5 - SUMMARY

This work aims to evaluate sprinkler irrigation systems and equipment used in Egypt . Since , sprinkler head is the main part of sprinkler irrigation equipment , different types of sprinklers (Rain Bird 30 , Rain Bird 70 , and Rolland were tested under different operating pressures (0.15 , 0.20 , 0.25 , 0.30 and 0.35 MPa) in order to study their performance .

Hand - move , side -roll , solid - set and center - pivot systems were also investigated under field operating conditions

The results can be summarized as follows :

- Increasing pressure from 0.15 MPa to 0.35 MPa always causes better water distribution pattern close to the ideal one, associated with increasing in the water application rates over most of the wetted area and increasing in the maximum trajectory radius for all the sprinkler types.

- The highest alues of the effictive radius (11-12 m) and the average application rates (3-3.3 mm/h) were observed at the highest operating pressure mainly 0.3 MPa for Rain Bird 40 and Rolland sprinklers and 0.35 MPa for Rain Bird 70 sprinkler head.

- The correct operating pressure range from 0.25 - 0.30 MPa for Rain Bird 30 and Rolland sprinklers and from 0.3 - 0.35 MPa for Rain Bird 70 sprinkler according to the known requirements of water application rate, spacing and soil surace

condition and should be maintained fixed throughout the irrigation period. Lower pressure causes non-uniform water distribution .

- Using the local manufactured Rain Bird 30 type sprinkler head on hand move system operating at 0.20 or 0.25 MPa pressure with sprinkler spacing of 12x12 m or 12x18 m gave the best water distribution cefficient (CU) ranging from 76% to 87% . Using similar size sprinkler head of type Rolland (French made) at the same condition gave less water distibution uniformity coefficient (CU) ranging from 65% to 73% only .

- For energy conservation, installing the locally made Rain Bird 70 sprinkler type on hand move laterals at spacing of 18x18 m provided sufficient uniformity of water distribution (CU equal to 85%) when its operating pressure was maintained at 0.3 MPa instead of 0.35 MPa (CU equal to 86.5%) . Also, 0.3 MPa pressure produces lower application rate than 0.35 Mpa , and it may be compatible with the soil intake rate.

- Values of CU and DU for side - roll system were less than those of hand move system by about 10-15%, and this may be attributed to the effect of the height of sprinkler above the ground. Therefore, side - roll system should be equipped with sprinklers on risers with minimum height of 50 cm above normal height of irrigated crop, in order to improve its water distribution uniformity.

- Using the plastic sprinkler head type "Rolland" with spacing of 15x15 m was appropriate for solid set or fixed system and more economical than the similar size made of bronze .

- Average application rates for center pivot systems were 8mm and 6mm for low pressure at 17.5 h/rotation and high pressure at 21.7 h/rotation resp.

- CU and DU values were higher (89% and 83%) for the low pressure center pivot than those for high pressure center pivot (77.6% and 68.2%).

- The water losses from sprinkler irrigation systems ranged between 10 and 40% according to the operating pressure and meteorological condition .

- Data of the total irrigated area covered by each sprinkler system during 4 days irrigation cycle were graphically plotted for different water irrigation depths and various application rates (operating pressures). against daily operating time. These graphs help in selecting the most appropriate system and the operating conditions that fit the soil type, the crop water requirements and the availability of operators during the day time (allowable operating time perday).

- The maximum field capacity of the system with its different affecting factors as determined was simplified by

the following linear equation:

$$A = K\ (t.I/d)$$

where:

A : is the total irrigated area in (feddan).

d : is the water requirement in mm per irrigation.

I : is the water application rate in mm per h.

t : is the daily operating time in hours.

K : is a constant depending on no. of sprinklers, spacing, irrigation cycle and field efficiency of the sprinkler equipment.

$$\left(K = \frac{N(S_l \times S_m)}{4200} \cdot \eta_f\right)$$

- Investment cost was estimated for different systems : 125%, 412%, 180% and 182% for side roll, solid set, center pivot (low pressure) and center pivot (high pressure) respectively, taking hand-move system as a base of the comparison (100%).

- The lowest cost of operation per houre was for hand move (12.5 L.E/h) and the cost of side roll (12.99 L.E/h).

- The highest total irrigation cost L.E/fed/irrigation was the cost of the high pressure center pivot which is 134% for the hand move and 173% for the cost of low pressure center pivot.

- The most economical sprinkler irrigation system was the side roll system, followed by the low pressure center pivot

system, since their costs were 63% and 77% of the cost of the hand move system respectively.

- Selecting sprinkler irrigation equipment should be on the basis of the economical and the technical evaluation, taking into consideration the adaptability of the sprinkler equipment to the conditions of the area irrigated.