Farm Pond: A Sustainable Source of Income for Farmers

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Water is a part of the larger ecosystem in which the reproduction of the bio diversity depends. Fresh water shortage is not limited to the arid climate regions only, but in areas with good supply the access of safe water is becoming serious problem. Lack of water is caused by low water storage capacity, low infiltration, larger inter annual and annual fluctuations of precipitation (due to monsoonic rains) and high evaporation demand. The available water resources are under severe pressure due to increasing demands and the time is not far when water, which we have always thought to be available in abundance and free gift of nature, will become a inadequate commodity. Conservation and preservation of water resources is urgently required to be done. Water management has always been practiced in our communities since ancient times, but today this has to be done on priority basis. Due to population explosion, our country faces a serious threat to the management of water resources as the gap between demand and supply widens. Thus it is the responsibility of all to conserve our precious water resources. Harvesting of rainwater is of utmost important. A judicious mix of primeval knowledge, modern technology, farmer's involvement and above all, peoples' participation will go a long way in revitalizing and amplification of water harvesting practices throughout the country.

Need for Rainwater Harvesting

Water is a becoming a limited commodity and it is considered as a liquid gold in many parts of the country. The demand of water is also increasing day by day not only for Agriculture, but also for household and industrial purposes. It is estimated that water need for drinking and other municipal uses will be increased from 3.3 Mhm to 7.00 Mhm in 2020/25. Similarly the demand of water for industries will be increased by 4 fold i.e. from 3.0 Mhm to 12.00 Mhm during this period. At the same time more area should be brought under irrigation to feed the escalating population of the country, which also needs more water. But we are not going to get one litre more water than we get at present though the demand is alarming. The perennial rivers are becoming dry and ground water table is depleting in most of the areas. In some areas the depletion is about 30-50m in the last 30-40 years (Sivanappan,

2006). Country is facing floods and drought in the same year in many states. This is because, not adequate action was taken to conserve, harvest and manage the rainwater efficiently. The Theme paper on Water vision 2050 of India, prepared by Indian Water Resources Society (IWRS) has indicated that a storage of 60 Mhm is necessary to meet the demand of water for irrigation, drinking and other purposes. But the present live storage of all reservoirs put together is equivalent of about 17.5 Mhm which is less than 10% of the annual flow in the rivers in the country. The projects under construction (7.5 Mhm) and those contemplated (13 Mhm) are added, it comes only 37.50 Mhm and hence we have to go a long way in water harvesting to build up storage structures in order to store about 60 Mhm. Therefore there is an urgent need to take up the artificial recharge of the rain for which water harvesting and water conservation structures are to be build up in large scale.

Objective of Rainwater Harvesting

1. Restore supplies from the aquifers depleted due to over exploitation.
2. Improve supplies from aquifers lacking adequate recharge.
3. Store excess water for use at subsequent times.
4. Improve physical and chemical quality of ground water.
5. Reduced storm water run off and soil erosion.
6. Prevent salinity ingress in coastal areas.
7. Increase hydrostatic pressure to prevent/ stop land subsidence.
8. Recycle urban and industrial wastewater etc.
9. Rehabilitate the existing traditional water harvesting structure like village ponds, percolation tanks, etc.
10. With minor scientific modifications and redesigning, convert the traditional water harvesting structure into ground water recharge facilities.

Benefits of Rainwater Harvesting

- Rise in ground water levels in water
- Increased availability of water from wells
- Prevent decline in water levels
- Reduction in the use of energy for pumping water and consequently the costs.
- Reduction in flood hazard and soil erosion
- Benefiting in the water quality
- Arresting sea water ingress
- Mitigating the effect of droughts and achieving drought proofing
- Reviving the dying traditional water harvesting structures and their rehabilitation as recharge structures.
- Effective use of lack of defunct wells and tubwells as recharge structure
- Up gradation of social and environmental status etc.

Types of Farm Pond

The ponds are mainly of two types. One is embankment type and other is dug out type. The embankment type pond is constructed across streams/ravines and big gullies in order to impound certain quantity of runoff water which will otherwise find its way to rivers. The impounded water infiltrated into subsoil and recharges the groundwater table. The excess runoff is collected in dug out farm pond and the stored water can be used as a supplementary irrigation to the crops grown in adjoining areas.

Dimensions of farm ponds for different catchments at AICRPDA, Akola centre

Based on the runoff from different catchments, the capacity of the farm pond has been decided at AICRPDA, Akola. Accordingly, the location for construction of the farm pond had been chosen and the dimensions were decided and construction of three farm ponds for three different catchments was done and the details are given in Table 1 and 2.

Availability of water in the farm pond

Depending upon the amount of rainfall and the intensity of rainfall, the runoff from the catchments can be accumulated in the farm ponds. On the basis of availability of water in the farm ponds and as per need the protective irrigation can be given to the crops in *Kharif* as well as *Rabi* season. The expected area coverage depending upon the availability of the water in the farm pond is given below in Table 3.

Results

In Vidarbha region of Maharashtra State and most part of the country, occurrence of high intensity rainfall events may results in floods. In these areas dry spell even within the monsoon periods are not uncommon, resulting in fluctuation in crop production. In these areas it would be wise to harvest the runoff water, store it and recycle it for using to different agronomical crops by constructing farm ponds and other water storing structures. Farm ponds hold great promise as a life saving device for rainfed crops in area characterized by low and erratic rainfall. In view to have sustainability in rainfed agriculture and development of water resources the experiment on rain water management through farm pond technology has been undertaken and results for the year 2018-19 are presented here.

Productivity (*Rabi*):

During the *Rabi* season 2018-19, the storage was there in the farm ponds. The sowing of chickpea was done in the month of October. The germination in treatment T_3 (without irrigation) was very poor due to less residual moisture in the soil. However, the protective irrigations of 50mm depth were given to chickpea and the recorded yield of chickpea with protective irrigations is given in Table 4. The highest yield and B:C ratio (1560kg ha^{-1} and 2.24) was recorded in the treatment two protective irrigations of 50mm depths each with sprinkler set from stored pond water (T_2).

The stored farm pond water was also used for supplemental irrigation to different vegetables by using micro-irrigation systems. The details of vegetables along with irrigation system used, yields and water used is given in Table 5. It was observed that in the vegetable crops like Coriander, Fenugreek, Radish, Spinach, Dolichus bean (wal), Brinjal and Cow pea the water use efficiency was in the range of 2.25 – 6.00kg/m^3. The total income from these small vegetables plots during the season 2018-19 is Rs. 9710.

Conclusion

Rainwater harvesting through farm pond had increases the yield level in the range of 45 to 46% during *rabi* season and water use efficiency was increased in the range of 2.25 to 6. 00 kg/m^3 for vegetables. It will be possible for the farmers to go for the vegetable crops during rabi. The water was also available for the cattle and for other agricultural operations. The farmers having availability of farm pond water can have sustainable income due to vegetables.

References

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Table 1. Dimensions of farm pond

Farm pond no.	Catchment area (ha)	Capacity (cum)	Top dimensions (m x m)	Bottom dimensions (m x m)	Depth (m)	Side slopes
1	5.0	2753	45 x 27	36 x 18	3.0	1.5:1
2	5.0	4265	60 x 30	51 x 21	3.0	1.5:1
3	2.0	370	18 x 11	12 x 5	3.0	1:1

Table 2. Cost estimation of farm pond

Farm pond no.	Capacity (cum)	Cost of Earthwork (Rs.)
1	2753	1,70,000
2	4265	2,63,500
3	370	22,900

Cost of portable pump set, 3HP with discharge of 1000 lpm : Rs. 34700/-

Cost of Sprinkler set (30pipes of 75mm dia, 3.2 Kg/cm²and 8 nozzles) : Rs. 35000/-

Table 3. Expected area which can be provided protective irrigation from the available pond water (ha)

Depth of water in the farm pond (m)	Availability of water in the farm ponds (cu m)			Expected area which can be provided protective irrigation from the available pond water considering 10 % losses (ha)		
	Farm pond 1	Farm pond 2	Farm pond 3	Farm pond 1	Farm pond 2	Farm pond 3
Full	2753	4265	370	4.95	7.68	0.66
2.5	2294	3554	307	4.13	6.40	0.55
2.0	1836	2844	246	3.30	5.12	0.44
1.5	1377	2133	184	2.48	3.84	0.33
1.0	918	1422	123	1.65	2.56	0.22
0.5	459	711	61.5	0.83	1.28	0.11

Table 4. Yield of chickpea

Treatments	Yield ($kgha^{-1}$)	% increase in yield over T_1	Net returns ($Rs.ha^{-1}$)	B:C ratio
T_1- One protective irrigation (After sowing)	1067	-	14201	1.58
T_2 -Two protective irrigations (After sowing and at flowering)	1560	46.23	31333	2.24

Table 5. Irrigation through micro-irrigation system from farm pond for different vegetables

Vegetables	Irrigation system	Water applied (m^3)	Plot Area (m^2)	Yield ($kg\ plot^{-1}$)	Net Income ($Rs\ plot^{-1}$)	B:C ratio	Water use efficiency, Kg/m^3
Coriander	In-line Drip	6	32	24	960	2.80	4.00
Fenugreek	In-line Drip	12	96	71	2130	3.54	5.91
Radish	In-line Drip	12	64	72	1080	2.43	6.00
Spinach	In-line Drip	12	96	72	2160	3.28	6.00
Dolichus bean (Wal)	In-line Drip	8	32	18	540	1.78	2.25
Brinjal	Micro-Sprinkler	18	60	82	1640	2.73	4.55
Cowpea	Micro-Sprinkler	10	30	40	1200	2.52	4.00
Total		78	410	-	**9710**	-	-

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