User Allocation and Implication on Water Quality and Farm Income: The Lower Chenab Canal Irrigation System in Pakistan

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The irrigated agricultural sectors in many countries are challenged by the low crop yields and declining agricultural production, which questions the food security. This is exacerbated by unequal distribution of the canal (surface) and ground water along the irrigation systems and the water quality (salinity) but inadequately addressed in scholarly work. An economic modelling for various water use scenarios have been developed to address the problem of inequality in water use and impact of salinity on crop yield (such as wheat). These models were estimated through a socio-economic farm household survey conducted in three locations: head, middle and tail reaches of the Lower Chenab Canal (LCC) irrigation system in Pakistan. A multistage stratified random sampling method was conducted to collect data from 256 farm households during 2010-2011 and 2012-2013 cropping sessions, respectively. The models were estimated by regression analyses for the effect of water quality on the crop yield under different water use scenarios. For each scenario, the canal and ground water use were defined as the percentages of total water use. The base scenario for instance included 60:40, 50:50, and 30:70 percentages of the canal and ground water use at the head, middle and tail locations, respectively. The optimal water use model implies that the use of more ground water for the head distributary is advisable (30:70) whereas the tail distributary can utilize more canal water (70:30). Further the gross margins (farm incomes) estimated for the distributaries suggest that farmers could be better off under the optimal water use scenario among all the other scenarios tested. The optimal water use scenario can significantly reduce the negative effect of salinity on crop yield and improve farm income. The modelling approach developed in this study can be useful to design better water use scenarios for other crops and areas facing similar issues.

Keywords: Crop yield, Groundwater, Irrigation, Socio-economic impacts, Water quality