

Influence of Farm Ponds towards Imparting Climate Resilience to Rainfed Farming : Success from NICRA Villages

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ABSTRACT

Farm ponds are recommended for fragile dry-land ecosystems to harvest rainwater *ex-situ* as a sustainability measure. Through National Innovations in Climate Resilient Agriculture (NICRA) under Zone VIII, water was harvested in 146 farm ponds in drought prone villages under Krishi Vigyan Kendras since 2011 in five locations (Chickballapura, Davangere and Tumakuru of Karnataka; Namakkal and Villupuram of Tamil Nadu) and utilized the harvested water for cultivation of a variety of crops. This also helped to enhance the cropping intensity from 23.18 to 185 per cent in the study area.

WATER, the most crucial resource for sustainable agricultural production in the dryland / rainfed areas, is not being used fully. Much of the rainfall runs off the ground. The runoff not only causes loss of water but it also washes away precious top soil. Rainfed area which constitutes over 55 per cent of the net cultivated area in the country contributing 40 per cent of the food grains, supporting 60 per cent livestock and 80 per cent of the pulses and oilseeds (Anon., 2011) is suffering from land degradation and socio economic constraints of farmers.

The Indian farmers have evolved various coping mechanisms over time, but these mechanisms are not able to cope with the extreme weather aberrations in the recent years. Therefore, there is a need to use modern science combined with indigenous knowledge of farmers to enhance the resilience of Indian agriculture to climate change. In order to deal with the climate change and its impacts, the Indian Council of Agricultural Research (ICAR) initiated National Innovations in Climate Resilient Agriculture (NICRA), a multi-institutional, multi-disciplinary network project in 2011. The project aims to enhance resilience of Indian agriculture to climate change and climate variability through strategic research and technology demonstration. The Technology Demonstration Component (TDC) of NICRA as on-farm participatory demonstrations of available technologies is being implemented in 121 most vulnerable districts with the help of 121 Krishi Vigyan Kendras coordinated by CRIDA and Agricultural Technology Application Research Institutes in the country.

MATERIAL AND METHODS

The study was conducted with farmers' participatory research mode involving the farmers under NICRA implemented by three KVKs of Karnataka and two KVKs of Tamil Nadu. Annual rainfall analysis in the study area indicates that Karnataka received more annual rainfall during *kharif* season, whereas Tamil Nadu received more annual rainfall during *rabi* season (Table.I). The water harvested in the farm ponds in each year was utilized for providing protective irrigation to the crops during long dry spells in the same season or utilized for cultivating crops in the subsequent season. The water in the farm pond was lifted either manually or using small capacity oil pump.

Five KVKs implemented farm pond structures, of which three in Karnataka (Chickballapura, Davanagere and Tumakuru) and two in Tamil Nadu (Namakkal and Villupuram) to harvest runoff water under the NICRA project. In Chickballapura KVK, water was harvested in 8 farm ponds during 2012 to 2015 with dimensions (m) of 10 x 7 x 2. The ponds were constructed without lining material and water storage capacity was 140 m³. In Davanagere, water was harvested in 24 farm ponds during 2012 to 2015 with dimensions (m) of 10 x 10 x 3 and water storage capacity of 300 m³. The farm ponds were constructed without lining material. In Tumakuru, water was harvested in 81 farm ponds during 2012-2016 with two different dimensions (m) of 20 x 20 x 2 and 10 x 10 x 2 and water storage capacity of 800 and

TABLE I
Rainfall during last five years (2011-15) in NICRA villages of KVK under Zone-VIII

NICRA KVK District	Year	Normal rainfall (mm)	Total rainfall (mm) from Jan-Dec	No. of rainy days	No. of dry spells> 10-15 days	No. of dry spells> 15 days	No. of highest rainfall intensity events (> 60 mm) day	Water inundation floods> 10 days (No. of events)	Rainfall (mm) distribution across season		
									Khairf	Rabi	Summer
Chickballapura, Karnataka	2011		107.5	12	2	1	0	0	52	55.5	0
	2012		799.9	28	4	4	2	2	452.5	97	250.4
	2013	740.0	827.5	33	3	4	2	1	611.6	61	154.9
	2014		353.7	17	3	5	0	0	230.2	0	123.5
	2015		1163	47	2	4	4	3	499	492	172
Davanagere, Karnataka	2011		213.6	28	3	1	0	0	185.5	33.7	0
	2012		371.9	36	2	1	0	0	195.6	0	134.3
	2013	648.1	699.9	67	1	-	2	0	383.9	35	281
	2014		786.3	67	1	0	1	0	576.8	150	59.5
	2015		653	36	1	1	2	0	410	100	143
Tumakuru, Karnataka	2012		779	49	3	1	1	0	310	193	276
	2013	696.0	824	50	4	0	1	0	500	169	155
	2014		1082	63	2	0	3	0	560	225	297
	2015		1132	67	1	1	3	0	335	460	337
	2011 (Sep-Dec)		405.46	31	1	1	0	0	0	316	0
Namakkal, Tamil Nadu	2012		469.6	30	2	9	2	0	146.8	245	76
	2013	410.0	639	24	5	7	4	0	284	269	48
	2014		548.3	32	4	7	1	0	307	217.3	24
	2015		487	29	5	8	0	0	270	208	0
	2011		936.5	45	4	8	2	0	428	373.5	135
Villupuram Tamil Nadu	2012		957.5	48	5	8	2	0	352	595	10.5
	2013	1058.0	1158.1	53	3	6	2	0	731.8	362.75	63.5
	2014		1095.75	51	5	7	2	0	502	459.5	134.25
	2015		1262.5	55	5	4	5	1	322.5	940	0

TABLE II
Details of farm pond and their capacity

NICRA KVK District	No. of Farm ponds and Water storage capacity (m ³)	Total Amount of water stored in farm pond (m ³)	No. of Supplemental irrigation in <i>Kharrif/Rabi</i> crop/Both season	Area brought under protective irrigation (ha)	Crops cultivated	Net returns (₹) varied for the area cultivated	Increase in cropping intensity (%)
Chickballapura (2012-15)	8 (140)	3331	42	15.7	Groundnut, Finger millet, Castor, Redgram and intercrop of Groundnut + Redgram	As low as ₹ 46,000/- in 2012 and as high as ₹ 1,28,150/- in 2015	100
Davanagere (2012-15)	24 (300)	9414	27	7.4	Cotton, Tomato, Fodder crops, Tomato, Beans and intercrop of Maize + Redgram	As low as ₹ 42,700/- in 2012 and as high as ₹ 3,32,745/- in 2015	185
Tumakuru (2012-16)	81 (800 and 200)	18519	187	61.0	Groundnut, Maize, Finger millet, Tomato, Aerobic paddy and Asterin	As low as ₹ 79,000/- 2015 to as high as ₹ 8,50,000/- in 2016	100
Namakkal (2012-14)	15 (387 and 713)	230.25	207	11.42	Groundnut, Sorghum, Onion, Jasmine, Paddy and Vegetable crops	As low as ₹ 52,240/- in 2012 and as high as ₹ 2,61,625/- in 2013	23.18
Villupuram (2012-15)	18 (1680)	16000	30	5.0	Groundnut, Sugarcane and Paddy	As low as ₹ 36800/- in 2013 to as high as ₹ 107980/- in 2012	42.75

200 m³. In Namakkal, water was harvested in 15 farm ponds of different dimension (m) of 14.02 x 10.36 x 1.52 to 22.86 x 16.76 x 1.82 during 2012 to 2014 with a water storage capacity varying from 387 to 713 m³. All these ponds were lined with silpauline sheet. In Villupuram, water was harvested in 18 farm ponds of dimension (m) 30 x 28 x 2 with a water storage capacity of 1680 m³. The ponds were constructed without lining material.

RESULTS AND DISCUSSION

In Chickballapur, 3331 m³ of water was harvested used for cultivated groundnut, finger millet, castor, redgram and intercrop of groundnut + redgram in about 15.7 ha area through 42 protective irrigations during *kharif* seasons. The net returns varied from as low as ₹ 46,000/- from 3.7 ha area in 2012 to as high as ₹ 1,28,150/- in 2015 from 4.6 ha area. It has also been reported earlier that supplemental irrigation, using a limited amount of water, if applied during the critical crop growth stages can result in substantial improvement in yield and water productivity (Oweis and Hachum, 2003).

Between 2012 and 2015, 9414 m³ of water was harvested in Davangere KVK and the utilized for cultivation of cotton, tomato, fodder crops, tomato, beans and intercrop of maize + redgram in about 7.4 ha area through 27 protective irrigations during *kharif* and *rabi* seasons. The net returns ranged from as low as ₹ 42,700/- from 4.6 ha area in 2012 to as high as ₹ 3,32,745/- in 2015 from 5.4 ha area.

In Tumakuru, between 2012 and 2016, 18,519 m³ of water was harvested and used for giving 187 protective irrigations for groundnut, maize, finger millet, tomato, aerobic paddy and aster in about 61 ha area during *kharif* and *rabi* seasons. The net returns varied from as low as ₹ 79,000/- in 2015 from 2.0 ha area to as high as ₹ 8,50,000/- in 2016 from 31.0 ha area.

Between 2012 and 2014, 230.25 m³ of water was harvested in Namakkal and used for providing 207 protective irrigations to groundnut, sorghum, onion, jasmine, paddy and vegetable crops in about 11.42 ha area during *kharif* and *rabi* seasons. The net returns

varied from ₹ 52,240/- in 2012 from 1.4 ha area to ₹ 2,61,625/- in 2013 from 4.81 ha area (Table II). LDPE film lining which was tried on an experimental basis for the past several years is now extensively being used in states like West Bengal, Gujarat, Rajasthan, Madhya Pradesh, Punjab, Haryana and the irrigation departments of other states. The experience indicates that lining with plastic films saves sufficient quantity of water from seepage (Singh and Kumar, 2007).

In Villupuram, about, 16000 m³ of water was harvested during the year 2012-15 and cultivated groundnut, sugarcane and paddy crops in 5 ha area and the harvested water was used for 30 protective irrigations during *rabi* season. The net returns ranged from ₹ 36,800/- in 2013 from 0.4 ha area to ₹ 1,07,980/- in 2015 from 2.0 ha area (Table II).

Runoff harvesting in farm ponds and its subsequent recycling for crop production helped to enhance cropping intensity ranging from 23.18 to 185 per cent in the study area. Many small and marginal farmers have found farm ponds to be ideal solutions to their water struggles. They are small in size and can be filled with small amounts of rain. Furthermore, since they are individually managed farmers can freely use the harvested water without any competition or conflict. Farm ponds can also provide an additional source of income for families by supporting activities like fish rearing and growing vegetables.

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