College of Agriculture Engineering Sciences

Soil and Water Department

3rd stage (Irrigation System)

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Irrigation System (Center pivot)

What is Center pivot irrigation?

Center pivot irrigation is a mechanized sprinkler system that irrigates crops in a circular pattern. In this type of system, a long pipeline rotates around a central pivot point. This system is common in flat areas.

Components of the Center Pivot Irrigation

1-The Pipeline

The long irrigating pipeline with water emitters (sprinklers) can be from 140 to 250 mm in diameter, according to the system flow and the length; standard sizes of approximately 160 mm (6 inches) and 200 mm (8 inches) are very common.

The length of the pipeline can be from 50 to 750 meters according to the design. It is made of high material galvanized light steel or aluminum.

2- The water emitters

The water emitters, computerized sized and spaced for high uniformity of application, are mounted on the pipeline at the spacing of 1.5 to 3.0 m. according to the type of sprayer emitters, and operation.

The discharge rate of the emitters along the pipeline is not the same but varies **from lower values near the center to higher ones towards the outer end**


3- Sprinkler Gun

A sprinkler gun is placed at the end of the overhang pipe and may increase the length of the line by its sprinkling radius

3- The Central Tower

This is a pyramidal structure of about 3.5 – 4.5 m in height, built up with galvanized steel

It is the head of the system and carries all equipment necessary for the control of the system

4- The Center Pivot System Control

A System Control, protected in a cabinet, is installed on the pivot central tower. It is control of flow and pipeline movement–operation time and speed/time per lap, Automatic starter, position stop device.

5- Drive towers

The main pipe, on which the emitters are mounted, is supported over the ground by wheeled towers.


Selection Criteria for The Installation of The Centre Pivot Irrigation Systems

- **The Size and shape of the field**

The area should be relatively level.

- **Type of soil**

The soil should be of medium to light texture with a high infiltration rate of >15 mm/h and good internal drainage.

- **Water quality**

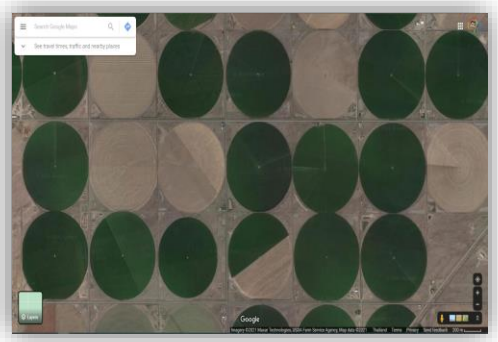
The water should be of normal pH, free from suspended solids, salinity hazards, sodium hazards, and toxicity problems.

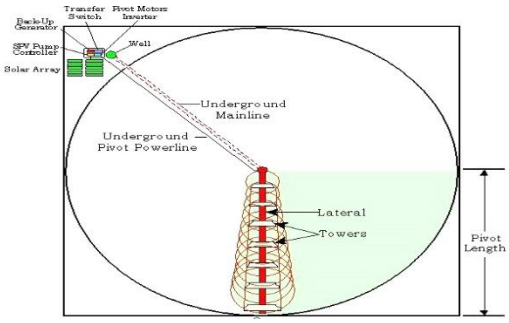
- **Kind of crops**

Winter Crops (Wheat, barley, Chickpeas, Lentils) Industrial Crops (Soybeans, Maize, Sunflower), Other Crops (Leafy Vegetables, Groundnuts, Watermelons, Lucerne etc.)

The main steps design of the Center Pivot irrigation

- Determination of the irrigated area, the length of the CP radius, and the crop's main characteristics
- Calculation of the crop irrigation requirements at peak demand and soil available moisture
- Irrigation schedule (dosage, daily operating hours, and interval)
- System main characteristics





How to calculate the area irrigated by the center pivot

Because the irrigate by a center pivot is the circle, we can calculate the circle's area by knowing the tower's length.

$$A = \pi r^2$$

A= area irrigated by a center pivot (ha) and r = length of the tower (m)

Example:

Calculate the area of the field irrigated by the center pivot if you know the length of the towers is equal to 130 meters and the shout distance of the gun equal to 35 meters.

Select the velocity of the Center pivot

In general, the velocity is calculated by the following equation:

$$V = \frac{L}{t}$$

V= velocity of center pivot system (m/hr), L= perimeter of the circle is irrigated by a center pivot (m), and T= time (hr)

$$L = 2\,\pi r$$

Example 2:

Select the suitable velocity of the center pivot if you want to continue one shift per 12 hr and know the length of the towers is equal to 140 meters and the shout distance equal to 30 meters.

Class Rom Activity

Calculate the area of the field and the times need to continue one shift of the center pivot if the velocity of this is equal to 118 m/hr if you know the length of the towers is equal to 170 meters and the shout distance of the gun equal to 25 meters.