Effect of Modern Agricultural Techniques on Sustainability of Groundwater and Enhancing Field Crops Production in Dhamar

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Introduction

Water scarcity forms a major constraint in realizing the goals set in the Yemen national strategic development plans. Dwindling water resources and increasing population threatens the future of the coming generations. Irrigated agriculture consumes more than 80% of the total annual groundwater that is abstracted. Most of the irrigated areas still depend on traditional irrigation methods with low efficiencies (35%). MAI and MWE made great efforts to reduce groundwater consumption in the agricultural sector. Expansion in applying agricultural irrigation water saving techniques face many obstacles such as farmers' limited financial capacity, most of farmers are smallholders and farmers' doubting in attainment of their usual crop yields if applying agricultural irrigation water saving techniques.

Objectives

Main objective is to assess impact of applying agricultural irrigation water saving techniques on groundwater abstraction and crop yield. Sub-objectives are to predict the amount of irrigation water that could be conserved when applying agricultural irrigation water saving techniques for cultivation of tomatoes and potatoes crops in Dhamar basin, and the evaluate the effect of applying agricultural irrigation water saving techniques on annual declining rate of groundwater table in Dhamar aquifer.

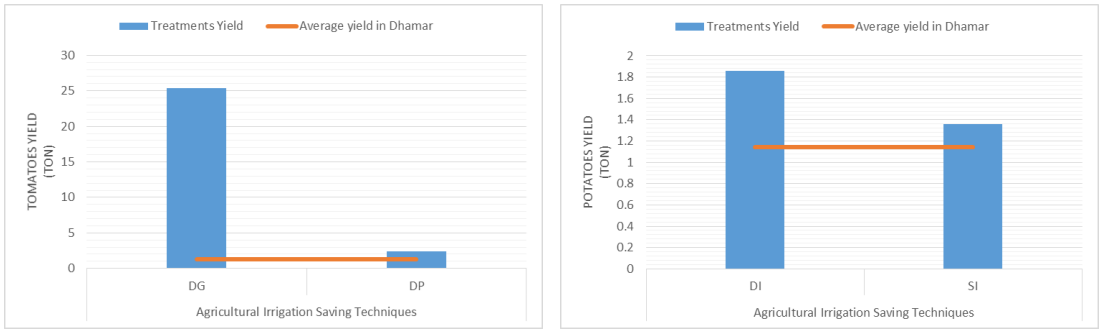
Treatments

1- Tomatoes under drip irrigation and in greenhouses (DG)
2- Tomatoes under drip irrigation system and plastic mulch (DP)
3- Potatoes crop under drip irrigation system (DI)
4- Potatoes crop under conveyance pipes irrigation system (SI)

Results

DG technique consumed the highest saving percentage in IWR for production of tomatoes comparing with DP technique by (13.8%) and by (95.66%) when comparing with average IWR using traditional irrigation in Dhamar. Where DP technique was higher by (81.86%) than average IWR using traditional irrigation system in Dhamar.

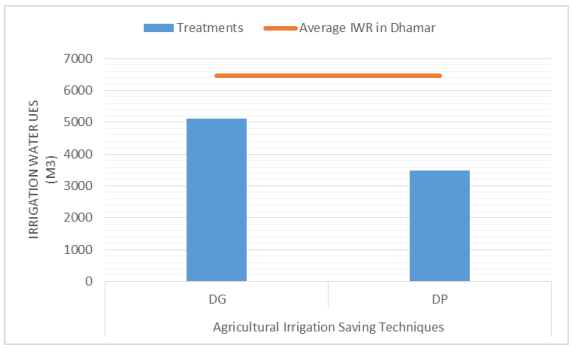
DG technique increased per unit area (m^2) tomatoes yield by (19.97 times) comparing with per unit area (m^2) for average yield of tomatoes under traditional irrigation in Dhamar. On the other side, DP increased per unit area (m^2) tomatoes yield by (0.88 time) comparing with average tomatoes yield per unit area (m^2) in Dhamar.

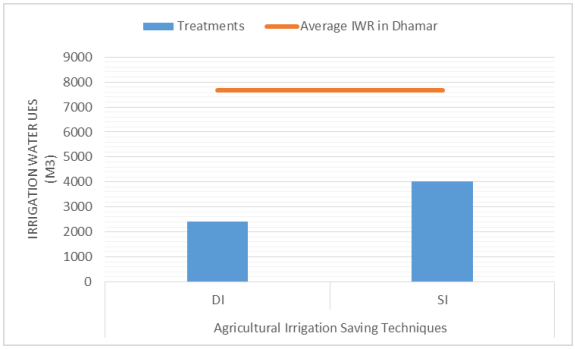


Tomatoes Potatoes

Impact of agricultural irrigation saving techniques on tomatoes and potatoes yield comparing with average yield in Dhamar per m2

DG technique could realize reduction in Dhamar groundwater abstraction by (95.67%) if production of tomatoes in Dhamar were totally depend on greenhouse in combination with drip irrigation, where DP could realize a reduction of (81.86 %) if the same comparison were done.
DI technique recorded the highest saving percentage in IWR for production of potatoes comparing with SI by (33.15%) and by (75.17%) when comparing with average IWR using traditional irrigation system Dhamar. Where SI IWR saving was higher by (42.02%) than that of average IWR using traditional irrigation system in Dhamar.

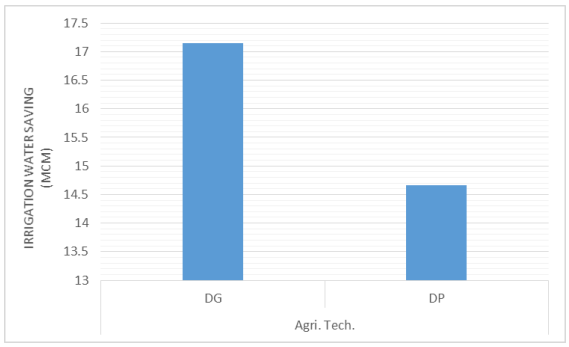


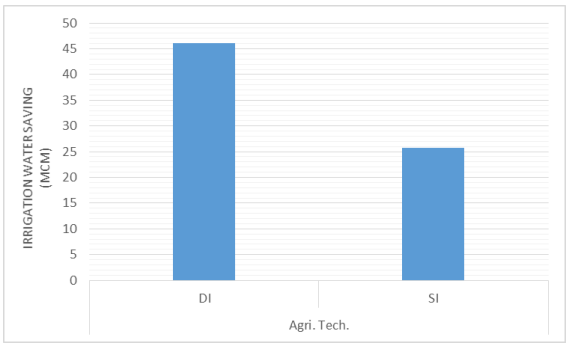


Tomatoes Potatoes

Impact of agricultural techniques on saving IW for tomatoes and potatoes production comparing with average IWR in Dhamar

DI technique could reduce abstraction from groundwater by (75.17 %) if production of potatoes in Dhamar were totally depend on drip irrigation system, where SI could realize a reduction of (42.02 %) when conducting the same comparison.
DI techniques augmented per (m^2) potatoes yield by (1.63 times) comparing with average per (m^2) potatoes yield in Dhamar. Where SI increased per (m^2) potatoes yield by (1.18 times) comparing with of average per (m^2) potatoes yield in Dhamar.

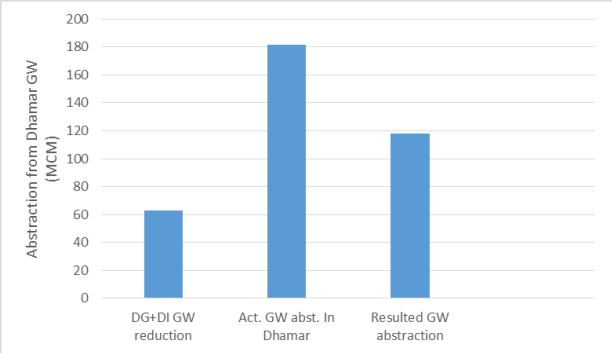




Tomatoes Potatoes

Impact of agricultural techniques on saving IW used at level of total tomatoes and Potatoes areas in Dhamar

When depending on DG plus DI for producing their actual annual yield, the predicted reduction in GW abstraction from Dhamar aquifer is of (118.38 mcm) which represent saving percentages (34.83%) of total annual groundwater abstraction from Dhamar aquifer.



Estimating of the reduction in GW abstraction when applying DG+DI for tomatoes and potatoes to produce actual both yield in Dhamar

Recommendations

1. The low efficiency of actual irrigation methods applied in Dhamar need to be improved to control abstraction from groundwater and reduce its annual declining rate.
2. There is a highly request to investigate the reasons that constrain the movement towards increasing coverage areas with modern irrigation systems, from the water governmental sectors side as from agricultural water users sides, and at two levels the planning one and the implementation one.
3. As in combination application of greenhouse and mulching techniques with drip irrigation system proved their effectiveness in sustaining groundwater resources, it is extremely requested to put greenhouse and mulching techniques at the same level of interest in developing agricultural strategic and action plans.
4. Tackling from success of modern agricultural irrigation water saving techniques in increasing crop yields, awareness and mobilization plans should dedicated to water users using on results of this research by governmental water sectors in meaner to enhance their local groundwater management experiences.
5. The high impact of greenhouse with drip irrigation technique in both reducing IWR and increase tomatoes yield give an advantage for agricultural planner to depend mainly on it to guarantee the actual average tomatoes yield in Dhamar using the lowest irrigation water requirement.
6. There is a need for more research studies to cover the request for modification cropping pattern from water conservation vision in condition that aid in enclosing the food gab at level of Dhamar governorate.