INTERNATIONAL WATERS EXPERIENCE NOTES

Demonstration Projects for Efficient Water Use

Abstract:. Pilot projects showcasing water saving potentials were implemented in the Kura II Project. These demonstration projects encompassed mobile application for municipal water network leak detection and awareness raising; E-learning modules for rational water use for school students in the two national languages; E-learning module for rational water use for local communities targeting households and commercial enterprises in the two national languages; installation of drip irrigation at pilot sites in Georgia and Azerbaijan and installation of an Aquaponics system training center in Azerbaijan. The drip irrigation pilots were implemented starting in 2019, one in Azerbaijan and three in Georgia. The water savings due to the introduction of drip irrigation were huge, in particular in Georgie where 90% less water was consumed. The pilot site in Azerbaijan resulted in roughly 30% less water consumption but higher production rates. Advance irrigation technology is a measure to enhance water security in both countries and especially indispensable in Azerbaijan to adapt to climate change.

Demonstration Projects for Efficient Water Use

Experience of the GEF – sponsored

UNDP GEF/IW: Kura II: Advancing IWRM across the Kura river basin through implementation of the transboundary agreed actions and national plans

GEF- ID: 5325

PROJECT DESCRIPTION

UNDP-GEF Kura II Project was developed to address the priority needs in the ministerially endorsed Strategic Action Plan (SAP) through implementation of the SAP and national Integrated Water Resources Management (IWRM) Plans to strengthen and harmonize coordinated conjunctive transboundary ground and surface water management. It comprised five components: Support for institutional governance protocols; professional development and capacity building for water managers across sectors; stress reduction measures in critical areas; stakeholder education and empowerment; and, enhanced science for governance.

One component was the implementation of pilot projects showcasing water saving potentials. These demonstration projects encompassed:

- Mobile application for municipal water network leak detection and awareness raising
- E-learning modules for rational water use for school students in the two national languages
- E-learning module for rational water use for local communities targeting households and commercial enterprises in the two national languages
- Installation of drip irrigation at pilot sites in Georgia and Azerbaijan
- Installation of an Aquaponic system training center in Azerbaijan

The drip irrigation pilots were implemented starting in 2019, one in Azerbaijan and three in Georgia. While the Georgian sites had already irrigation infrastructure, the Jafarkhan site in Azerbaijan was previously not used for agriculture activities. The Georgian sites were already irrigated to cultivate onions and potatoes.

THE EXPERIENCE

Issue

Irrigation plays an important role in Azerbaijan. The vast majority of water is abstracted for irrigation purposes. Azerbaijan faces the situation that water runoff originates far away from irrigation areas, which makes water transport necessary. Losses are significant in the irrigation sector. Losses during water transport account for approximately 1/3 and losses in the distribution system account for 2/3 of the total sum of losses. This is partly attributable to poor equipment and a lack of incentives to use water efficiently.

Water efficiency is at a low level in Georgia and the agricultural sector faces technical and socio-economic problems. Support for irrigation was nearly non-existing resulting in outdated infrastructure. Canals are not equipped with lining, irrigation schemes are poorly managed and traditional flood or furrow irrigation prevails. At present, rehabilitation works of channels and pumping stations have taken an intense course in Georgia. Georgian Amelioration Ltd. is currently supported by international donor organizations like World Bank, IFAD, ORIO, etc. However, the programs mainly focus on infrastructure development while farmers still prefer their traditional irrigation techniques.

The agricultural sector faces also a generation problem in Georgia. The young generation has no interest in farming with the consequence that young farmers are an exception. The average age of farmers tends to become older and leads to an unhealthy age structure. Young people leave the countryside and agricultural skills are lost. In addition, the agriculture sector is confronted with a competition through imported and cheap products from Turkey.

Although water losses are recognised as a problem in both countries, water use efficiency is deficient for a long time, especially in Georgia where measures addressing farmers have not yet emerged to counter the problem. One main reason for low water use efficiency is the lack of incentives to save water.

In Georgia, the current tariff system is guided by the Decree #2 "On the Amelioration Service Tariff" of February 1, 2011 of the Georgian National Energy and Water Supply Regulatory Commission. This Decree defines the cost of irrigation of 1 ha agricultural land to 75 GEL. This tariff does neither account for the amount of irrigation water used and neglects the fact that the financial outcome of 1 ha irrigated land depends on the crops. The tariff structure does not encourage farmers to use water efficiently. The most important aspect is that farmers must achieve a minimum profit of 75 GEL for each ha irrigated land to compensate costs, which decouples payment from efficient use. The water tariff focuses on the size of land cultivated. Crops with a high water demand and high yield are considered equal with crops with low water consumption. Farmers saving water are not promoted compared to farmers without any interest in water savings. Thus, efficient irrigation techniques are not promoted.

The Tariff Council of the Republic of Azerbaijan controls prices for water. At present, the prices were calculated taking into account abstraction of water from the sources and transport to the consumers. The economic situation of farmers, prices for the agricultural products and the overall economic situation in the country were reflected in the decision as well and led to the lowest possible tariff. The discounted tariff for 1000 m3 of irrigation water supplied to Water Users Associations, municipalities, and agricultural water users was approved to be 0.5 Manat. The low value is not an incentive to invest in water saving measures.

Addressing the issue

In recent years, World Bank financed rehabilitation projects were performed in irrigation systems in Azerbaijan. Among other lining of canals was a primary measure. Lining can be seen as a step to reduce seepage water losses and indirectly evaporation losses due to higher flow velocities. More advantages lining brings about are a reduced cross section needed to transport the same flow compared to unlined canals, reduced costs for maintenance, reduced erosion, more accurate hydraulic calculation of flow which is supportive for better gate operation.

Lining, however, only accounts for roughly 1/3 of the losses in irrigation schemes. Improving the service of water provision to farmers should be accompanied with improvements of the

farmer's ability to irrigate more efficiently. Currently, irrigation is largely performed by flood or furrow irrigation. This is the most inefficient irrigation technique. Water soaks into the soil but can also evaporate or run off. The amount of water is difficult to dose and water is not only applied where it is needed. In the light of a larger variability of flow and expected longer dry spells in the future, a higher irrigation performance will be one of the pillars for more water use efficiency.

At present, sprinkler or drip irrigation is not often used in Azerbaijan and hardly found in Georgia. Only few areas in Azerbaijan are equipped with advanced irrigation techniques, predominantly by private companies. Thus, experience in the countries is still limited, standards are not yet set and capacity building of WUAs and farmers is required.

A second gap is related to the operation of advanced irrigation techniques. While drip irrigation is pretty forgiving of errors in design and installation, the amount of water irrigated is quite sensitive. By far the largest loss of crops and thus productivity and efficiency is the direct result of improper irrigation scheduling.

Therefore, the introduction of drip irrigation and the improvement of irrigation scheduling is considered key to improving low water use efficiency. The installation of the Aquaponic system training center in Azerbaijan to promote and disseminate the use of this modern technique for the integration of fish culture with hydroponic plant production in a recirculating setup. This system has 89 to 99% water use efficiency.

The Kura II project started with pilot areas. Design and installation need careful planning and should consider equipment which is available in the country. Training accompanying the implementation looked into a) how to select the equipment, b) how to design the dimensions and c) how to install it and finally d) how to operate the system including irrigation scheduling.

The drip irrigation pilots were implemented starting in 2019, one in Azerbaijan and three in Georgia. While the Georgian sites had already irrigation infrastructure, the Jafarkhan site in Azerbaijan was previously not used for agriculture activities. The Georgian sites were already irrigated to cultivate onions and potatoes. This means that a comparison with/without drip irrigation was not possible at all locations.

Drip irrigation or trickle irrigation provides water at very low rates through small diameter plastic pipes to the fields where it drips slowly onto the soil. The plastic pipe or emitter or dripper is designed to deliver flow rates between 2 to 20 litre per hour. The advantage of drip irrigation is that only the rooted part of the soil is wetted. Water savings occur due to reduced evaporation losses, no surface runoff and reduced percolation losses. According to FAO water use efficiency with drip irrigation can reach more than 90%. The Aquaponics training center was installed in April 2021 at the premises of one of the active NGOs in Azerbaijan and a training of trainers was conducted to NGO's team on the operation of the aquaponic system. IDEA NGO will organize a series of training courses for local farmers on the use of Aquaponics system to widely disseminate this advanced technique.

RESULTS AND LEARNING

Summary of work and outputs

Water savings in the drip irrigation pilot sites in Georgia were huge. 90% at the Ruisi site with onions and 75% with potato at the Tsalka site. Water savings at the Jarfarkhan site

in Azerbaijan were in the range of 30% and revealed 20% higher production rate per m³ of water supplied. The figures may not be fully representative since the comparison is based on only two years so that hydrological conditions during these given years may have impacted on the water needs and thus on water savings and production.

However, drip irrigation is regarded as the most efficient irrigation method and FAO estimates water savings potentials of approximately 50% (Perry, 2017). Changing from traditional to hi-tech (drip) irrigation has a number of implications.

- Water saved is released to other users
- More production is achieved per unit of water
- Maintenance is regularly required to prepare the fields with the emitters
- Water accounting is recommended to enable the evaluation of water savings
- Training in the use of a drip irrigation system
- Interrow cropping is difficult or even impossible without destroying emitters

The water released to other users offers opportunities that are not possible otherwise. The opportunities enable downstream riparians to use the water for their own purposes, which must be included in a benefit-cost analysis. One central advantage to stakeholders is the possibility to tailor the amount of water required so that the optimal soil moisture is kept and losses are minimized. Water accounting in order to evaluate water savings is required to inform future investments.

Awareness on the value of water in general and sustainable use in particular are pillars for efficient water use. The Kura II project embarked on and supported strategies in terms of awareness raising in two ways:

- Mobile application for municipal water network leak detection and awareness raising
- E-learning modules for rational water use

The leak detection is based on crowd sourcing in which leaks are reported by everybody who detects one. Instead of only a few specialists that try to find leaks in a water supply network, everybody can contribute, which in turn multiplies opportunities to find a leak by many times. An app was developed that can be downloaded. The Hydro-Heroes Water Saving App is an opportunity to empower stakeholders to report water leakages from their mobile phones directly to the municipal water companies and learn about conserving water in the process. It is like “Pokemon Go, but saving the world, one drop at a time”. The app is targeted for youth aged 14-35, but can be used by anyone to report leakages using mobile phones and geolocation, linking in to the on-line system that municipal water companies currently have.

REPLICATION

The Implications on crop yield and water use efficiency in Azerbaijan with the effect of drip irrigation can be concluded as the following:

The Aran regions is considered most important for agricultural development in Azerbaijan. The Jafarkhan (Saatli district) pilot site is located within this region. The deficit season, which is characterised by higher potential evaporation rates than precipitation, covers almost the entire year and calls for the necessity of year-round irrigation. High water deficits and thus low to zero crop yields are unavoidable without irrigation. Water deficits and in turn irrigation demand can be summarized for the Aran region as the following:

- Assuming a water efficiency of 30%, the Aran region requires
  - 13,200 m^3/ha/a for cotton in order to compensate expected annual water deficits.
  - Rice cultivation would require up to 18,600 m^3/ha/a.
  - Potato and vegetable up to 12,100 m^3/ha/a.
  - Barley and oats result in the lowest values with 6,800 m^3/ha/a.
- With drip irrigation and assuming a water efficiency of 90%, the Aran region requires
  - Cotton 4,400 m^3/ha/a in order to compensate expected annual water deficits.
  - Rice up to 6,200 m^3/ha/a.
  - Potato and vegetable up to 4,030 m^3/ha/a.
  - Barley and oats 2,250 m^3/ha/a.

The water savings are a strong argument for replicating the pilot projects.

The Implications on crop yield and water use efficiency in Georgia with the effect of drip irrigation can be concluded as the following:

All regions in the countries, which seem suitable for large-scale agriculture, have a deficit season, which is characterised by higher potential evaporation rates than precipitation. The risk of annual water deficits and thus low crop yields without irrigation is high but varies largely with the crop type. The Alazani and Rustavi/Lower Kartli region are target areas for replication of drip irrigation. Considering drip irrigation, observations at the pilot sites have shown that up to 90% could be saved compared to traditional flood or furrow irrigation.

SIGNIFICANCE

The agricultural sector is by far the largest water consumer in both countries and outstrips all other water consuming sectors. Improving water use efficiency in the agricultural sector is key to improve water use efficiency in the countries. The economic opportunities that that become possible through the water savings will reach an important amount and help improve environmental flow and can be seen as a significant adaptation to climate change.

REFERENCES

UNDP-GEF Kura II Project: https://kura-river.org/

KEYWORDS

Water Use Efficiency, Pilot sites, Drip Irrigation, Sprinkler Irrigation, Adaptation to Climate Change, Advance Irrigation Technology