


Research Paper

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A Comparative Study of Sprinkler Irrigation and Surface Irrigation for Wheat Crop

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ABSTRACT

A comparative study of sprinkler irrigation and surface irrigation for wheat crop is carried out at Middle Gujarat zone. Wheat is the most important cereal crop cultivated in middle Gujarat zone. The farmers are applying higher irrigation than the crop requirement. For middle Gujarat zone, the irrigation requirement of wheat crop is about 6 irrigations each of 60 mm depth. Due to heavy irrigation the problems like rise in water table, water logging and secondary salinization are increasing in this area. Any method to reduce in total water requirement will help in overcoming and prevention of such adverse effects. The sprinkler method of irrigation has been proved to be the most suitable for wheat crop.

Keywords : Sprinkler irrigation, wheat, benefit-cost ratio, water use efficiency.

INTRODUCTION

Irrigation water may be applied to crops by flooding it on the field surface, by applying it beneath the soil surface, by spraying it under pressure or by applying it in drops. The common methods of irrigation are surface irrigation, sub surface irrigation, sprinkler irrigation and drip irrigation.

In the sprinkler method of irrigation, water is sprayed into the air and allowed to fall on the ground surface somewhat resembling rainfall. The spray is developed by the flow of water under pressure through small nozzles. The pressure is usually obtained by pumping. With careful selection of nozzle sizes, operating pressure and sprinkler spacings the amount of irrigation water required to refill the crop root zone can be applied nearly uniform at a rate to suit the infiltration rate of soil.

Sprinkler irrigation methods are needed for more scientific and economic use of water for food production. This method prevents soil deterioration in the form of scouring, packing and crusting of soil, rise in water table, disposal of fertile top soil, reduction of soil permeability etc. Moreover the method is best suited for irregular topography, sloping grounds, fields containing crops with different water requirements. It can serve a large number of farmers with the same supply line.



Fig. 1: Sprinkler Irrigation

STUDY AREA

The State of Gujarat, situated on the West coast of India has a total geographical area of about 188 thousand sq km with an average population density of 174 per sq km. The ever increasing demand of water due to rapid growth in various sectors has created tendency to harness available water resources at an unsafe rate at various regions of the state. This has led to various water management problems. The state has around 25 lakh ha under irrigation accounting to 26 per cent of total cropped area. Eighty per cent of this is irrigated by wells, 18 per cent by canals and 2 per cent by other resources, mainly tanks. The Central Gujarat area is taken under the comparative study of sprinkler and surface irrigation.



Fig. 2: Map of Gujarat

RESULTS AND DISCUSSIONS

Table 1: Grain yield, water applied and water use efficiency due to different irrigation method and its irrigation levels

Particulars	Sprinkler method IW/CPE ratio			Surface method
	0.60	0.80	1.00	
Yield (kg/ha)	2704	3183	3614	2779
Total water applied (mm)	210	260	310	420
Water use efficiency (kg/ha/mm)	12.9	12.2	11.7	6.6
Saving in water over control (%)	50	38.1	26.2	

INTERPRETATION:

The first year results showed that with the application of 310 mm water through sprinkler, the grain yield of wheat was statistically higher than that obtained with 420 mm of water applied through surface method. In the second and third years of the experiment, there were no significant difference among the treatments indicating that 0.6 ratio with sprinkler was as good as surface method. Under the treatment 0.6 ratio of sprinkler with 56% saving in irrigation water 1.3 ha additional area can be cultivated. The ultimate return per mm of water used was maximum in these treatments.

Pie-chart 1: This shows that amount water saved in sprinkler method is 75% as compared to other irrigation methods, where water saving in border, check basin & furrow method are 8%, 8% & 9 % respectively.

Pie-chart 2: This shows that yield increase in sprinkler irrigation method is higher as compared to other methods. The yield increase in sprinkler method is 69 % than border method 11%, check basin method 10% & furrow method 10 %.

CONCLUSIONS

Efficient irrigation systems are cost-effective. However, many systems are not efficient resulting in water wastage, increased energy use and reduced profits. The wheat growing farmers of middle Gujarat zone (AES-II) under the situation of irrigation water constraint and enough land availability are advised to irrigate their crop through sprinkler to save about 56% of irrigation water. The crop needs five irrigations to be given at an interval of three weeks including the first irrigation at the time of sowing. The system should be laid at 12.0 m x 12.0 m spacing and should be operated at 2.75 kg/cm² pressure to get 1.67 cm/hr application rate. The set should be operated for 3 hours per irrigation for a total application of 50 mm. Sprinkler irrigation methods are needed for more scientific and economic use of water for food production. This method prevents soil deterioration in the form of scouring, packing and crusting of soil, rise in water table, disposal of fertile top soil, reduction of soil permeability etc. Moreover the method is best suited for irregular topography, sloping grounds, fields containing crops with different water requirements. It can serve a large number of farmers with the same supply line.

REFERENCES

Irrigation theory and practice by A. M. Michael | Irrigation engineering and hydraulic structures by S. K. Garg | Irrigation, water power and water resource engineering by Dr. K. R. Arora | Civil engineering by R. Agor | en.wikipedia.org/wiki/Irrigation_sprinkler