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Research Paper :

Tube well recharge techniques in vertisol of Raisen district of M.P.

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ABSTRACT

Ground water plays an important role in irrigated agriculture. Study area received average annual rainfall of 1327 mm but it is erratic and undependable. The average rainfall of June, July, August and September is 156.3mm, 473.3mm, 371.1mm and 214.1mm, respectively. The irrigated area of the district is 180839 ha in which well irrigated area is 92564 ha. There is good potential for artificial recharge through wells for increasing the productivity of land and for stable agricultural production. Study carried out in Raisen district of M.P. reveals that due to over exploitation of ground water without adequate recharge resulted lowering of water level as well as enhancement of pumping cost. The recharge tube wells resulted in rise in ground water level by 0.7 to 1.97 m per annum. The payback period for the system is nine months.

Key words : Ground water, Tubewell, Recharge, M.P.

Uncontrolled development of ground water resource leads to sharp decline in ground water levels resulting in dwindling of yield or drying up of wells. The vagaries of monsoon add to compounding of water scarcity and drought becomes a recurring features. Ground water management require consideration of efficiency, equity and long term sustainability of ground water resource in term of both quantity and quality at desired levels. Ground water management is essential to balance the exploitation of the resource with the increasing demand of water.

Athaiya, 2002 suggests managemental strategies for protecting as GW resource. Surplus water during monsoon must be conserved and artificially recharged to ground water system. Roof top rainwater harvesting is to be made mandatory in urban areas amending the bylaws.

In Madhya Pradesh annual rainfall varies from 800 to 1600 mm. There is very good potential for rainwater harvesting and recycling for increasing the productivity of land and stable agricultural production. The ultimate usable ground water resources are 350 km^3 out of which 260 km^3 will be available for irrigation. The category wise water used in undivided Madhya Pradesh is given in Table 1.

Table 1 : Category wise water used in Madhya Pradesh (km^3)

Category	1989	2002	2025
Irrigation	303	383	505
Community water supply (Urban)	7	10	18
Power Plants	4	6	15
Industries	10	18	50
Miscellaneous	10	15	40

Source: Mohale and Goel (1996)

METHODOLOGY

Study area detail:

The Raisen area received on average annual rainfall of 1327 mm, about 90% of this is received during June to September as torrential monsoon showers. The average rainfall during June, July, August and September is 156.3 mm, 473.3 mm, 371 mm and 214.1 mm, respectively in Raisen District. The rainfall during 2004-05 to 2006-07 is given in the Table 2.

Table 2 : Rainfall data of Raisen district during 2004-07 (in mm)

Year / Month	2004-05	2005-06	2006-07
June	227.4	95.4	17.2
July	228.6	759.4	337.6
August	442.3	182.1	464.8
Sept.	72.3	165.8	266.9
Oct.	61.6	4.7	1.7

The Table 2 show that in the year 2004-05, the maximum 442.3mm rainfall occurred in the month of August followed by 228.6mm in July.In year 2006-07 maximum 464.8mm rainfall was recorded in August followed by337.6mm in July.

The data in the Table 3 indicated that area under cultivation in *rabi* and *kharif* season are 39700 ha and 138500 ha, respectively. The data revealed that total irrigated area is180839 ha. in which 66,635 ha of the area is irrigated by tubewell followed by 55,573 ha of canal irrigation and 25,929 ha area under open well.

Through tube well, water is drawn from the deep

Table 3 : Irrigated area status of the Raisen district

Category	Area in ha
Canal	55573
Tubewell	66635
Open well	25929
Pond	709
Other	31993
Total irrigated area	180839
Kharif crop area	138500
Rabi crop area	397000

aquifer/ confined aquifer at faster rate than natural recharge rate. It result in to depletion of ground water level in wells of command area. Water level has been lowered up to 30 m in the study area. To mitigate the shortage of water and to avert water crisis, now the time has came to recharge tube well with good quality of water.

Layout of the recharge technique:

A pit of 2.5 to 3 m diameter is excavated to a depth of 3 m around the tube well casing pipe as filtration unit. Perforations of 1 cm diameter are made at distance of 4 to 6 cm on casing pipe at 1 m from ground level up to 3 m depth. Coconut coir is wrapped in the perforated portion of casing pipe. In the circular pit filter material *viz.*, a boulder in bottom depth of 1 m, small boulder/ gravel (80 mm gitti) in the middle 1 m depth and course sand in the upper portion 1 m depth are filled (Fig. 1 and Table 4). This technique is recommendation for tube wells being used for irrigation purpose. CIAE water level indicator is used for measurement of water level in tube wells.

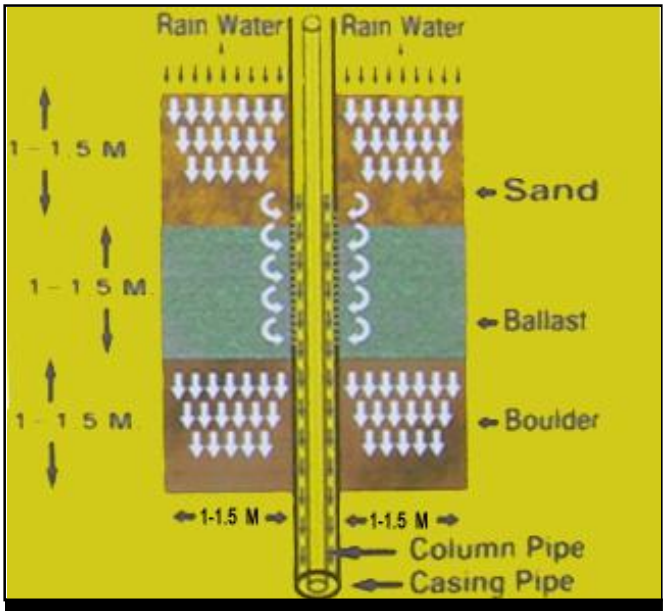

Fig. 1 : Layout design of tube well recharge

Table 4: Dimension of recharge pits

Village	Dimension of recharge pit	
	Depth of pit	Diameter of pit
Hinotia mahalpur	3 m	2.5 m
KVK farm TW No.1	3 m	3 m
KVK farm TW No.2	3 m	2.5 m

RESULTS AND DISCUSSION

Studies carried out in Raisen District of Madhya Pradesh revealed that due to over exploitation of ground water without adequate recharge, resulted lowering of water level as well as yield of wells. The ground water table observation was recorded monthly from tubewells by CIAE water level indicator/measuring tap at Krishi Vigyan Kendra Farm and village Hinotiya Mahalpur (Table 5).

The ground water observations data show that there was significant increase in water level from 23 m (June 05-06) to 10.9m (July 05-06) in tube well No.1 , water level from 21.8 m (June 06-07) to 10.5m (July 06-07) in tube well No.2 at KVK farm and water level from 17.7 m (June 06-07) to 11.9m (July 06-07) in tube well at farmers field in village Hinotiya Mahalpur. Before recharging. Tube well No 1 dried up in the month of May 2005, while after recharging the water level was increased 22.6 m and 23 m in the month of May 2006 and May 2007, respectively. Similar trends were found in enhancement of water level in recharge tube wells (Fig.2).

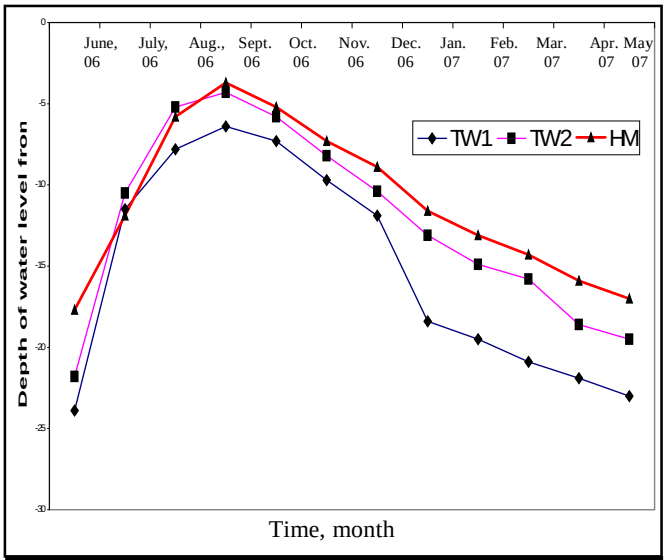

Fig. 2 : Ground water fluctuations in different recharge tubewell during June 2006 to May 2007

The area irrigated through recharge tube well increased from 8.4 ha to 16.7 ha at farmers field. In KVK farm, the increase in area was 4.8 to 7.1ha and 8.1 ha to

Table 5 : Water table below ground level (bgl) from ground level in tube well (in m)

Month	Tube well No.1 At KVK farm			Tube well No. 2 At KVK farm		Tube well At Hinotiya mahalpur	
	05-06	06-07	07-08	06-07	07-08	06-07	07-08
January	-	15.2m	18.4 m	-	13.1 m	-	11.6 m
February	-	17.7m	19.5 m	-	14.9 m	-	13.1 m
March	-	20.7m	20.9 m	-	15.8 m	-	14.3
April	Dry	22.6m	21.9 m	-	18.6 m	-	15.9 m
May	Dry	22.6m	23 m	-	19.5 m	-	17 m
June	23 m*	24.9m	25 m	21.8*m	18.9 m	17.7* m	15.2 m
July	10.9 m	11.5m	13.1 m	10.5 m	12.4 m	11.9 m	12.8 m
August	8.8 m	7.8m	8.6 m	5.2m	7 m	5.8 m	6.4 m
September	6.7 m	6.4m	6.9 m	4.3 m	5.2 m	3.7 m	4.2 m
October	7.9 m	7.3m		5.8 m		5.2 m	
November	10.3 m	9.7m		8.2 m		7.3 m	
December	12.8	11.9m		10.4 m		8.9 m	

* Constructions of tube well recharge system at particular site in the month of June

14.5 ha in tube well no. 01 and 02, respectively in the year 2006-07 (Table 6).

The payback period for the system is 9 months. The cost of techniques was about Rs.6000/-

Table 6 : Irrigated area of the particular tubewell

Village	Irrigated area (in ha)	
	Before Recharge	After Recharge
Hinotiya Mahapur (Farmer field) 2006-07	8.4	16.7
KVK Farm Tubewell no. 1		
2005-06	4.8	7.5
2006-07	4.8	7.1
KVK Farm Tubewell No. 2		
2006-07	8.1	14.5

Conclusion :

The area facing problem of over exploitation of groundwater, the inducement of recharge by artificial methods is very dependable techniques for rehabilitation of such depleted aquifers. The recharging through tube well indicated that irrigated area increased.

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