

Effects of Sprinkler Irrigation System and Water Use Efficiency (WUE)

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Abstract

Although the population of Egypt is over ninety million, It is unable to fulfill the food requirements as enough amount of water is not available for sufficient production of crops. In order for recognizing and implementing the steps to minimize water usage and improving the crop production techniques, this research is carried out into the farm fields of farmers in 2009 and 2010, 2010 and 2011 to evaluate the effectiveness and economy feasibility of the sprinkler irrigation system for the growth of the wheat crops. In the National Researches Centers and Development Station in Nubaria, two field studies were performed. Under sprinkler irrigation method the water related characteristics of the crops like wheat have been readied in the region. Treatments composed of two irrigation sprinklers, set sprinklers (S1) and the lateral hand motions (S2), and 3 levels of irrigation (IF1: only once in a whole week; IF2: only twice in the whole week, IF3: three times in a whole week). Also, the highest amount of net profit occurred under strong defined sprinkler irrigation scheme and irrigation size. The suggested sprinkler method and irrigation schedule for each case for winter wheat in the Nubaria is solid set sprinkler (S1) and three-fold irrigations per week (IF3). The method of sprinkler irrigation is most general method of adaptation of irrigation water that normally falls as rainfall. It is then pumped into the air and irrigated by spray heads to the whole surface of the soil for the purpose it is that it get split up so that the waters tiny drops get directly on the ground.

Keywords: Economical parameters, Hand move laterals, Crop, Irrigation Frequency, IWUE, Solid set of Sprinklers, Water Use Efficiency (WUE).

Introduction

Huge demand to decrease the water consumption has already made a serious pressure on the agricultural sectors so that it get more accessible to the urban population and the industries in various temperate where population is way more than rural areas and is growing exponential but the groundwater is getting shorter in supply. It drives the cereals market to grow cereals, in particular wheat and the rice, by utilizing less amount of water. The water level is among the most significant considerations when managing pressurized irrigation. Owing to variations in the soil humidity and the wetting patterns, based on it the crops yield can vary depending on various irrigation frequencies apply the same quantity of water[1]. The greater will be the water irrigation levels, lower would be the wetted volume of soil and the greater mean amount of surface water to be retained in the wetted volume of surface over a time where the overall irrigation water will be equal. So the High irrigation level could offer favorable situations for surfaces with water flow and the high irrigation level could provide favorable conditions for field water mobility and root uptake.

In the sprinkler-irrigated region, the increase in the photosynthesis rates and the decrease in the leaf's respiration level at the nighttime has been founded [2]. The amounts of nutrients present in the body of rhizosphere might be large or even more unsustainable instantly after the irrigation levels, and might decline to levels of deficiency as the time goes by. So the Reduction in the time period between the successive irrigation techniques to ensure steady, adequate water concentration in the root system can reduce nutrient concentration variability, thereby increasing growth of the agricultural crops.

Wheat is one of the world's number one crops. This crop is best suited with well-drained clay loam, , and the sandy soils [3]. Consequently, better the management of the resources specifically for the irrigation by utilizing advanced technologies are important for the optimizing productions and for providing the farmers with very high returns. Growing the water use capacity are also the most effective way of growing crop production, saving water and protecting the atmosphere, providing the amount of cultivated land does not increase. Wheat is very prone to tension from the atmosphere [4]. For better growth and yield it also requires regular irrigation. Impact of sprinkler irrigation schemes and irrigation intensity on water usage capacity and cost-effective parameters of wheat output to decide the optimal treatment for optimum water quality and net profit. An irrigation sprinkler (also known as a water sprayer, or simply a sprinkler) is a system used it to irrigate fields, lawns, gardens, country clubs as well as other areas. They are being used for the refrigeration and airborne dust management [5].

The irrigation sprinkler (also known as a water sprinkler, or simply a sprinkler) is a system used to irrigate fields, lawns, parks, golf courses and similar areas. These are often used for cooling and for managing airborne dust. The sprinkler irrigation is the process of spreading water close to rainfall in a regulated manner [6-7]. The water is circulated can a network which can consist of pumps, valves, wires, and sprinklers. Sprinklers for irrigation can be used for domestic, commercial, and agricultural use. It is useful on rocky terrain where there is not enough rainfall, as well as on sandy soil [8-9]. These perpendicular pipelines are then joined towards the main water pipeline present at the regular interval of the time, with spinning nozzles at the rim. If the water has been allowed to be flowed under pressure into the central pipes along with the assistance of the draining it [10]. This sprinkles on the grain. In the sprinklers or the over heading of irrigation process, water is set piped inside the field to the one more centric position and spread by sprinklers or arms with high pressure overheads.

It drives higher pressure sprinklers which themselves travel in a circle. This can also rotate in a complete or partial circle. Rain guns are similar to impact sprinklers, except just that they typically work at very high level of pressures of forty to one hundred thirty lbf/sq. Inch (two hundred seventy five to nine hundred kilo pascals) and flows of fifty to twelve hundred), generally between 0.5 and 1.9 inches (ten to fifty mm) in diameter. Weapons are used for agricultural purposes such as dust reduction and mining, in addition to irrigation [11]. Most irrigation sprinklers are embedded in the field along with their accompanying pipes, while sprinklers are still common above field and traveling. Most irrigation sprinklers work by electrical and hydraulic technologies and are organized into regions which can be switched on and off simultaneously by actuating a solenoid-controlled valve.

The sprinklers in the home lawn differ greatly in scale, expense and sophistication. Those include sprinklers for effects, oscillating sprinklers, spray sprinklers, indoor sprinklers and compact sprinklers. Even systems that are permanently mounted may run on timers or other automatic operation. For esthetic and practical reasons, they are sometimes equipped with retractable heads which minimize damage during lawn mowing. Such types of systems may typically be configured to start every week automatically on a fixed time and day [12].

If extra irrigation is required or if no definitive device is in place, small portable sprinkler systems can be temporarily installed on the lawns. These are also fastened to a domestic water faucet and put for a short amount of time. Some devices can be permanently mounted in the earth properly, and are permanently connected to the piping system of a household. In Australia a Nomad-developed ancient sprinkler called a 'set-and-forget tractor sprinkler' was used. The water intensity meant the sprinkler was working steadily over a lawn [13]. The amounts of nutrients in the rhizosphere may be large or even unsustainable instantly after irrigation, and may decline to levels of deficiency as time goes by.

In the irrigation sprinkler system, the water openly sprayed into the atmosphere and is allowed for freely to fall very close to the rainfall onto the surface of ground. The spray is created by the flow of water into narrow orifices or nozzles under pressure [14]. Usually pressure is obtained through pumping. Through careful selection of nozzle sizes, working pressure and sprinkler placement the volume of irrigation water needed to replenish the seed root zone can be distributed almost evenly at the rate acceptable to the soil infiltration rate.

Table 1: Response of the Different Crops towards the Sprinkler Irrigation technique

Crops	Water Saving, %	Yield increase, %
Bajra	56	19
Barley	56	16
Bhindi	28	23
Cabbage	40	3
Cauliflower	35	12
Chillies	33	24
Cotton	36	50
Cowpea	19	3
Fenugreek	29	35
Garlic	28	6
Gram	69	57
Groundnut	20	40
Jowar	55	34
Lucerne	16	27
Maize	41	36
Onion	33	23
Potato	46	4
Sunflower	33	20
Wheat	35	24

Source : INCID (1998) adapted from Table 6.5

1. Advantages:

- Removal of the conveyance pathways, and thus absolutely no loss in conveyances.
- Appropriate for all types of soils except the thicker clays.
- Appropriate for the irrigating agricultural fields where they have a very small plant biomass per unit area. It is ideally suited for the oil seeds and the other vegetables and cereal fields.
- This water saving techniques for irrigating the agricultural crops.
- Drip irrigation is the main effective method for providing water and nutrients for the growth of the agricultural crops.
- It provides organic matter directly to the root system of the crop, in the right quantities, at the proper time so that each plant receives just what it needs to develop optimally when it requires it.
- Improvement in the yield of agricultural crops.
- Mobile in nature, can be transferred from one place to another.
- May also be used for undulating area.

- The labor costs are lower than other forms of irrigation.
- This will save land because it needs zero bunds etc.
- Regions especially at the higher altitudes than the sources that could be watered, irrigated.
- Chance of using the soluble and the chemical fertilizers.
- Fewer trouble with the sprinkler nozzles get clogging because the water lades with the mud.

Response of the Agricultural Crops to the Water Sprinkler Systems:

These trials performed in the various parts around the world shows the water savings because of the main sprinkler system ranged especially from the sixteen to seventeen percentage over conventional process with yield increases from three to fifty seven percentage in various crops and agro-climatic conditions as illustrated in the table 1.

Various types of the Sprinkler System:

The Sprinkler system is divided into two main groups, depending to irrigation water spray arrangements [15].

- Perforated Pipe system
- Revolving sprinkler system/ Rotating head system

(i) The Perforated Pipe Systems

It is comprises of the drilled gaps and the nozzles from which water is dispersed under pressure along their length. Usually pipe systems are designed for the relatively very lower (1 kg/cm^2) pressure value. The said application rate for the specific pressure and spacing varies from 1.25 to 5 cm an hour [16-17].

So Based on these factor of the portability, these sprinkler systems will be categorized further into these mention below types listed below:

a) A Portable system:

The portable systems possess some main lines, portable laterals and pumping plants as illustrated in the Fig. 1.

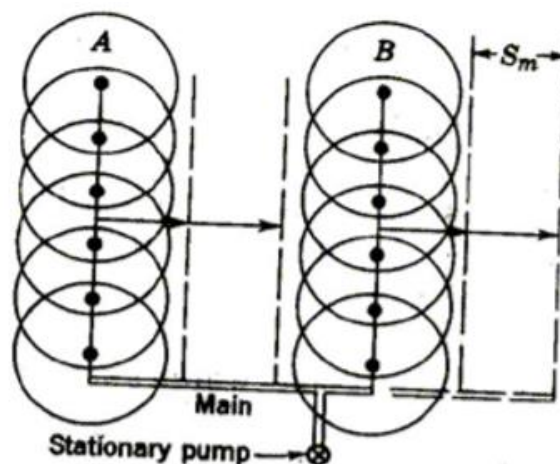


Fig. 1: A completely Portable Irrigation (advance Sprinkler) System

b) half portable systems:

A half portable system resembles exactly to a portable device, the only change seen is in the water supply and the pumping position of plant is kept fixed.

c) Half permanent systems:

A half permanent system basically incorporates the lateral modular pipes, fixed with the main lines and the sub mains, along with a water supply and the drainage office supplies.

d) Completely Permanent system:

A completely permanent network comprises the continuous sub mains, laid mains and the laterals, as well as the reservoir and pumping water supply.

e) Solid type set systems:

A solid type set systems requires the enough laterals so to get rid fully of rotation. These laterals is field positions acquired early during the harvest season and stay for the season.

(ii) Revolving sprinkler system/ Rotating head system:

Tiny size nozzles are mounted around the lateral pipes on the riser pipe that is set at regular intervals, and at the pipes in lateral way are typically laid onto the table. Possibly they are even placed on the posts upper to the height of the field and rotated by ninety degrees to give water the rectangular line. The most common system for spinning the sprinkler heads in revolving style sprinklers are associate with small hammer that get triggered by thrust of the water which is hitting against the vane attached with it.

Selection of sprinkler system and its capacity:

The adopted sprinkler system has to ensure the continuous distribution of water without leakage or erosion. The sprinkler system's distribution rate needs to approximate the penetration rate of the most stringent soil in the region. When the amount of irrigation increases the amount of soil absorption, the water either drainage the farms or migrates inside the fields leading in both over and also in under watered fields. Efficiency of the adopted sprinkler system is exactly same to the flow rate necessary for properly irrigate the region, and it is represented in terms of liters per acre per minute. The efficiency of the network depends on: maximum crop nutrient uptake in the further seasons; successful rooting of crops in depth; soil structure and the infiltration speed, usable presence of soil water retaining efficiency; well or well pumping ability.

Sprinkler Systems and there Maintenance:

The construction of a proper sprinkler device in itself will not qualify for performance. It must be assured, especially for the pumps that are tractor-driven that perhaps are driving force and the pumps are arranged in the alignment. For this, both the pump shaft and also the drive shaft will be positioned with about the similar heights that it can be prevented from inclination towards the universal shaft from being too wide. This automatically let's all fast coupling pipes connect correctly. Moreover assurance about the linkages and rubber seal rings are specially cleaned before meeting couplings.

The engines and motors are operated keeping the valves stopped before operating sprinkler mechanism. The pump are made to achieve the already stated pressure value on the type-plates or else the suction line has a fault. The transmission valve is gradually opened until the pump reaches the controlling load. Likewise, when the control generator is halted the transmission valve is locked. After stopping, pipes and sprinkler-lines are moved

as required. The decommissioning of the installed setup happens in the similar reverse orders of the above mentioned procedure of assembly.

CONCLUSION

Throughout these African countries, the overarching government agenda is to foster social and economic growth through irrigated agriculture that is sustainable over time, economically rational, politically feasible, socially acceptable and technologically sound, without having undesirable environmental impacts. Irrigation improvement projects do need to help as many households as possible, particularly those belonging to the rural community's most disadvantaged communities. Development of irrigation, particularly small-scale irrigation, would be an essential component of a diversification and expansion strategy to improve future food security.

There is a need to recognize crops and irrigation strategies that will give the irrigation water and total investment higher returns. The best and most economical water uses for irrigation by sprinklers are important for any irrigation production strategy. The findings and suggestions which may be applicable for the four countries covered are as follows. If extra irrigation is required or if no definitive device is in place, small portable sprinkler systems can be temporarily installed on the lawns. These are also fastened to a domestic water tools and put into for a very short amount of period. Some devices could be mounted permanently in the earth properly, moreover these connected to the piping system of a household permanently. Water is circulated into a network that is constrained of valves, pumps, sprinklers and the wires. The used Sprinklers for irrigation could also be utilized for the domestic, commercial, and the agricultural use. It is significantly useful for rocky terrains the regions suffering from not enough rainfall, also for the sandy soil it is a must. The perpendicular pipelines are made to join the main system of pipelines at the regular intervals of the time, with spinning nozzles at the rim.

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