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Plot Size Studies in Forage Oat Under Two Methods of Irrigation

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ABSTRACT

The data on green forage yield of oat were collected from the uniformity trial conducted under two methods of irrigation, viz., surface and sprinkler method. C.V. % per unit area was more under sprinkler irrigation than that for surface irrigation. The cause of large variation in forage yield under sprinkler irrigation was also studied. The results revealed that the optimum plot size for field experimentation on forage oat is of 6 units (14.4 sq. m.) in case of surface irrigation and of 8 units (19.2 sq. m.) in case of sprinkler irrigation.

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INTRODUCTION

The results of any field experiment subject to variation not only due to the treatments under study but on account of soil and weather factors over which one has very little control. The uncontrolled variation (experimental error) can be reduced by proper planning of field experiments. The size and shape of the experimental plots play vital role in the precision of the experimental results (Day, 1920; Swanson, 1930; Hutchinson and Panse, 1935; and Patel and Patel, 1968). Like land, irrigation facility is also a limiting factor on the research farm. Sprinkler irrigation is now becoming popular because of its many fold advantages. The information on plot size for field experimentation under normal method of irrigation (surface) may not be useful for direct adoption under sprinkler irrigation. The present investigation was, therefore, undertaken during the year 1976-77 with a view to determine an optimum plot size for field experimentation on forage oat under two methods of irrigation viz., surface irrigation and sprinkler irrigation.

Experimental :

Uniformity trial in forage oat was conducted to collect the necessary information for this investigation. The crop was sown in rows 0.30 m apart at IDC Project Farm, Gujarat Agricultural University, Anand Campus, Anand. Half the area was irrigated by surface irrigation method and remaining half by sprinkler irrigation method. Seven blocks each of 48 rows x 20 m long were harvested in units of 4 rows x 2m length each, giving 120 units per block. Thus the dimensions of the basic unit were 2 m length and 1.2 m width. There were 840 units under each method

of irrigation. The green fodder weight was recorded separately for individual units.

Statistical :

The plots of size 2,3,4,5,6,8,10,12, 15,20,24,30 and 40 units were formed by combining adjacent units both lengthwise as well as breadth-wise. The C.V.% per unit area for various sized plots was estimated. The method "point of maximum curvature" is used to select optimum plot size.

Variation in water discharge in sprinkler system :

Michael (1969) noticed about 10 per cent difference in the discharge (pressure loss) of the first and last sprinkler points, in a carefully designed sprinkler system. Hence it was thought worthwhile to study the variation in water discharge of the sprinkler system available with IDC farm, so that such variation, if required, may be coupled with the variation in the forage yield to help decide plot size. To measure water

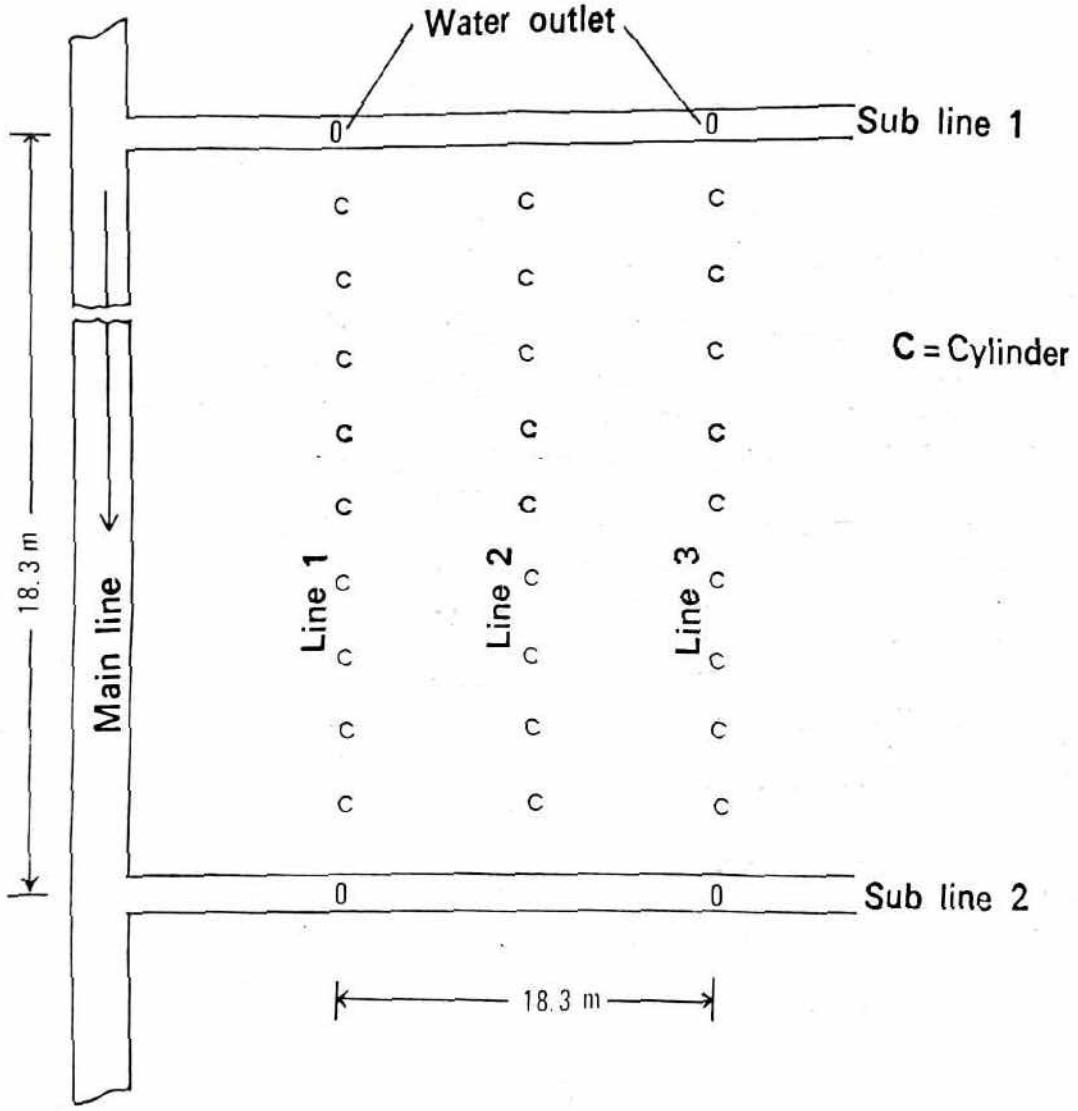

TABLE 1

Water discharge collected in the sprinkle system, cm/hr.

Cylinder Number *	*Line 1*	*Line 2*	*Line 3*	*Average*
1	1.44	1.07	1.75	1.42
2	1.60	0.95	1.83	1.46
3	1.36	0.92	1.53	1.27
4	1.16	0.93	1.15	1.08
5	1.32	0.90	1.07	1.10
6	1.35	1.05	1.32	1.24
7	1.48	1.05	1.61	1.38
8	1.40	1.20	1.53	1.38
9	1.32	1.15	1.17	1.21
A.V.	1.38	1.02	1.44	–

(* Numbering from subline 1 to subline 2)

discharge, 27 measuring cylinders were arranged in three rows each 9.15 meter apart (Fig. 1). The distance between cylinders within row was 2 m. The sprinkler set was run for 5 hours daily at the same experimental site after harvest of the crop, when there was practically no wind. This operation was repeated for four times at every two days interval. The discharge collected in each cylinder was recorded and converted on unit time basis; the results are summarised in Table-1.

The results (Table-1) reveal that the water distribution through sprinkler system over experimental area was uneven. It varied from 0.90 cm/hr in line 2 to 1.83 cm/hr in line 3. A gradient was observed from point to point with in line and also between lines. Such gradient in water distribution may cause variation in seed germination, tillering as well as growth and in the green forage yield of oat.

Comparison of C.V.% for various sized plots :

The separate comparisons were made in both the methods of irrigation on the basis of C.V.% among 14 different size that covered 21 different shapes of plots. The results are presented in Table 2.

The results obtained for surface irrigation and sprinkler irrigation are similar except that there is increase in variability in sprinkler irrigation. Since variation in forage yield due to soil fertility is a common phenomena in both the methods of irrigation, the uneven water spray (Table-1) over cropped field might be responsible for large variation in forage yield of oat under srpinkler irrigation. The rate of reduction of coefficient of variability with the increase in plot size, in general, is more in sprinkler irrigation than that of surface irrigation. Coefficient of variability per unit area decreases with the increase in size of plot in both the methods of irrigation. However, beyond 6 units plot size in case of surface irrigation and beyond 8 unit plot size in sprinkler irrigation, the decrease in coefficient of variability has not been proportional to the amount of land used. The results thus reveal that 6 unit plot (14.4 sq. m.) is optimum for forage oat to be grown under surface irrigation whereas it is 8 unit plot (19.2 sq.m.) for sprinkler irrigation.

Number of Replications :

The precision of a treatment is indicated by its standard error, which largely depends on the number of replications in the experiment. The number of replications required to reduce the standard error of a treatment mean to 5 per cent are worked out, and presented in Table-3.

The results (Table-3) reveal that for a desired degree of precision the number of replications required are more in

TABLE 2

Coefficient of variability (%) per unit area for forage yield of Oat.

Size of plot			*Irrigation method*		*Average for the plot size*	
No. of rows	*Length of row m*	*No. of units*	*Surface*	*Sprinkler*	*Surface*	*Sprinkler*
4	2	1	32.99	42.54	32.99	42.54
4	4	2	19.07	24.37	19.28	25.27
8	2	2	19.49	26.17		
12	2	3	13.53	18.91	13.53	18.91
8	4	4	11.11	15.38	11.11	15.27
16	2	4	11.12	15.16		
4	10	5	9.47	12.47	9.47	12.47
12	4	6	7.39	11.16	7.58	11.25
24	2	6	7.77	11.33		
16	4	8	6.07	8.95	6.07	8.95
4	20	10	5.60	7.45	5.56	7.71
8	10	10	5.53	7.97		
48	2	12	4.31	5.46	4.23	6.10
24	4	12	4.16	6.74		
12	10	15	3.39	5.73	3.39	5.73
8	20	20	3.37	4.82	3.05	4·65
16	10	20	2.74	4.48		
48	4	24	2.02	3.28	2.02	3.28
12	20	30	1.91	2.42	1.84	2.71
24	10	30	1.75	3.01		
16	20	40	1.48	2.58	1.48	2.58

sprinkler irrigation than that in surface irrigation i.e. to attain a given degree of accuracy, more number of replications or large sized plots are required for experimentation under sprinkler system than surface irrigation system. As a norm, there should be minimum three replications in any field experiments. It can be seen from Table-3 that the 6 unit plot size under surface irrigation and 10 unit plot size under sprinkler irrigation are meeting this requirement. Therefore, the optimum plot size for respective system of irrigation is 6 and 10 unit sized plots. In case of sprinkler irrigation, beyond 8 unit plot size,

TABLE 3

Number of replications required to reduce standard error to 5 per cent.

Basic unit	*No. of replications required*	
	Surface	*Sprinkler*
1	44	73
2	15	26
3	8	15
4	5	10
5	4	7
6	3	5
8	2	4
10	2	3

the decrease in variability is not proportional to the amount of land used. The results thus lead to the inference that the 6 unit and 8 unit plot size are optimum plot size for field experimentation on forage oat to be grown respectively under surface and sprinkler irrigation method.

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