATION

Drip irrigation is a controlled, slow application of water to soil over a long period of time, usually lasting several hours. The water flows under low pressure through plastic pipe/tubing laid along each row of plants. It reduces water loss by up to 60 percent. Flow rate needs to be adjusted so there is no flooding or runoff. Apply enough water to wet the soil to a depth of 4-6 inches. Avoid frequent light applications of water. Water in early daylight hours.

Fig.1: Drip irrigation system implemented in the study area

Table 2: Year-wise beneficiaries from Central and State governments for implementing Smart Irrigation System in Chikkaballapur Taluk. (Source: Department of Agriculture, Govt. of Karnataka)

Sl No.	Year	Drip Irrigation	Sprinkler Irrigation
1	2013-14	36	2
2	2014-15	50	9
3	2015-16	51	10
4	2016-17	150	-
5	2017-18	201	-
6	2018-19	277	-
7	2019-20	309	-
8	2020-21	288	180
Total		**1362**	**221**

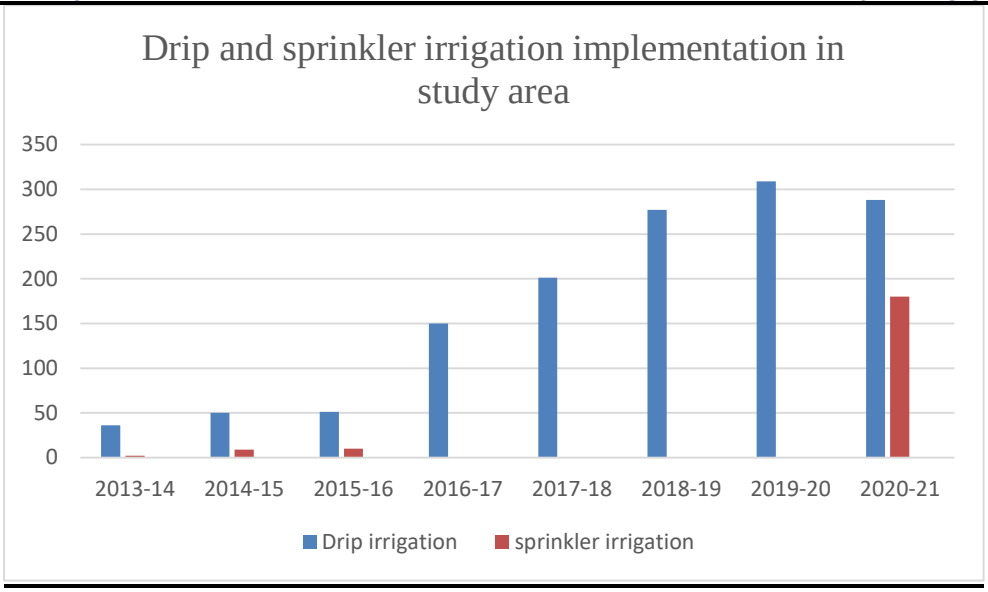

Fig. 2: Showing the subsidies given to farmers for implementation of drip and sprinkler.

Table 3: Drip beneficiary farmers in numbers in the study area (Source: Department of Agriculture, Govt. of Karnataka)

Sl No.	Year	No. Beneficiaries	Subsidiary Amount (Rs.)
1	2015-16	351	15878890/-
2	2016-17	364	17390920/-
3	2017-18	235	12148300/-
4	2018-19	158	11706404/-
5	2019-20	245	17648445/-
6	2020-21	326	30066350/-

VI. CONCLUSIONS

In the study area the sprinkler irrigation and drip irrigation system are already in practice as there is a conservation for water done using these modern techniques of irrigation systems.This irrigation system allows cultivation in places with water scarcity thereby improving sustainability. Central and State governments are helping famers in various scheme like Rashtriya Krishi Vikas Yojana (RKVY), National Food Security Mission (NFSM), Pradhan Mantri Krishi Sinchayi Yojana (Central Schemes); Mikhya Manthrigala Hani Niravari Yojane, Krishi Bhagya (State Schemes) to set-up and adopt smart irrigation system to reduce the water losses and which in turn reduces the pressure on water supply for irrigation in the country. As already explained in Chikkaballapur taluk there are no perennial rivers and agricultural activities are mainly depending on the rainfall and groundwater. In the study area already large number of people have implemented the smart irrigation techniques (drip and sprinkler) to reduce water pressure. The famers in the taluk are growing vegetable, flowers, fruits and cash crops (grapes) through smart irrigation systems and they are very happy with the smart irrigation techniques.ue to increase in population, irrigation like drip and sprinkler will overcome the scarcity of water and increases the crop yield. Known about the differences between traditional and conventional methods of irrigation

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REFERENCES

[1] Chandrashekar H, Chandrashekar Math, S S and Ganachari, S.N**.** 1975. A First Approximation of Groundwater Potential of the Chikkahagari basin, Karnataka. Groundwater Studies Series 171, Department of Mines and Geology, pp.1-12.

[2] Dhawan, B. D. 2002. Technological change in Indian irrigated agriculture: A study of water saving methods. Commonwealth Publishers, New Delhi.

[3] N.K. Narayanaswamy, S. Shivanna, S. B. Bramhananda, H. C. Vajrappa. 2014. A GIS based morphometric Analysis and Associate Land use Study of Dakshina Pinakini River Basin, Chikkaballapur and Bangalore Rural Districts, Karnataka. Journal Applied Hydrology, XXVII (1-4): pp. 52-62.

[4] Prisilla 2012. Design and Implementation of Smart Irrigation System. International Journal of Mathematics and Applied Sciences. 10 (5): pp. 55-62.

[5] Radhakrishna, B P., Dusan Duba and Palmquist W N. 1975. Groundwater development in Hard rock areas of Karnataka State, India, Department of Mines and Geology GWS No. 150p.

[6] Radhakrishna BP. 2006. Groundwater in Karnataka, Published by Geological Society of India, Bangalore., 106p.

[7] Shivanna S., Bramhananda S B., Narayanaswamy N. K., and Pavan. 2014. Groundwater Studeis in Chikkaballapur District, Karnaaka. *Proc. Volume:* Second National Seminar on Futuristic Technology in Civil Engineering for Sustainable Development held at SJBIT, Bangalore pp. 1-7.

[8] Shivanna S., N. K. Narayanaswamy and S. B. Bramhananda. 2015. Water Quality Assessment for Agriculture in Chikkaballapur District, Karnaaka. *Proc. Volume*: Third National Seminar on Futuristic Technology in Civil Engineering for Sustainable Development held at SJBIT, Bangalore pp. 165-167.

[9] Sivanappan, R. K. 1998. Status, scope and future prospects of micro-irrigation in India. In Proc. Workshop on Micro-irrigation and Sprinkler Irrigation System, CBIP New Delhi., 4: pp.1-7.

[10] Srinivasa Reddy. 1998. Hydrological Studies of Upper Pennar basin in parts of Karnataka and Andhra Pradesh. Unpublished Ph.D thesis submitted to Bangalore University.