Integrated Farming for Crops, Fish and Livestock by Recycling Brackish Water from Fish Ponds

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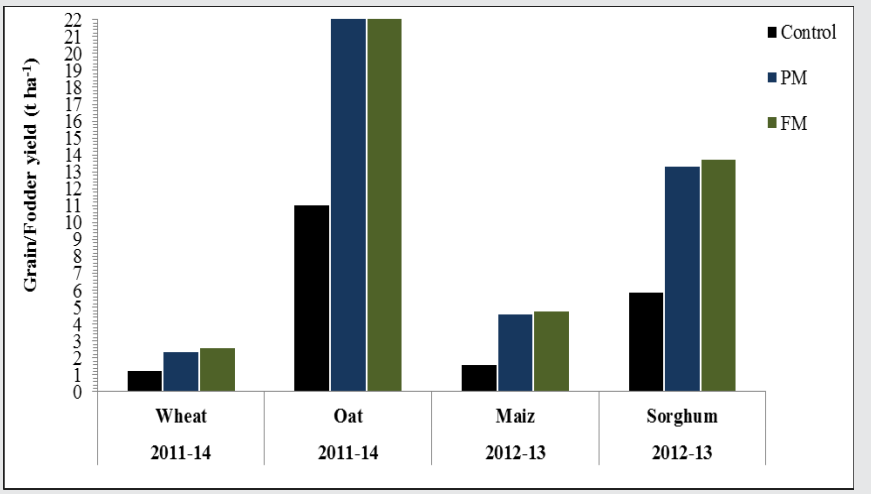
Salinity/sodicity adversely affects the productivity of agricultural lands and thus socio-economic conditions of the farming community are poor. In Pakistan 14×10^6 ha area is currently affected due to twin menace of waterlogging and salinity and it is growing rapidly. The availability of water in Pakistan has decreased from 5300 m^3/year/person in 1950's to 1100 m^3/person/year in 2014 and it is estimated to be < 1000 m^3 per capita (threshold level) by the year 2025. Poultry and fisheries are allied fields, which can be used to enhance the farm income under the circumstance of unavailability of good quality soil and water resources. Integration of plants/vegetables with poultry, livestock and/or fisheries helped increase the farm income and thus sustain the life of resource-poor farming community. By integrating poultry and fisheries with agriculture, a model was demonstrated for the farming community having small land holdings by utilizing marginal quality soil and water resources.

Field experiments on salt-affected soils were carried out for sustainable and economical irrigation with recycled water from fish ponds receiving animal manure and poultry manure at Proka Farm II, UAF. Experiments comprised of a permanent layout and composite soil samples were collected for determining various physical and chemical characteristics. Water samples from tube well and recycled fish ponds water were analyzed for quality parameters (EC, SAR and RSC).

Results revealed that saline-sodic water with EC and SAR higher than the critical levels of 1 dS m^{-1} and 10 $(mmol\ L^{-1})^{1/2}$, respectively, recycled from fish ponds was successfully used to reclaim calcareous saline-sodic (sandy loam) soils following wheat-maize and oat-sorghum crop rotations. Soil reclamation was found better with the application of recycled water from fish ponds in which Poultry Manure (PM) and Farm Manures (FM) were mixed. Furthermore, rotation of grain (wheat-maize) and fodder (oat-sorghum) crops showed better effect of recycled water. The net benefit remained the highest with recycled water

from fish pond receiving PM followed by FM. More income was obtained from wheat-maize than that from oat-sorghum crop rotation. This suggests that low quality water recycled from fish ponds receiving poultry and farm manures could successfully be used for irrigation on marginal salt-affected soils. It is evident that the research cum demonstration remained very good and effective method of educating farmers. Further it is warranted that there should be additional demonstration and technology transfer projects and activities to replicate the findings in other areas for the benefit of stakeholders having small land holdings. Although salt-affected soils and saline-sodic water resources are often viewed as representing major environmental and agricultural challenges in terms of biomass production, yet such soil and water resources can be productively used.



Effect of recycled water from fish ponds on grain and fodder yields of crops

Economics (Rs. ha^{-1}) of applied treatments for wheat-maize and oat-sorghum crop rotations (2011-2014)

Treatment	Total Expenditure	Total gross income	Net benefit	Total Expenditure	Total gross income	Net benefit
	wheat-maize			**oat-sorghum**		
Control	213322	280107	66785	77840	132755	54915
PM	224189	513246	289057	93693	296752	203059
FM	229738	499340	269602	91708	265768	174060

Note:

Calculations were based on 5 crops each of wheat and oat and 4 of maize and sorghum.

Effect of recycled water from fish ponds receiving farm manure on growth of oat