

Check Basin Size for Irrigating Chick-pea in Heavy Black Soils

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ABSTRACT

An experiment was carried out to find the proper size of check basin and corresponding optimal flow rate for irrigating chick-pea (*Cicer arietinum*, cv. 'Dahod yellow') in black cotton soil of South Gujarat at the Main Irrigation Research Centre, Navsari during November to March 1979-80 and 1980-81. The study was conducted on four sizes of check basins (50 m², 72 m², 98 m² and 128 m²) and three inflow rates (3.0 l/sec, 4.5 l/sec and 6.0 l/sec). The statistical analysis of the data indicated that the check basin of 50m² size with 3.0 l/sec inflow rate was suitable for irrigating chick-pea.

(Received on 30th Aug. 1982)

INTRODUCTION

The check basin method of irrigation is by far the most common method of irrigation in India and many parts of the world. This method of irrigation is well suited for a wide variety of crops and soils. The pattern of irrigation and sizes of check basins, however differ considerably from place to place depending upon the local conventional practice followed by the farmers, who generally do not possess sufficient knowledge regarding the proper sizes of check basins and inflow rates for various crops and soils. For the given soil characteristics of a region, with a suitable combinations of plot size and inflow rate, it is possible to apply required amount of water uniformly throughout the basin.

Information to recommend the optimum size of check basin for efficient use of water is scanty. Ram *et al.* (1976) reported that the highest wheat

yield was obtained in the check basin of 5m x 5m on sandy soil. Yadav (1973-75) reported that maximum wheat yield (25.47 q/ha) and water use efficiency (109 kg/ha/cm) were obtained in check basin of 250 m² size and non-erosive inflow rate on sandy loam soils. Slabbers (1971) carried out study at the Marvedasht pilot project at Iran and found that a rectangular basin size of 25m x 10m was best for growing sugar beet in sandy loam soils. Wayse *et al.* (1980) reported that in clayey soils, check basins of 8.33m x 6m size with 8 l/sec inflow rate was suitable for irrigating wheat crops. It was further reported that rectangular shape was superior to other shapes. Hence the soil type, crop and flow rates are the major factors affecting the check basin size considerably.

Chick-pea, which is one of the major pulse crops in India, is normally grown under unirrigated conditions. However, recent studies (Joshi *et al.*,

1979) have indicated that giving three irrigations the yield can be increased substantially. Since the normal practice of growing pulse crops in this country is by adopting check basin system, it follows that a properly designed check basin under irrigated condition will improve the water application efficiency and the production of chick-pea.

MATERIALS AND METHODS

The experiment was conducted at the Main Irrigation Research Centre, Navsari, India during November to March of 1979-80 and 1980-81 in levelled heavy black soils having pH 7.95, EC 0.37 millimohs/cm field capacity 32.44%, permanent wilting point 17.20%, clay content 62% and bulk density 1.42 g/cm³. Chick-pea (cv. Dahod yellow) with 30 cm x 15 cm spacing was sown on 28th November and 21st November in the year 1979 and 1980 respectively. The experiment was laid out in split plot design with four sizes of rectangular (2 : 1 length breadth ratio) check basins, namely, 50m², 72m², 98m² and 128m² and three flow rates, namely 3.0, 4.5 and 6.0 l/sec replicated three times. Width of the irrigation channels and the peripheral bunds of the check basins were 60 cm and 30 cm respectively. Infiltration rate was measured by concentric cylinder infiltrometer. Water

TABLE 1

Water application, storage and distribution efficiencies of chick-pea as influenced by check basin sizes and inflow rates.

Check basin area (m ²)	Water application efficiency in percentage for flow rates			Water storage efficiency in percentage for flow rates			Water distribution efficiency in percentage for flow rates		
	3.0	4.5 (1/sec)	6.0	3.0	4.5 (1/sec)	6.0	3.0	4.5 (1/sec)	6.0
50	87	88	82	70	67	42	96	93	94
72	86	87	84	71	68	70	93	91	90
98	83	87	86	66	69	69	90	94	95
128	84	87	83	68	67	67	92	94	95

discharge was measured by Parshall measuring flume. Soil moisture was determined gravimetrically just before and after 24 hours of irrigation at 0-15 cm, 15-30 cm, 30-45 cm, 45-60 cm and 60-75 cm soil depths to estimate different irrigation efficiencies. A light irrigation of 4 cm was applied for germination just after sowing. Three more irrigations each of 7.5 cm were applied at branching (30-35 days), flowering (55-60 days) and pod formation (70-75 days) stages of chick-pea as per recommendation of this centre. During the year 1981-82, a large scale trial was taken on a plot of 71 m x 90 m with the recommended check basin size and flow rate for testing the applicability of result in farmer's field.

RESULTS AND DISCUSSION

Infiltration rate

The cumulative infiltration rate equation was developed as $d=1.01 t^{0.38}$ where d is cumulative depth of infiltration in cm and t is elapsed time in minutes. The fit was found to be good. The instantaneous rate $I=0.38 t^{-0.62}$ can be obtained from the above equation.

Water application, storage and distribution efficiency

The values of efficiencies for different check basin sizes and inflow rates are given in Table-1.

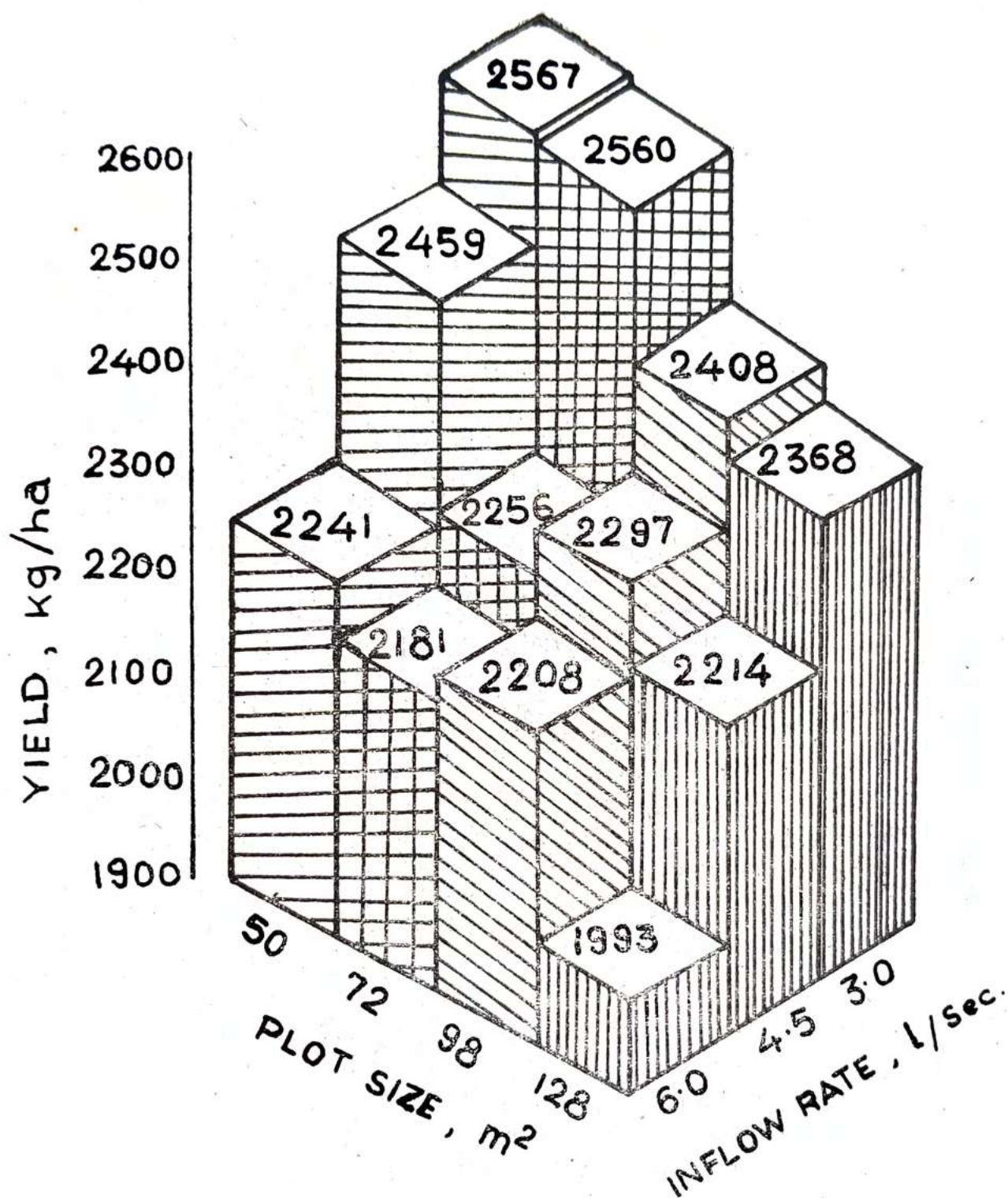


FIG: I EFFECT OF DIFFERENT PLOT SIZES AND INFLOW RATES ON YIELD OF CHICK-PEA

The efficiencies of water application were 87% and 88% for the 50 m² plot size with 3.0 l/sec and 4.5 l/sec flow rates respectively and were significantly superior over other treatments. The efficiencies of water storage of 70% and 71% for plot sizes of 50 m² and 72 m² with 3.0 l/sec flow rate were found better compared to other treatments. The highest distribution efficiency of 96% was obtained for the treatment combination of 50 m² check basin size and 3.0 l/sec inflow rate.

Yield

The average yield for two years for different treatments combinations of plot sizes and inflow rates are given in Fig. 1. An analysis of pooled data (Table 2) on yield of the crop revealed that yield for all the three discharge rates were significantly different from each other. The highest yield was obtained from 3.0 l/sec discharge rate. As far as plot size is concerned, it falls in three contrasting groups viz.

TABLE 2

Yield of chick-pea (q/ha) as influenced by check basin sizes and inflow rates.

Check basin area (m ²)	Grain yield for inflow rates of			Mean yield
	3.0	4.5	6.0	
	(l/sec)			
50	25.67	24.59	22.41	24.22
72	25.60	22.56	21.81	22.32
98	24.08	22.97	22.08	23.04
128	23.68	22.14	19.93	21.92
Mean yield	24.76	23.07	21.56	—
		<i>S.Em</i> ±	<i>C.D.</i>	<i>C.V.</i>
		(q/ha)	at 5%	(%)
Inflow rate		0.27	0.88	5.72
Check basin size		0.24	0.69	4.92
Interaction		0.42	N.S.	

(i) 50 m² (ii) 72 m² and 98 m² and (iii) 128m². The highest yield was obtained from 50m² plot size. Analysis of variance for pooled data indicated no interaction between inflow rate and check basin size. Thus check basin size of 50 m² rate would give highest yield.

The large scale trial (1981-82) of 50 m² check basin size and 3.0 l/sec inflow rate gave average net plot yield of 30.88 q/ha and gross yield of 27.21 q/ha. It was higher than the highest yield obtained from the experimental trial. It indicated that the recommended treatment combination would sustain higher yield in farmers field.

In heavy black soils operation of levelling within plot for irrigation is tedious and it is more labour intensive so as the size of check basin increases. In this paper, study shows that the treatment of 50 m² check basin size with 3.0 l/sec inflow rate gave the highest yield. With regard to other irrigation parameters namely water application, storage and distribution efficiencies, the same above mentioned treatment was superior to other treatments. Hence, the treatment of 50m² check basin size and 3.0 l/sec inflow rate is suitable for growing chick-pea in irrigated condition under similar agro-climatic conditions of South Gujarat.

ACKNOWLEDGEMENT

The authors are thankful to Dr. A. K. Bhattacharya and Dr. T. J. Khatri, Professor and Head of Agricultural Engineering and Associate Professor of Statistics respectively for their valuable suggestions. Thanks are also due to the Indian Council of Agricultural Research, New Delhi for financing the project on Water Management under which the work was carried out.

REFERENCES

- Joshi, R. S., Desai, N. D. and Panchal, G. N., 1979. Maximising production of gram through proper irrigation. *Guj. Asso. Agril. Sci.*, June, '79: 151-156.
- Ram, R. S., Jain, T. C. and Jain, K. C., 1976. Evaluation of check basin method of irrigation for wheat crop in light soils. *Indian J. Agric. Sci.*, **46** (2): 81-87.
- Slabbers, P. J., 1971. Design criteria for basin irrigation systems. F.A.O. Irri. and Drain. Paper No. 3 : 15.
- Yadav, J. S. P., 1973-75. Annual Progress report of I.C.A.R. scheme on Water Management and Soil Salinity.
- Wayse, U. S., Gore, K. P. and Singh, J. K., 1980. Check basin size for irrigating wheat crop in clayey soils. *J. Instt. Engg. (India)*, **6 I** (ND1): 27-29.