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Review on Analysis of Design & Construction of Farm Pond for Sustainable Water Resource Management of War Village, Dhule District

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Abstract: *Water is one of the most important natural Renewable resources and all forms of life are totally dependent on it. Rainfall problem in drought prone area is one of the biggest issue so that in those areas rainwater harvesting system implement. Farm pond is one of the best option for providing supplemental irrigation and to improve productivity. A farm pond is a large hole dug out into the ground, usually square or rectangular in shape which harvests rainwater and stores it for future use. This paper highlighted the social, economical, and environmental effects of farm ponds, and the progress of farm ponds in Dhule district (war village). This review paper explores the vital role of farm ponds in arid regions. By examining various design considerations, construction techniques, and integrated water management strategies, the paper aims to highlight how farm ponds can improve water availability for horticulture, thereby contributing to sustainable agricultural practices in in Dhule district (war village). Farm ponds have been built all over the world to encourage agricultural expansion. The fundamental goal of this research is to comprehend agricultural development through farm ponds and their impact on the socio-economic development of farm pond owners.*

Keywords: Farm pond, water management, arid regions, rainwater harvesting system, irrigation, socio-economic development

I. INTRODUCTION

In the low rainfall area of the world, where water is as precious as gold, the strategic development of farm ponds is a cornerstone of water management practices focused at harvesting and storing rainwater and runoff, by means creating a reliable water source for irrigation during dry season. Farm ponds serve multiple functions, including water storage, groundwater recharge, and sometimes, fish farming, which can provide additional income for farmers. The influence of farm ponds extends beyond agricultural benefits, contributing towards biodiversity as well. This village is situated in a drought-prone region. In these area the depth of black cotton and red soil is shallower than that of other soils. There are gravel and sandy soil types, and they store water to a lower extent. This type of research can help villages grow their agriculture in a holistic way. This type of research can help villages grow their agriculture in a holistic way. The issues of Indian agriculture cannot be overlooked as more than 62% population is directly dependent on it. Therefore, it is essential to understand the issues related with farming activities and to provide specific suggestions. Dhule district is known as one of the drought-prone region in Maharashtra. Most importantly, rainfall is less than half of the potential evaporation. There are various schemes to secure agriculture and to reduce the frequency of crop failure in such regions. What is the way out? It is possible to hold the runoff water through the Farm pond by stopping it, storing it, and using it for safe irrigation when it is needed. Which can be used during late arrival of monsoon? A farm pond is considered as relatively useful for use of stored water in the dry time. "Farm pond is an artificial dug-out structure with definite shape and size for collecting and storing surface runoff water. The Main goal of this research is to improve agricultural development through farm ponds and their impact on the socio-economic development of farm pond owners. This type of research is critical for agricultural planning at the village

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level in order to achieve significant growth. The major goal is to collect surplus run-off water with the help of dug-out farm ponds in order to increase agricultural yield and income for resource-poor dryland farmers. The major goal is to collect surplus run-off water through dug-out farm ponds.

II. LITERATURE REVIEW

[1] Dattatray Sheshrao Ghungarde, Surindar Gopalrao Wawale (August 2021), This is the first study to look at how ponds influence the adoption of water-saving irrigation practices. Sustainable rural development and the management of other small, scattered wetlands can benefit from the conservation advice and analytical methodology. The current study examines agricultural improvement in Nivadunge village using farm ponds. The evolution of agriculture was tracked using a variable parametric method. This village is situated in a drought-prone region. The depth of black cotton and red soil is shallower than that of other soils. There are gravel and sandy soil types, and they store water to a lower extent. This type of research can help villages grow their agriculture in a holistic way. Farm ponds have been built all over the world to encourage agricultural expansion. Natural-based solutions are increasingly being recognized as a viable option for addressing water-related issues.

[2] Poonam, Shweta Chouhan and PK Singh (January 2022), The present study consists of three parts. Estimation of peak runoff rate, estimation of runoff volume, estimation of cost of plastic lined pond for different capacity. These scrutinized data were then grouped into weeks (total 17 weeks) and finally two days maximum rainfall values were selected from each week. We designed plastic lined pond of 2000 m3 capacity for catchment area of 30 ha, 40 ha, 50 ha, for which values of estimated peak runoff rate were 4.62 m3 /sec, 5.73 m3 /sec, 7.77 m3 /sec and volume of runoff were 4.137 ha-m, 5.512 ha-m, 6.890 ha-m respectively and total cost for design of plastic lined pond rates as per BSR, 2013-2014, Panchayat Samiti, Girwa (Udaipur) was Rs. 5,88175. All in all, considering the benefits accuring from the implementation of the project and during the life time of the structure (10-15 years) it can be safely said to be beneficial. Water is one of the most important natural resources and all forms of life are dependent on it. Rainfall in drought prone area is highly erratic storage must be an integral part of any rainwater harvesting system. Plastic lined farm pond is the best option for providing supplemental irrigation and to enhance productivity.

[3] Dr. Mrs. Vidula A. Swami Professor, Dr. Mrs. Sushma S. Kulkarni, Mr. Sheetal S. Varur ,Mr. C. V. Nishikanth (July 2018), The study is undertaken to develop an appropriate technology for soil conservation and to verify the increase in the ground water storage in such area. This gives dual benefit of soil conservation as well as ground water recharge for the area thus saving the area from severe soil loss as well as increasing the water availability below the ground surface, thus fulfilling the water demand of the village and protecting the top fertile soil from getting washed away due to rainfall. Considering the topographical features of a small plot of area 2 hectares of Kaneri watershed situated in Kolhapur District, Maharashtra, the structures for water conservation had been implemented in it in June 2011. The structures included gulley plugs on existing water stream followed by the farm pond at its end along with farm terraces and continuous contour trenches surrounding the water stream. These practical evidences proved the positive impact of watershed development structures on water conservation and ground water recharge. Similar measures were taken in KIT campus in Gokul Shirgaon as per its topographical and hydrological situations and the results were evaluated. India is the country of villages with large population living in the rural areas. In the hilly areas due to high velocity of water, soil conservation is a tedious job. If rainwater harvesting is done in these areas, soil will get conserved as well as the ground water storage will be increased.

[4] Jeet Raj, Aman , Suryakant Sonwani and Sanket Kolambe (April 2021), To increase food security in a drought-prone area, the water harvesting, capture and storage of rainwater are technologies proven for uses during dry periods. Erosion control and groundwater revive are extra favorable circumstances of water harvesting techniques that contribute to agricultural development and resource conservation. The contour map of the study area is used to select the location for the creation of the farm pond. Clay loam is found in soil texture analysis. For clay loam soil, the study area with a depth of 3.5 m and a side slope of 1.5:1 may be suitable. The available rainfall was computed for 75% probability by using empirical formula is found to 1.41483 ha-m. The tube well draft was calculated to be 0.8640 ha-m. The capacity of the designed farm pond is 0.6639 ha-m.The proposed pond facilitated total supplemental irrigation of 8.5 cm depth to an area of 6.5 ha paddy.

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[5] RavanashreeM ,Devi M b, Ramachandiran P, Aakash,Chaudhari Radhika Pravinbhai , Manjusha Kc and Ramachandiran (December 2024)- This review paper explores the vital role of farm ponds in arid regions, where water scarcity significantly impacts horticulture -a key source of nutrition, food security, and economic resilience. It explores the challenges of water management in such harsh environments and positions farm ponds as crucial for capturing and storing rainwater to support agriculture. By examining various design considerations, construction techniques, and integrated water management strategies, the paper aims to highlight how farm ponds can enhance water availability for horticulture, thereby contributing to sustainable agricultural practices.
Despite technical, economic, social, and environmental challenges, innovative approaches in farm pond implementation can offer a sustainable solution to water scarcity, underscoring their importance in securing livelihoods and food security in arid landscapes. This script gives critical information into farm ponds as sustainable water management solutions for arid regions' horticulture. It is useful for providing guidelines for design, implementation, and challenges and, thus, contributes greatly to research in agricultural water security in water-scarce areas.

[6] Ankita Yadav (July 2019) It is widely known that the state of Maharashtra, for the last many years, has frequently faced drought and drought-like conditions. To deal with this challenge, a number of policies and interventions have been implemented by State and Union government bodies while various coping mechanisms are being adopted at the local level. One such intervention is the construction of farm ponds. The State government has introduced schemes like 'Magel tyala Shettale', (Farm Ponds on Demand) and 'Jalyukt Shivar Abhiyan', while the Union government has also supported farm ponds by allocating funds under schemes such as the National Horticulture Mission (NHM), Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Rashtriya Krishi Vikas Yojana (RKVY), Pradhan Mantri Krishi Sinchai Yojana (PMKSY), etc which also provide subsidy for plastic linings. Harvesting rainwater is crucial in semi-arid regions of Maharashtra, that receive very low rainfall.
As Maharashtra is underlain by hard rock which have very low porosity, it allows only limited recharge by percolation. It is also important to note that water resources in semi-arid Maharashtra are fragile and sensitive to human interventions and climate variability. Negative externalities like increasing rates of evaporation and erratic rainfall events are compounding the problem. Hence, farm ponds become a crucial tool in ensuring farmers have access to water in the periods of low rainfall. In this blog, we take a closer look at farm ponds and their impact, in the context of six selected villages in Sangamner, Maharashtra.

III. DATABASE AND METHODOLOGY

Data for this study was gathered from both primary and secondary sources. A village survey is conducted, and data is gathered through standardized questionnaires.

3.1 Site Selection for Farm Pond

The plastic lined pond are designed and constructed in the areas where soils are porous and seepage losses from the ponds are very high. These structures are also constructed in the area where groundwater is saline and there is need to store the harvested surface water for longer duration of time to fulfill the agricultural as well as domestic needs. The selection of a suitable site for the location of a farm pond should depend on the following factors-

1. The catchment of the pond should be well protected to prevent silting of particles.
2. The pond should be selected in such a way that the catchment size is optimum.
3. Soil conservation should be taken into Account during deciding the capacity of the farm pond.
4. The site should be such that a large volume of water could be stored with minimum excavation.
5. The pond site should be such that, the drainage lines, farmsheds ,feeding lots, corrals, sewage lines, mines dumps and other similar area should not be there.
6. The site near to the dam, should not be selected for pond construction.
7. For selecting the pond site, it should also be ensure that there is no buried pipe lines or cables at the area.
8.The site, where low H.T. Power lines are present in the area, should be avoided for pond construction because they can create the problem for use of farm pond.

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3.2. Expected Problems in Farm Pond Construction War

While farm ponds offer numerous benefits, their construction and operation may face some specific challenges:

1. Seepage Losses: Even with HDPE liners, water may seep through embankments or liner defects.
2. High Evaporation Rates: Open ponds lose significant amounts of water in summer. It is important to understand the extent of evaporation losses, if we are to assess the efficacy of farm ponds.
3. Silt Accumulation: Runoff carries silt into the pond, reducing storage capacity over time.
4. High Maintenance Costs: Regular cleaning, desilting, and repair costs can be a burden for small farmers.

3.3 The Necessity of Farm pond in Dhule District

Dhule district, situated in Maharashtra's rain-shadow region, experiences frequent droughts and irregular rainfall, making water scarcity which is a persistent challenge. War village, one of the affected regions in Dhule district.

The lack of reliable irrigation sources leads to reduced agricultural productivity, and economic instability, in Dhule district. and which causes migration of peoples during dry seasons.

1. Storing Rainwater: Capturing and storing rainwater during monsoon to ensure water availability throughout the year.
2. Reducing Groundwater Dependency: Providing surface water for irrigation, reducing over-extraction of groundwater.
3. Enhancing Agricultural Output: Supporting multi-cropping systems to increase productivity and farmer income.
4.Improving Livelihood Resilience: Mitigating the impacts of erratic rainfall and drought, ensuring food and economic security.

3.4 Addressing Specific problems-

1. Seepage Mitigation- To solved the problem of seepage, compaction of the bottom soil of farm pond should be carried out, addition of specialized clay like sodium bentonite or lining can be provided by synthetic liner (like HDPE).
2. Evaporation Reduction- To prevent the Evaporation losses Use of floating plants,shade net or partial pond cover should be provided.
3. Silt Accumulation control- for controlling Accumulation of silt Install sediment traps at upstream side and do annually Removal of silt.
4. Lower Maintenance cost- Organize UMA training programs and get an information on all cost effective aspect from (Krishi Vibhag).

IV. OBJECTIVES

1. Providing supplemental irrigation and to improve productivity in the form of Farm pond in war village.
2. Provide sustainable agricultural practices in in Dhule district (war village) by providing Farm pond.
3.To comprehend agricultural development through farm ponds and their impact on the socio-economic development of farm pond owners.

V. CONCLUSION

Farm ponds can help ease water constraints caused by various factors, including climate change. This approach has the potential to increase the amount of water available for supplemental irrigation, while also increasing planted area and productivity, which resulting into increased in crop yields. In climate change scenarios, a farm pond responds to increased drought frequency, particularly mid-season, and final dryness. Therefore, farmpond is the best option. The challenges of putting farm pond technology into application on a large scale are also explored.

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