CHAPTER - I

INTRODUCTION

The gross cropped area in agriculture is estimated to have increased from 165.8 million hectares in 1970-71 to 168 million hectares in 1979-80 in the country. It is anticipated that the gross cropped area will increase to 179.7 million hectares by 1984-85 and 188 million hectares by 1994-95. There is limited scope for bringing additional area under cultivation. Therefore the possible alternative to food production is by adoption of multiple cropping. Since the distribution of rainfall with respect to time and space has been highly variable and practically no rainfall occurs in most of the part of the country in post monsoon period during rabi(Winter season), the increase in gross cropped area and stabilised production is possible, by provision of irrigation facilities. The irrigated area has increased from 38.19 million hectares in 1970-71 to 55 million hectares in 1979-80. It is estimated that an ultimate irrigation potential of the order of 113 million hectares could be created from all the sources by 2000 A.D.

1.1 Status of Ground Water

The estimated net recharge available for ground water development in India is about 85 million hectare-metres per annum. The working group of the Planning Commission's Task

Force on Ground Water Resources (1972) estimated that the total usable ground water potential would be only 75 to 80 per cent of the net ground water recharge available and thereby recommended a figure of 26.25 millions hectare-metres per annum as the long term potential for the ground water development in India.

The sixth Plan of the Government of India envisages that the gross irrigated area would increase to 64 million hectares in 1984-85. It is proposed to bring 51.76 per cent of the gross cropped area under irrigation in 1994-95 as against 29.76 per cent in 1979-80. There is going to be greater stress on conjunctive use of ground and surface water which is considered crucial to sustain long term growth in agriculture. The ground water utilization has been 6.5, 19.8 and 22 million hectares during the period 1950-51, 1977-78 and 1979-80. The yearwise breakup of the target to be achieved during the period 1980-85 is given in the Table 1.1 below:

Table 1.1 Physical targets of irrigation during 1980-85

Year	Additional irrigation targets, million ha		Total
	Surface water additional potential	Ground water additional potential	
1980-81	0.20	1.30	1.50
1981-82	0.20	1.35	1.55
1982-83	0.20	1.40	1.60
1983-84	0.20	1.45	1.65
1984-85	0.20	1.50	1.70
Total	1.00	7.00	8.00

It is obvious from the table that the ground water exploitation per annum is going to be seven times than that of surface water. It is proposed to have the following target for the exploitation of ground water through different sources.

Dug well : 12 lakhs, private tubewells - 12 lakhs, Deeptube-wells - 15,000.

The deeptubewells are mostly constructed by government agencies while the shallow tubewells and dug wells by farmers. The hydraulics, technology and economics of construction of shallow tubewells have not received attention it deserves. The latest information regarding shallow and deep tubewells constructed by the government in different districts of West Bengal is presented in Table 1.2. In addition, an estimated number of 50,000 shallow tubewells have been constructed by the farmers.

1.2 Objective of CADP

The Comprehensive Area Development Programme (CADP) was started in different districts of West Bengal in 1974 for all round development of certain selected villages. The programme was started altogether in 16 locations. In each place (CADP) takes care of about 4,000 to 10,000 hectares of land by providing all agricultural inputs to the farmers

Table 1.2 Particulars of shallow and Deep Tubewells Constructed in Different Districts of West Bengal

Sl. No.	Name of the district	No. of shallow tubewells	No. of deep tubewells
1	Bankura	Nil	93
2	Birbhum	Nil	64
3	Burdwan	408	379
4	Calcutta	Nil	Nil
5	Cooch Behar	90	28
6	Derjeeling	Nil	1
7	Hooghly	361	346
8	Howrah	30	131
9	Jalpaiguri	Nil	33
10	Malda	239	187
11	Midnapore	187	325
12	Murshidabad	909	460
13	Nadia	600	591
14	Purulia	Nil	Nil
15	24 Parganas	312	279
16	West Dinajpur	200	142
Total		3336	3058

on no loss no profit basis. One such area is in Debra P.S. in the district of Midnapore. The CADP area lies in the south West part of Debra P.S. It lies between the latitudes $22^{\circ}22'$N and $22^{\circ}27'$N and longitudes $80^{\circ}30'$E and $87^{\circ}36'$E in the survey of India toposheet. It is approachable by Calcutta Bombay national highway and the nearest railway station is Balichak on Howrah Kharagpur route of South Eastern railway. The total area under Debra CADP is 1630 hectares. One of the most important activities of the CADP authority is to supply irrigation facilities to the farmers, specially for rabi cultivation. By way of providing irrigation facilities to the farmers, the CADP constructed 33 deep tubewells in area of 48 sq. km during the year 1974-75. In addition, there exist number of private and government owned shallow tubewells.

1.3 Research Need

Although government constructed a large number of deeptubewells for the purpose of supplying irrigation water, but the shallow tubewells are finding more popularity among the farmers. Because even a big farmer with a land holding of more than 10 hectares is not capable of constructing a deeptubewell. More than half of the total irrigated area in the country receives its irrigation supply from shallow wells, tanks and river diversions.

Although the depth of aquifer in Debra CADP area is large but the length of strainer for shallow tubewell is selected arbitrarily without any scientific basis. The location of the tubewells is selected depending upon the convenience of individual farmers without paying any attention to the recharge and interference phenomena. In fact, suitable data based on actual field experiment are not available by which optimum length of strainer can be selected. Detailed informations regarding discharge, drawdown, cost of irrigation for different penetration ratios are not fully available. As the number of tubewells goes on increasing, it becomes vital to fix their spacing. Detailed information regarding optimum spacing of partially penetrating wells based on ground water withdrawal and recharge is lacking. It is felt necessary to study the discharge drawdown relationships, economics of irrigation for different spacing of a cluster of partially penetrating wells in a command area.

1.4 Objectives

Considering the urgent need for proper ground water utilization in Debra CADP area in West Bengal and elsewhere in the country through construction of partially penetrating wells, research work was initiated at the Agricultural Engineering Department, Indian Institute of Technology, Kharagpur and field research at Salkuti village in Debra CADP area,

West Bengal, India, with the following specific objectives.

i) To analyse the flow phenomenon in semiconfined aquifer for partially penetrating well, develop a theoretical equation relating the variables involved and verify it under laboratory and field conditions.

ii) To develop a mathematical model for optimum depth of penetration of shallow tubewells and test its applicability under field condition.

iii) To analyse the interference phenomena among the cluster of partially penetrating wells and develop design criteria for spacing.

iv) To develop an optimum plan for safe ground water withdrawal in the command area in conjunction with other water resources.