Short Communication

Conversion of Wasted Land to Water Storage Tank and Its Utilization for Increasing the Crop Productivity in Malwa Region – A Case Study

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It is being experienced in most of the villages in India that the cultivated area is reducing day by day due to various reasons viz. increasing population, urbanization, industrial development and negligence by absentee farmers (Anonymous, 2013) and thus per capita land availability is reducing day by day (Kokate, 2012). Further, development of washes, gully development due to uncontrolled runoff has also resulted in reduction in cultivated area. Even a large area is still lying unused at many locations which can be otherwise brought under cultivation with a little effort. Land fragmentation is also one of the most reasons for increase in non productive cultivable land. Due to increased population and increasing demand and supply of food grains, it is desirable that the uncultivable lands are brought atleast in some use that may help in increasing the agricultural production (Venkateswarlu *et al.,* 2012). Bringing new area or converting wasted land to agriculture by following any soil and water conservation technology would, therefore, be considered as a significant contribution in the area of rainfed agriculture (Ranade, 2006). Any effort in this direction would be of much use for increasing the land availability for higher production and natural resource management in the area. With this idea in view, the present study was undertaken during 2011 to bring such land into cultivation for enhancing agricultural productivity and also to ensure crop diversification with multiple crop cultivation.

This study was under taken by Operational Research Project for Dryland Agriculture RVSKVV, Campus, College of Agriculture, Indore in a village Lohan, District Dewas Madhya Pradesh during 2011. In this village, it was observed that one hectare portion of a cultivable land was lying unused for several years. Actually this part of the land area was leased out to a contractor in year 1995 to excavate it so that the soil is used for laying the base of Maksi - Dewas rail line. Since the excavated material was carried away from the cultivated area to a distant location using dumpers, this one ha area was converted into degraded portion of approximately 85 m x 85 m x 10 m size. Since this portion was on the highest point of the entire cultivated land, it was receiving and collecting only rainfall water (0.5 m) falling over the excavated area. Being at highest point, no runoff from other area was being received by this excavated portion. Therefore, this portion despite having potential of big water harvesting tank, was not collecting/storing enough water during monsoon season which can be otherwise used for irrigating the adjoining fields during rabi season. Due to lack of sufficient irrigation water in this portion, it was not being utilized for any purpose & thus was not able to aid the farmer to increase/support agricultural activities. Therefore, it was totally a degraded uncultivable, unused area lying barren. On the observation of that site, it was observed that this area can be converted into a huge water harvesting tank which not only can collect rain water but also can be filled to its capacity with additional runoff water diverted from upper catchment other than farmer's low laying area. Thus efforts were made in this direction and this unused portion was converted into use water harvesting tank.

Since this area was lying unused for almost 15 year, it was decided to use heavy machineries like JCB, dumpers and trolleys to provide it a regular shape and size like a water storage portion. The JCB excavated the irregular shaped portion and side slopes of 1:2 were maintained all around the tank area. This excavated soil was used by the farmer to fill up the depressed portion in his fields and the make area levelled. Even the neighboring farmers also paid for the excavated soil so that they can use it in their fields too for reclaiming the washes and shallow gullies. For this purpose the farmer paid ₹ 80,000/- for reshaping and leveling of this portion. On the other hand, he received almost 90,000/- from the neighbouring farmers in lieu of cost of excavated soil provided them to carry it to their cultivated fields. With the result, at almost no cost or expenditure incurred by the farmer to develop this area in to an excavated tank area of 85 m x 85 m x 10 m with a regular shape.

Arrangement of additional runoff water

Since this excavated area was at the highest point of the cultivable area and at the boundary of the farmer's field, it was not possible to divert any runoff from the farmer's own cultivable area. Therefore, it was thought off that the runoff water from other area should be brought in this excavated portion. On the observation of the upper portion of the tank area, it was found that a prominent drainage line is located at about 220 meter away which receives runoff water from other farmers' fields and drains it to a subsidiary

of River Kshipra during entire monsoon season. Therefore, it was decided that the excess runoff from this drainage line is diverted towards the excavated tank area. Since the portion above the tank area belongs to another farmer, it was not possible to divert the excess runoff through an open excavated surface drain as it will pass through the cultivated area of other farmer making it fragmented and reducing a sizable portion cultivable. Provision of open drain may also a possible reason of conversion of this portion in to permanent gullies due to continuous and uncontrolled runoff volume. Therefore, it was thought that drainage line and the tank area is connected through an underground pipe line buried 30 cm below soil surface. For this purpose, the neighbouring farmer was also requested and convinced to cooperate. Thankfully, he readily agreed upon and granted permission to divert the runoff water through underground pipes passing through his field. Thus, two 8" diameters PVC pipe was buried to carry excess runoff from the drainage line to tank area. Beyond this junction portion of the drainage line and pipe, a loose bolder structure at 2 meter away from the pipe opening was constructed so that the runoff velocity is reduced and diverted towards the pipe opening without disturbing the natural drainage of the drain line. Thus, the provision of the underground pipe increased the chances of providing additional runoff water from the other neighbouring farmers' cultivated areas during monsoon season. This work was completed in the month of May 2011. For installation of the pipe and construction of loose boulder structure, the farmer incurred ₹ 80000/- for this purpose. Thus, with the efforts and technical guidance of the project team, a huge water harvesting tank of size 85 m x 85 m x 10 m was available with the farmer to be used as water storage tank of 60000 cu.m. with investment of 80000/- .

Utilization of water harvesting tank

The rainfall distribution during the study period is given in Table 1. During monsoon season 2011, the ORP area recorded 1048 mm rainfall, which was well distributed, and thus no significant dry spell was observed. Immediately in the following monsoon season 2011, the tank received huge amount of runoff of water through underground pipes in the month of July itself, so that it filled to it's full capacity. Thus, the tank was able to store approximately 60000 cu.m. water which was otherwise storing only meagre amount of rain water falling over its area. After the harvest of soybean in the month of September last week, an area of 11 ha was provided pre sowing irrigation for rabi cultivation by utilizing only 1/3 of storage water which amounts to 18 cm/ha due to inherent properties of vertisols. The pre sowing irrigation requires maximum amount of irrigation water as the upper soil profile becomes dry after the harvest of soybean due abrupt increase in temperature and heat. The cracks are developed on the soil surface and therefore much water is needed to replenish the moisture and to bring the soil profile to field capacity. The farmer sown the entire 11 ha area with various varieties of wheat *viz.* HI 1544, HI 8663, HI 1531 and MP 1203 which was otherwise occupying only 3 ha for the want of sufficient irrigation water before the construction and development of this unused area lying unutilized for the last 15 Years. After the pre-sowing irrigation, the 11 ha area was provided with two more subsequent irrigations each of 7 cm each from the storage tank. Since in this area, the ground water is utilized using tube well but it is not possible to provide the entire area with uniform quantity of irrigation water as tube wells provide the water with reduced and uneven discharge mostly in the month of December onward. Therefore, the additional availability of irrigation water in the form of surface storage not only allowed the farmer to grow wheat crop in the entire 11 ha area but also increased the productivity by almost two times by ensuring better germination through uniform distribution and additional irrigation water. Farmer refilled the tank with the tube well (which provides water at reduced discharge rate due to sharp fall in ground water level December month onward) water again so that the cultivated fields are irrigated at higher and uniform discharge rate through utilizing the pump in the tank. Therefore, the conjunctive use of surface water and ground water was also ensured in this study.

It the year 2012, the tank got field to its full capacity again in the month of July. The stored water in the tank gave so much confidence to the farmer after the harvest of soybean that he brought 5 ha area under short duration potato variety and other 6 ha area under wheat cultivation (Table 2). Therefore, due to availability of water, the crop diversification was adopted and new crop like potato was introduced by him. After the harvest of potato, the farmer cultivated the area with late varieties of wheat and produced higher wheat production till the end of March 2013.

In the year 2013, despite heavy rainfall of almost 1350 mm, the crops during *kharif* season experienced a dry spell of 25 days in the month of September and came under severe moisture stress. This time the farmer provided a life saving irrigation to the entire long duration variety of soybean in 11 ha area which resulted in appreciable increase in soybean production (1.75 times than the control/irrigated soybean). In the following rabi season, the farmer cultivated in 11 ha area with multiple varieties of potato (Chipsona 1 and 2, Jyoti, Lavkar) and wheat and increased the overall agricultural production and farm income.

It is concluded that efforts should be made to bring unused/ underutilized land into agricultural use which can increase the total production and gross income of the farmer. Similarly, the availability of water in the form of surface storage also helps in crop diversification, supplementing it during moisture stress/dry spells and reaping high remunerative crops.

Table 1 : Rainfall distribution recorded during the study period (2011-2014) in ORP area

Particulars	Details
Normal onset date of monsoon	15 June
Actual onset in 2011, 2012, 2013, 2014	22 June, 2 July, 25 June, 10 July
Average rainfall (mm)	1067
Rains (mm) in 2011, 2012, 2013, 2014	1048, 1232, 1339, 626

Month	June	July	Aug	Sept
Normal rains (mm)	153	374	392	148
		Actual rains		
2011 (1048/52 RD)	105	368	461	114
2012 (1232/37 RD)	-	455	354	523
2013 (1339/43 RD)	249	604	398	68
2014 (626/39 RD)	15	315	87	205

*RD- rainy days.

Table 2 : Crop diversification due to availability of additional surface water in the tank during 2011-2014

Area	Season	Year			
		Before the tank 2010	**2011 -12**	**2012-13**	**2013-14**
11 ha	Kharif	Soybean (11 ha)	Soybean (11 ha)	Soybean (11 ha)	Soybean (11 ha)
	Rabi	Wheat (3 ha)	Wheat (11 ha)	Potato (5 ha)	Potato (5 ha)
	Rabi	Chickpea (8 ha)	-	Wheat (6 ha)	Wheat (5 ha)
				Late wheat variety (5 ha) after harvest of potato	Late wheat variety (5 ha) after harvest of potato

Shaping and deepening of excavated portion

Installed underground pipeline with loose boulder structure in drainage line

During monsoon season

Water stored in the tank area

Filled tank 2013

Irrigation from the tank during rabi 2013

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