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Research Article

A COMPREHENSIVE STUDY OF HAVELI SYSTEM OF FARMING IN CENTRAL INDIA

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Abstract- Ground water recharge is now becoming a matter of concern but in Indian agriculture it has always been considered. Haveli system of farming, practiced in black cotton soil area of central India is an age-old practice which gives a good recharge in monsoon and assured good yield in *Rabi.* In Haveli system rain water is held in bunded fields generally from II week of July to the end of October then this water is drained and crops are taken. In order to understand the complete phenomenon of this system this study was undertaken in a Haveli intensive area of Jabalpur district. Patan and Shahpura are two such blocks covering geographical area 60734 ha and 81548 ha respectively and the Haveli area of Patan and Shahpura block was estimated to be 31984 ha and 34533 ha respectively. Three villages, namely Shahsan and Dhaneta of Patan block and Ghunsor village of Shahpura block were selected randomly for the study having Haveli area of 6260 ha, 3940 ha and 14987 ha respectively. Basic information was collected through survey and then Haveli fields were demarcated and dimension of bunds, depth of water stored, moisture after drainage, crops taken and other agricultural practices were studied. A SMW- wise timetable of different activities conducted in this system is prepared. Haveli farmers were divided in four groups *i.e.*, big, medium, small and marginal and relevant information were collected through questionnaire. it was observed that the medium and big of farmers have more adoption of Haveli cultivation. Thus, a complete study of Haveli cultivation was made and presented in this paper. It was concluded that this system is beneficial to farmers as compare to non haveli farmers as they require more field operation, more irrigation, more seed rate and also more fertilizer.

Keywords- Upstream bund, Downstream bund, Side stream bund, Standing water, Weed control, Groundwater recharge

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Introduction

Water is a natural resource, essential for life, livelihood, food security and sustainable development, but it is also a scarce resource. Growing demand for water for industry and municipalities, combined with environmental problems results in less water available for agriculture in the future. India gets a high amount of rainfall but it is not evenly distributed over the space and time. Most of the time, even in a normal rainfall year the precipitation occurs for not more than 50 days and during these rainy days also, it does not fall uniformly over 24 hours. In most of the areas of the country the availability of utilizable surface water is so low that people have to depend largely on ground water for agriculture and domestic and agriculture purpose [1]. Recharge to the ground water occurs through various sources of rainfall, canal, surface water bodies, irrigated fields, water conservation structure and other sources. Rainfall is the principal means for replenishment of moisture in the soil and recharge to the ground water. The intensity and duration of rainfall, soil type, antecedent moisture condition, water table depth and underground strata govern the amount of ground water recharge. Percolation pond and check dam help to recharge the ground water but their limited storage capacity provides a limited augmentation in comparison to rainfall recharge. It is the time to think about traditional methods used to manage water reserves in a sustainable manner [4,5]. There is an excellent traditional water harvesting and runoff farming system, known as Haveli. In this system rain water is stored within the field by making large bunds all around the field. This practice has been followed traditionally since long back in history in central India particularly in the kymore plateau and Satpura hills Agro-climatic zone of Mdhya Pradesh. Harvesting runoff during rainy season and its storage is the first step towards this. This not only conserve moisture in the upper soil but continuous seepage and percolation contribute to ground water recharge also. The contribution of this system in ground water recharge is ignored, not known or known to the wiser persons only and due to these reasons, the system almost disappeared slowly and slowly in spite of all known benefits. [3] Now it is the need of time to rejuvenate this system. In order to achieve this goal, an effort is made in the present paper to have a comprehensive study of *Haveli* cultivation in the central part of the country.

Haveli system of farming

In Haveli system, levelled cultivated fields, surrounded by large bunds, are kept fallow during Kharif season. Rain water is collected in the field and is retained during monsoon and a month later then drained in the month of October. Afterwards, a minimum tillage is required to sow *Rabi* crop. Standing water during Kharif season destroy weeds and provides additional ground water recharge from Haveli fields. In Haveli area soil remains submerged during the rainy season and after drainage a moist seed bed is found at sowing time of *Rabi* crops. The embanking is done either by enclosing the field on all four sides or by building the large bund at the lower end of the field and the field being converted into a small tank during monsoon. In fact, the embanking held up water in the field during monsoon period and ensures sufficient moisture for *Rabi* crops to harvest without rainfall or irrigation from any sources between sowing and harvest. This practice in Haveli area make soil so fertile that it can bear good wheat crop year after year in succession without manure and without irrigation even in years of scanty monsoon rainfall and in the absence of winter rains. Wheat is the main crop in the area while Lentil, Linseed, and *teora* is also grown. It is because of this system the regions could maintain huge reverse of ground water bellow alluvium and produced quality products in pulse and wheat [1].

Methods and Material

In the present study a cluster of villages having large Haveli fields has been undertaken and all the aspects of Haveli cultivation were analyzed, in order to understand system comprehensively. The study was conducted in three villages, namely Shahsan and Dhaneta of Patan block and Ghunsor of Shahpura block of Jabalpur district, having a potential Haveli area of 6260 ha, 3940 ha, and 14987 ha respectively. The entire northern portion of areas is occupied by alluvium, except some of the North eastern portion which is covered by Vindhyan sandstone. The southern part of the block is occupied by rocks of igneous and metamorphic origin. Igneous group includes basalts, whereas metamorphic includes marble schist and Quartzite. This Haveli area is estimated through the formula given below [2].

Potential Haveli area = Geographical area – Forest area – Uncultivable land –Other uncultivable land – Fallow land – Kharif sown area

Results and Discussion

Demarcation of Haveli area

Demarcation of Haveli fields was done with the help of Khasra maps. These demarcated fields are shown through [Fig-1, 2 and 3]. Boundaries of Haveli fields are shown with the dark blue boundaries and those of non-Haveli fields are shown through light black boundaries. It is clear from the figures that the Haveli fields are in majority and their distribution in the entire village is almost uniform, while the non-Haveli fields are staggered. The effect immerged during the survey that this has been an exclusive Haveli area, but with the introduction of soybean in the area few Haveli field are converted in the non-Haveli fields.

Fig-1 Demarcation of Haveli and Non-Haveli fields of Shahsan village

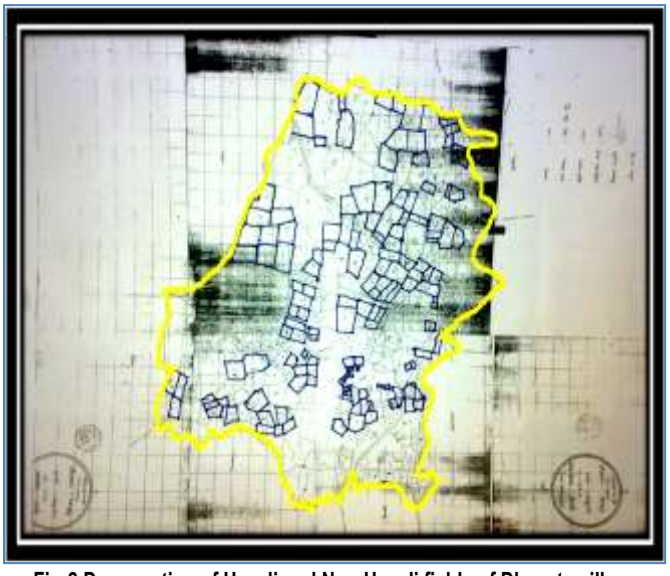

Fig-2 Demarcation of Haveli and Non-Haveli fields of Dhaneta village

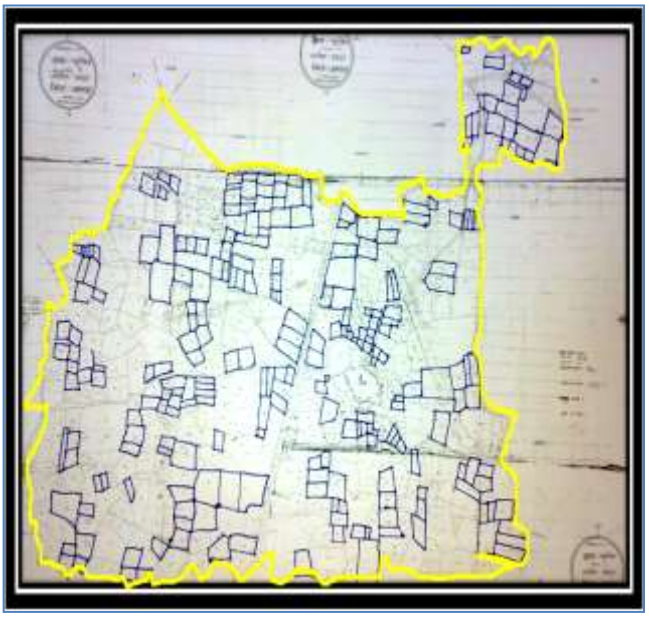

Fig-3 Demarcation of Haveli and Non-Haveli fields of Ghunsor village

Dimensions of Haveli bunds

Haveli fields are surrounded by large bunds. These bunds are classified as upstream bunds (USB), downstream bunds (DSB), side bunds 1 and side bunds 2 based on the direction of the slope of the fields. This has been observed that downstream side bunds are larger in size, and wider also then the upstream bunds. Side bunds are comparatively smaller. Fact observed in the fields that all the bunds are very old and breaching and repairing is a routine of every year. Before the monsoon season, farmer inspects his field and repair. Section is trapezoidal; height is almost uniform throughout the length, some variation is observed which may be due to settlement of the soil in parts. Shape of Haveli fields observed is rectangular. To study bunds, their dimensions and depth of water stored was recorded. In village Sahsan height of bunds varies from 0.9 m to 2.0 m while the width varies from 1.5 m to 3 m and length of bunds varies from 40 m to 210 m. In village Dhaneta height of bund varies from 0.9 to 2.5 m, width varies from 1.2 m to 3.0 m and length of bunds varies from 40 m to 110 m. In case of village Ghunsor the height of bunds varies from 0.9 to 2.0 m, width varies from 1.5 m to 2.5 m and length of bunds varies from 42 m to 112 m. An attempt has been made to find corelation between bund dimensions. The [Table-1] reveals about the correlation between the bund height in different villages Sahsan, Dhaneta and Ghunsor. Coorelation coefficientestmated between bund heights of Sahsan and Dhaneta is 0.427, while the same between Shahsan and Ghunsor comes out to be 0.682 which is higher than the correlation between Dhaneta and Ghunsor i.e. 0.604 and Shahsan and Dhaneta.

Table-1 *Correlation between bund heights of all three villages*

Village	Statistics	Co-relation Sahsan	With the Dhaneta	village Ghunsor
Sahsan	Pearson Correlation	1	0.427**	0.682**
	Number of Bunds	40	40	40
Dhaneta	Pearson Correlation	0.427**	1	0.604**
	Number of Bunds	40	40	40
Ghunsor	Pearson Correlation	0.682**	0.604**	1
	Number of Bunds	40	40	40
**. Correlation is significant at the 0.01 level (2-tailed)				

Table-2 *Mean and Standard Deviation of bund heights*

Villages	Mean	Std. Deviation	Number of Bunds
Sahsan	1.2675	0.50454	40
Dhaneta	1.4150	0.38931	40
Ghunsor	1.4425	0.39736	40

The [Table-3] shows the correlation coefficient between the bund width of the

different villages Shahsan, Dhaneta and Ghunsor. The table indicates that the correlation coefficient between the bund width of Shahsan and Dhaneta was estimated to be 0.243 which is poorly significant where as the correlation coefficient between Shahsan and Ghunsor comes out to be 0.700 which is higher significant than correlation between Shahsan and Dhaneta and co-relation between Dhaneta and Ghunsor i.e. 0.187,

Table-3 *Correlation between the bund widths of all three villages*

Village	Statistics	Co-relation Sahsan	With the Dhaneta	village Ghunsor
Sahsan	Pearson Correlation	1	0.243	0.700**
	Sum of Squares and Cross-products	9.819	2.532	6.674
	Number of Bunds	40	40	40
Dhaneta	Pearson Correlation	0.243	1	0.187
	Sum of Squares and Cross-products	2.532	11.096	1.896
	Number of Bunds	40	40	40
Ghunsor	Pearson Correlation	0.700**	0.187	1
	Sum of Squares and Cross-products	6.674	1.896	9.260
	Number of Bunds	40	40	40
**. Correlation is significant at the 0.01 level (2-tailed)				

[Table-4] shows the Mean of bund heights of villages Shahsan, Dhaneta and Ghunsor are 1.89 m, 1.96 m and 1.87 m respectively, means there are no more difference between bund widths of the Haveli fields where the water were stored. The Std. Deviation of these is also varies between 0.48 to 0.53 of different villages.

Table-4 *Mean and Standard Deviation of bund widths*

Village	Mean	Std. Deviation	Number of Bunds
Sahsan	1.8950	0.50177	40
Dhaneta	1.9600	0.53340	40
Ghunsor	1.8725	0.48727	40

Various activities and their time in Haveli system

Haveli system involves various time bond activities in it. An attempt has been to fit the time table of these activities in terms of SMW. [Table-5] reveals the time of occurrence of different phases of Haveli system besides this use of stored Haveli water is also shown in terms of Singhara cultivation and lift irrigation for the crop in nearby area. In well leveled Haveli fields water is filled till the upper limit of the field during monsoon season, the average depth of Haveli water storage depends on the size of bund. Stored water released from Haveli fields during 39 to 40 SMW. The drainage is made through the lowest elevation point of the Haveli field, when suitable field conditions develop *Rabi* crops are sown with minimum tillage by animal or tractor drawn implements.

Table-5 *Time table of Haveli system*

SMW No.	Summer operations after *Rabi* harvest	Ponding of water in Haveli fields	Recharge in Haveli fields	Drainage of stored water	Period to get field condition	Direct sowing of *Rabi* crop	Singhara cultivation and lift Irrigation from stored water
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Percolation through Haveli fields

In order to determine the rate of percolation from Haveli fields, three sites were selected in haveli areas. The peculiar characteristics of Haveli fields are that they have typical medium and deep black soils [4]. Depletion was measured with the

help of gauges installed in the fields. The water storage in the fields follows the rainfall pattern. Due to initial storms there was storage up to 60 to 70 cm in Shahsan village, which was reduced to 25 cm and then again secured as and when rain occurred and it was ranging from 40 to 60 cm, whereas at another site at same location it was ranging from 25 to 45 cm. At Ghunsor village storage depth ranged from 65 to 70 cm in initial period to 60 to 80 cm during peak time and then reduced to 30 to 50 cm at the end of season. In village Shahsan and Dhaneta of block Patan the percolation rate was found as 1.3 cm/day in initial monsoon period, which reduced to 0.6 cm/day in later period of monsoon. In village Ghunsor of block Shahpura, the initial percolation rate was 1.0 cm/day did not change even at later stage. The reduction in percolation rate of Haveli fields as affected by duration of monsoon may be attributed to the saturation of the fields due to input of moisture received from rainfall.

Conclusions

Following conclusions can be drawn from this study

- Haveli cultivation is beneficial due to less investment and increased output.
- In village Sahsan height of bunds varies from 0.9 m to 2.0 m while the width varies from 1.5 m to 3 m and length of bunds varies from 40 m to 210 m.
- In village Dhaneta height of bund varies from 0.9 to 2.5 m, width varies from 1.2 m to 3.0 m and length of bunds varies from 40 m to 110 m.
- In case of village Ghunsor the height of bunds varies from 0.9 to 2.0 m, width varies from 1.5 m to 2.5 m and length of bunds varies from 42 m to 112 m.
- Correlation coefficient between the bund height of Shahsan and Dhaneta was estimated to be 0.427
- Correlation coefficient between Shahsan and Ghunsor comes out to be 0.682.
- Correlation between Dhaneta and Ghunsoris 0.604 and Shahsan and Dhaneta.

Application of research: Haveli system of farming is an easy non –expensive technique method of ground water recharge, weed control and assured good yield (both in quality and quantity) in *Rabi* season. Now the Haveli area is reducing due to Soybean cultivation. This study may be helpful to rejunvate Haveli system.

Research Category: Haveli system of farming, Bund dimensions, Activities, Weed control, Ground water recharge.

Abbreviations:

SMW : Standard Metrological Week
m : Meter
USB : Upper Stream Bund
DSB : Down Stream Bund

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