ISSN (Online) : 2454-4159
International Journal of Advanced Research in Science Management and Technology
Volume 2, Issue 12, December 2016

Centre Pivot Irrigation-A Modern Method of Irrigation in Indian Perspective

Pavan Prabhakar Vispute[1]
PG Scholar, Dept. of Civil Engineering, S.S.V.P.S's B.S. Deore College of Engineering, Dhule, Maharashtra, India[1]

ABSTRACT—Our country India is an agricultural country. About 70% of total population of India is directly and indirectly depend upon agriculture o\for their livelihood and other similar needs. Tremendously increasing population of our country has put an extraordinary stress on the farming sector. The climatic conditions of South Asia is dependent upon Mansoon and our country is under full influence of it. Therefore, availability of water to crops at the time of requirement is an indispensible thing to get maximum production of crops to meet the food production target of the nation. At this stage it becomes unrealistic to depend solely upon natural source of water i.e rain. Hence at that time artificial irrigation comes to the scenario. Presently in India, Drip & Sprinkler irrigation are being practiced. This paper represents one of such modern method of irrigation which has yet to fetch an attention of Indian farmers. The Centre Pivot method of irrigation is unique methodology to irrigate crops in circular pattern. This method may also referred as overhead sprinkler irrigation, waterwheel irrigation or circle irrigation.

KEYWORDS- water requirement of crops, irrigation, soil erosion, cultivation, sandy soil.

I. INTRODUCTION

Center-pivot irrigation was invented in 1940 by farmer Frank Zybach who lived in Strasburg, Colorado–It was recognized as a method to improve water distribution to fields. Centre Pivot irrigation is a form of overhead sprinkler irrigation consisting of several segments of pipes joined together by trusses to support each other. The whole assembly is mounted on tires due to which it rotates in circular manner around a central point known as Pivot Point. The space between two tires is known as Span. The typical assembly is shown in figure 2 The arm of the system is connected with number of pipes at fixed intervals of horizontal distance between them are known as sprinklers. The average quantity of water from sprinkler can be controlled by Control Unit.

Various modifications in the system have done time to time to achieve optimum performance from the original concept of the system and to suit various topographical and climatic conditions of different locations of the world. The Centre Pivot irrigation comes under the category of Self Propelled irrigation system and in USA about 29% of the total irrigation is achieved by such self-propelled system of irrigation. The satellite picture shows the pattern of farm in Figure 1 Such a mechanized method of irrigation leads to increased yields in less use of water.

Fig. 1 The satellite picture

Fig 2 The typical assembly

ISSN (Online) : 2454-4159
International Journal of Advanced Research in Science Management and Technology
Volume 2, Issue 12, December 2016

India has large opportunity to adopt this system although it is very costlier that the traditional method of watering the crops like furrow or border strip method because of its long term returns to the farmers; the details of which are given in further portion of this paper.

II. GLOBAL HISTORY OF CENTRE PIVOT IRRIGATION

T-L Irrigation Solutions commercially introduced Centre Pivot system about 50 years ago is USA. Fig 3 shows primitive picture of the system. In 1952 American Society of Agricultural & Biological Engineers (ASABE) this system as 'an historic landmark of agricultural engineering'. In 22 July 1952 a patent was issued to Frank Zybach named as a self-propelled sprinkler irrigation system. After two years in 1954 another American Robert Daughtery who was a Valley Manufacturing Inc. introduced a modified version of the system and successfully adopted it in Nebraska. Valley Manufacturing Inc. marketed the system on large scale in up to 1960. The patent licence expired in 1969 and then towards with updating in the system in various ways it was commercially launched to serve the needs of big landlords of USA. After 1975 there was a sudden increased demand of the system due to shortage of labours to water the corps by traditional method of irrigation. The second important reason behind it was the due to the use of this system the land which was uneven in the topography also came under the irrigation. From the source of www.livinghistoryfarm.org it is guessed that till 2002 there were 2,58,000 systems of similar kind were installed.

In other countries like Australia, Brazil and New Zealand where farming is done by means of very advance technology this system has collected good attention of farmers. Typically this system is used for watering rectangular fields.

In India National Seed Corporation in its annual report of 2014-15 recommended the government to encourage the Indian farmers who have large possession on land adopt this system to accelerate the cultivation from their farms. Accordingly various manufactures of irrigation system are have their consistent demand from the authorities to subsides such irrigation system to reach the maximum numbers of farmers. As per the recent information available, in Pune (India) Brightstar India is a leading manufacturer of such systems. Their system is Solar Powered so as it can be also used during the time of power cut offs. Fig 4 shows one of such a system.

Fig 3 Centre Pivot system

Fig.4 Solar Powered System

III. THE SYSTEM

Circular System -The most commonly used design of the system consists of an arm whose length is about 1320 ft i.e 400 m and the arm is about 10 ft above the ground so as to also cover those crops whose height is more such as Wheat, Sugarcane etc. But crops which grow very close to each other are not suitable for the system because they may oppose

the movement of tyres in forward, backward or circular manner. In the primitive design of the system steel wheels were used for movement but it found that the wheels get sunk in the muddy saturated soil which used to brought an extra stress on the motor which is causing the movement of wheels. Hence afterwards, in the modifier versions, low pressure rubber tyres became popular which make easy for movement even on undulated field surface refer fig .5. The then systems were water powered later on they became hydraulic but there days they are driven by electric motors or using very advance technology such as solar energy to lower its operating cost. For circular system there is a pivot point around which the arm rotates in 360^0 and water enters in the carrying point at this point. The vertical structure which copes the entire weight of pipe material and water is known as tower and the distance between two towers is termed as span. The is that part of the system which touches the ground by means of wheels. The whole assembly is supported by truss system. Moreover this, a control panel is the heart of the assembly which consist of a digital display unit through which one can control the speed of rotation thereby quantity of water to be discharged in the field. The advance package of the system also provides the arrangement of automatic on/off of the system at particular tile interval which greatly permits the farmer to overlook the other important task of the farm. As the inner circles will have more number of circular rotation due to small radius but the outmost area of the farm there will be less number of rotation in the same time period. Hence water sprinkle rate at out portion is more that that of the inner portion. The pipes used for carrying water are typically low weight galvanised iron pipes having diameter about 4 inch to 12 inch i.e 100 mm to 300 mm; it increases towards the outer side due to more requirement of water.

Rectangular System-But many times when the available field is of irregular shape then circular systems are useless and then the field is to be divided in rectangular shapes and then apply small systems for the field. It is important to note that for a rectangular system the movement of the assembly is forward and backward between two fixed ends. This characteristic is typically suitable for Indian agricultural sector because here in India the fields are as less as 2 acres also in irregular shapes. Please refer the pictures given below.

Lateral System-It comes also with the another version of later system which has a separate machine which travels parallel to the sides of the field to irrigate upto 95% of the field are. It is more efficient in terms area under irrigation than that of circular system but it is costlier than it because separate length of pipe has to attached to it to supply water continually from the source so becomes uneconomical for large farms such as 100 acres.

Corner system- When circular system is adopted the corners of the field remain unirrigated which are further irrigated by introducing traditional sprinkler irrigation system to cover that area or the furrow method can also become useful and uneconomical. It is also practiced in many very large fields to introduce a separate circular system in small scale at all circular corners of the field.

Fig. 5 represents crop sowing pattern from air

ISSN (Online) : 2454-4159
International Journal of Advanced Research in Science Management and Technology
Volume 2, Issue 12, December 2016

IV. PROS AND CONS

PROS

- It is economical and efficient method of irrigation for large fields. It requires about 60% of the water than that of the traditional method of irrigation so considerably saves water.
- Soil needs not to be in level because water flowing over the ground is not due to gravity effect.
- Rubber tyres with moderate shock absorbing arrangement make the system suitable even for undulating field.
- Indian farmer often suffer from shortage of labour power so this system proves best because almost no labours are involved for operating.
- The towers of the system can also be equipped with CCTV cameras to inspect the diseases on crop plant and for theft supervision for large fields.
- As it is almost automatic so farmer needs not to present in the farm at the time of application of water. He can watch live footage of it on his own smart phone or computer.
- Herbicides, pesticides and soluble nutrient can be directly fed to each plant.
- Since water washes the leaves of the plant so reduces the chances of diseases.

CONS

- Very large initial cost in involved.
- All Indian farmers today are even hesitant to use Drip and Sprinkler method so it is very hard to for them to adopt such a system at large capital investment.
- If proper service and maintenance is not taken then the system may lead to breakdown.
- Heavy constituent of salt may lead to blockages of sprinkle nozzles which may lead to frequent replacement of them.
- For clayey soil care has to be taken so as wheel does not stuck in the muddy wet soil.
- Danger from thieves may be the major part of total failure of the system in Indian purview.

V. CONCLUSION

Various aspect of the Centre Pivot System are tried to study in the present paper but as far as we look toward this method in Indian perspective it may be concluded that in India there is vast opportunities to practice it when we look towards the advantages of the system such as its competency to operate automatically as per the availability of power, this ultimately relieves Indian farmer in a great way. Moreover this it saves considerably large area from being wasted in digging the trenches. On the other hand its cost is a big issue and therefore various innovations in this context are needful so as to make the system cost efficient so that average Indian farmer can install it; for such purpose various research institute of India should have to put their efforts in it. Secondly the central government should provide subsidy to the farmers to encourage then. Ultimately all such efforts will lead toward self sufficiency of the nation for food and to revive the economical background of Indian farmer.

REFERENCES

[1] **James, L. G . 1982. Modeling the performance of center pivot irrigation systems operating on variable topography. TRANSACTIONS of the ASAE 25(1):143-149.**

[2] **Marek, T. H., D. J. Undersander, and L. L. Ebeling. 1986. An areal-weighted uniformity coefficient for center pivot irrigation systems. TRANSACTIONS of the ASAE 29(6):1665-1667.**

ISSN (Online) : 2454-4159
International Journal of Advanced Research in Science Management and Technology
Volume 2, Issue 12, December 2016

[3] Seniwongse, C., I-pai Wu, and W. N. Reynolds. 1972. Skew ness and kurtosis influence on uniformity coefficient, and application to sprinkler irrigation design. TRANSACTIONS of the ASAE 15(2):266-271.

[4] Soil Conservation Service. 1982. Irrigation system efficiency evaluation, 1978-1981. Soil Conservation Service, March, 85 pp.

[5] Solomon, K. H. 1984. Yield related interpretations of irrigation uniformity and efficiency measures. Irrigation Science 5:161-172.

[6] Walker, W. R. 1979. Explicit sprinkler irrigation uniformity. ASCE, Irrigation and Drainage Division 105(IR2):129-136.

[6] Warrick, A. W. 1983. Interrelationships of irrigation uniformity terms. ASCE, Irrigation and Drainage Division 109(3):317-332.

[7] Warrick, A. W ., W. E. H art and M . Yitayew. 1989. Calculation of distribution and efficiency for no uniform irrigation. ASCE, Irrigation and Drainage Division 115(4):674-686.

[8] Wilcox, J. C . and G . E. Sw ailes. 1947. Uniformity of water distribution by some undertree orchard sprinklers. Scientific Agriculture 27:565-583.