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WATSAVE AWARDS 2011

Innovative Water Management Award

Summary of Prof. Dr. Subhash Madhawrao Taley's work

"Participatory Rainwater Conservation of Rainfed Agriculture of Vidarbha Region (Maharashtra), India"

(continued on next page)

Nominee Statement of about 1500 Words (in the following format)

I) Description of innovation

Rainfed farming, more popularly known as, "dryland agriculture" is spread in four continents covering almost 48 countries. About 80 per cent of the world's agricultural land is rainfed, contributing to at least 50 per cent of global food production. The global total cropland is estimated as 1.539 billion hectares of which about 0.407 billion hectares is irrigated and rest 1.13 billion hectares is rainfed cropland. If we do not improve the water use efficiency (WUE) in rainfed agriculture, we will potentially face food insecurity for basically one-third of the world's population. Total food demand is expected to increase by 50 per cent by 2015 through population growth and 110 per cent by 2050 through population growth and increased per capita consumption. As a result, crop land per person fell by 40 per cent, from 0.43 ha to only 0.26 ha. Food and agriculture are by far the largest consumers of water. Renewable fresh water resources are subject to severe competition between agriculture, industrial and residential uses, while demand is increasing for all these uses. The shift of water from agriculture to the growing cities and industry may hinder the future global food production. This means that rainfed agriculture will be increasingly important in meeting food requirement in the future.

Agriculture in Maharashtra state and that in particular in Vidarbha region can be characterized by low irrigation (17% and 7%) and low rainfall. Approximately 85 per cent of cultivated area (17.64 million ha in M.S. and 4.99 million ha in Vidarbha) is rainfed, and agricultural performance is significantly influenced by the monsoon. Precipitation is concentrated in just a few months of the year and is highly variable in frequency, intensity and geographic coverage. There are large variations in the quantity of rainfall with different parts of the state. Access to protective irrigation (canal or groundwater) is very limited in the low rainfall areas. Drylands support 65 per cent of the rural population and are the principal supplies of cereals, pulses and oilseeds. The importance of rainfed agriculture in terms of rural employment, sustenance and livelihoods cannot be over emphasized.

In vidarbha the rainfed farming largely subjected to the vagaries of monsoon with instability of yields, incomes and water use efficiency. In the present situation involving the farmers and motivating them to undertake more responsibilities to enhance the rainwater use efficiency by reforming the cultivation practices for the benefits and welfare, envisages in their attitudes, mind sets and enhancing their

skill and capacities towards *insitu* soil and water conservation, safe disposal of runoff, storage of runoff in farm ponds and recycling of water for protective irrigation during moisture stress. Since major agriculture is rain dependent, the appropriate rainwater management play very vital role in sustainable rainfed farming. Impact of climate change is visible on Vidarbha agriculture where assured rainfall zone has become a distress zone due to changing behavior of rainfall therefore comprehensive on farm study was undertaken in participatory mode to enhanced the water use efficiency by adopting the modified land configurations like deep cultivation, contour and across the slope cultivation, opening of furrow in alternate crop rows after 30 days of sowing and opening of tied drains etc.

II. Describe how the innovation saves / conserve water

Appropriate tillage practices with appropriate land configurations would provide more efficient in-situ water conservation of erratic rainfall events. Cultivation and sowing across the slope or on contour with opening of furrows enhances the availability of soil water, fragile tilth soil facilitates favourable soil environment for root growth at initial plant growth period and mulching reduces evaporative loses from the soil surface at the later stages of plant growth. Rainwater conservation practices adopted to reduce the loss of soil water through evaporation have recorded higher yield of rainfed crops. In-situ rainwater conservation practices with specific land configurations improves soil porosity, water intake rate and reduces the runoff, where as opening of deep furrows in between the crop rows during monsoon conserve the stored soil water through decreased evaporation by reduced soil water through decreased evaporation by reduced capillaries, results in reduced evaporation and act as soil much and increases the time of runoff concentration.

The excess rain water after storage in profile with different land configurations enhances the moisture content which can be used during moisture stress period through seepage system of rain water utilization. After second step the excess rain water harvested in to the farm ponds constructed in the lowest position of the catchments from the various part of the operational area. This stored runoff was recycled for the life saving irrigations during dry spells of monsoon season and during rabi at deficits moisture situation. This enhances the rainwater use efficiency in terms of more crop per drop.

III. Describe how the innovation was introduce and spread

The on farm study in participatory mode was undertaken during 2007-10 and the impact of the rain water management technologies was monitored scientifically with participation of the farmers

The study indicated that in deep cultivation the water use efficiency (kg/ha/mm) enhanced from 1.24 to 1.49 and from 0.98 to 1.09 in sole crop of soybean and cotton respectively. Similarly in intercrop of cotton and soybean water use efficiency enhanced from 0.54 to 1.09 in cotton and from 0.81 to 1.11 in soybean. The yield levels in deep cultivation were found increased by 11 to 36.95 per cent, runoff and soil loss were decreased by 8 to 12.69 per cent and by 17 to 30.90 per cent respectively over shallow cultivation. However the opening of tide furrows in cotton, soybean, black gram, green gram and hy. Sorghum enhanced the yield levels by 4 to 14.28 per cent and water use efficiency from 1.18 to 2.82 kg/ha/mm. In across the slope cultivation under sole crop of cotton, soybean, green gram, hy. Sorghum and intercrop of green gram / soybean+ pigeonpea enhanced the yield levels from 20 to 50 per cent and water use efficiency from 0.55 - 2.67 to 0.74 - 3.26 kg/ha/mm. Similarly in contour cultivation the yield levels were found enhanced by 38.88 to 87.50 per cent and water use efficiency from 0.55 - 2.67 to 0.89 – 3.71 kg/ha/mm. However in opening of alternate furrows in across the slope cultivation enhanced the yield levels by 25 to 56.25 per cent and water use efficiency from 0.55 – 2.67 to 0.92 – 3.41 kg/ha/mm however opening of alternate furrows in contour cultivation enhanced the yield levels by 54 to 93.78 per cent and water use efficiency from 0.55 – 2.67 to 1.04 – 2.82 kg/ha/mm. Similarly trend of enhanced productivity and water use efficiency was observed in chick pea and safflower during rabi season.

Harvesting of runoff from the cultivated fields in to farm ponds and utilized to provide protective irrigation during prolonged monsoonic break in kharif and moisture stress in rabi enhances the crop yields and water use efficiency. One protective irrigation from farm pond through drip system enhanced the yield of pigeonpea by 66.66 per cent and water use efficiency from 0.89 to 1.38 kg/ha/mm. Two protective irrigations through drip systems to cotton enhanced the yield level by 51.37 per cent and water use efficiency from 1.61 to 2.13 kg/ha/mm. One protective irrigation to soybean through sprinkler system from farm pond enhanced the yield by 24.13 per cent and water use efficiency from 2.15 to 3.48 kg/ha/mm. Similarly one or two protective irrigations through sprinklers system during rabi season to the chickpea and safflower from farm pond and river enhanced the yield levels by 42.85 to 166.66 per cent and water use efficiency from 0.55-1.48 to 1.38-2.14 kg/ha/mm. The results reveals the on farm improvement in land and water productivity in terms of enhanced crop productivity and water use efficiency which only because of linking the rainfed farming with attempts of drought proofing.

From the results it is concluded that the adoption of the modified land configurations like deep cultivation, across the slope, contour cultivation, and opening of furrows and tied furrows, green manuring, square basin lay out etc can store the rainfall properly in the soil profile and further effectively utilized in rainfed agriculture in terms of enhanced soil moisture, crop yields and water use efficiency and reduction in runoff, soil and nutrient losses. Involvement of farmers in rainwater management towards, "more crop per drop" indicated the more diffused impact by changing their thinking about how water is and should be managed and meet out the whether vagaries in rainfed agriculture to solve the water crises by way of more crop per drop.

IV. Scope for further expansion of the innovation

Almost three fourth of the cultivated area in India and even in Maharshtra state is un irrigated. In Vidarbha about 93 per cent of the total cropped area is rainfed and this results in large annual fluctuations in crop production. The scope for increasing irrigation potential appears to be very limited. All attempts to store the rainfall effectively in the soil profile, between the bunds and check dams and

in farm ponds need to be made on large area, so that the rainfall can effectively be utilized in rainfed agriculture. Subsequent crop improvement measures such as intercropping, across the slope cultivation, contour farming, timely implementation of all agricultural operations, adoption of improved varieties etc. are components of the integrated package of rainfed agricultural technology. This can only be possible by linking the farming with attempts of drought proofing. Providing the means of higher and prolonged residual soil moisture conservation to every farmer in the river basin are must, so that weather vagaries can be considerably managed, which rescue the farmers. *Insitu* recharge of rain water which calls for land treatments in such a fashion that the maximum water of rainfall gets infiltrated in to the soil profile and it becomes available to the crop during prolonged monsoonic break. Efficiently utilization of rain water (yield per unit of water used) is the only way of boosting agricultural production. Because of the fragile nature of the ecosystem the rainwater management in rainfed agriculture in the river basin for soil and water conservation is of paramount importance, and shall receive top priority in rainfed farming as they form the foundation for the sustainable agriculture. Water resources development stimulates all further development in the river basin in all respect.

All attempt to store the rainfall in soil profile between the bunds, check dam and farm ponds needs to done upto full extent in entire river basin for effective and efficient utilization in rainfed agriculture. Subsequently in order to reduce the runoff soil and nutrient losses and to enhance the crop productivity the crop improvement measures such as across the slope and contour cultivation with vegetative contour key lines and land configurations like opening of furrows, development of sown silvipasture system on the shallow and waste land in the river basin, timely implementation of all agricultural operations, adoption of improved varieties are the few component of sustainable rainfed agriculture in the river basin. This off course will need the participation of farmers in the river basin in view to reduce the runoff, soil and nutrient losses and to enhance the crop productivity and to decrease the sediment load and concentration of chemicals to avoid the adverse consequences on the function of the rivers and ecosystems.

Therefore in this context there is a full scope for further expansion of these innovations.

V. Role of the Individual nominee

Prof. (Dr.) S.M. Taley, Head, Deptt. of Agricultural Engineering & Director, Agroecology and Environment Centre, Dr. P.D.K.V., has played a major role in bringing the reforms in cultivation practices like across the slope, contour cultivation and opening of furrows in rainfed agriculture for *in situ* and ex-situ soil and water conservation. He has promoted the concept of protective irrigation from farm pond in rainfed agriculture, the alternate land use for the development of perennial plantation system in non arable and waste land with appropriate soil and water conservation measures. He has undertaken the comprehensive on-farm study by involving the farmers and motivating them to enhance the rain water use efficiency and to harvest "More crop per drop" by enhancing their skill and capacity. He worked with about 9,500 farmers in 115 villages of six district of Vidarbha region and facilitated adoption of rainwater management technologies with special focus on '*in situ* and ex-situ conservation practices' covering about 21000 ha area during 2009-10.

Farm pond technology was adopted by state Government and out of targeted 35000 farm pond about 15000 farm ponds have been completed so far. Farm pond technology is proving boon to rainfed Vidarbha for ensuring two crops per year. *In situ* and ex-situ conservation practices with protective irrigation registered 60% yield gain in cotton and additional income of Rs. 28000 per ha.

On the outset of enhancement in the adoption of these technologies during 2007-08 to 2009-10 from 9000 ha. to about 21000 ha. the year wise *in situ* rain water conservation / saving was estimated and given in following table.

Year	Area, (ha.)	*Water conserved / saving (MCM)*		*Total conservation / saving (MCM)
		In-situ conservation	Recycling of runoff from farm pond for protective irrigation	
2007-08	9000	97.20	0.02	97.22
2008-09	13500	145.80	0.03	145.83
2009-10	21000	226.80	0.05	226.85
Total	**43500**	**469.80**	**0.10**	**469.90**

* Estimation of rain water conservation and run off harvested is difficult task

The total rain water conservation / saving attributed to the adoption of these technologies is estimated to the tune of 469.90 MCM during last three years.

Certificate by the Nominee

Certified that, the above research on application in rainfed agriculture specially on rain water management been carried out during last three years under at Dr P.D.K.V., Akola for Vidarbha region within jurisdiction of the University.

(S.M. Taley)

Certificate forwarding note by Head of the Institution

This is to certify that the work submitted for 'WATSAVE AWARDS-2011' embodies the record of bonafide research carried out at the Dr. Panjabrao Deshmukh Krishi Vidyapeeth (Agricultural University), Akola in Vidarbha region of Maharashtra state.

(V.M. Mayande)
Vice Chancellor
Dr. P.D.K.V., Akola

Vice - Chancellor
Dr. Panjabrao Deshmukh
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