Water saving in irrigation

Potential water saving in irrigated agriculture by means of improving water use efficiency

From the partial position paper for irrigated agriculture in SA by M.C. Laker, 2013

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SUBTROP

The partial position paper drafted in 2013 stated clearly that on average there is quite a large scope for improving irrigation water use efficiency (WUE) in South Africa. Therefore, the existing and possible future irrigation water demand could be substantially reduced. Such "saved" water can be utilised for additional irrigation development and/or other uses, without harming production. The paper states that there is scope for both off-farm (supply system) and on-farm improvement of WUE. This is also highly applicable to the subtropical fruit industry. Land use planning and improved land suitability evaluation are two of the main requirements for improving irrigation use efficiencies.

Improvement of the efficiency of irrigation water supply has two main components, namely a) a technical component, dealing with the quality and maintenance of the water supply infrastructure, and b) management of the water supply, of which irrigation scheduling being one.

a) Major water supply infrastructure problems exist on several irrigation schemes, as well as many irrigation farms. These include mainly large water losses between the source (e.g. dam or river) and the scheme or farm / orchard due to leaking canals, pipes and dams. Such losses can amount to 50% of water entering the irrigation scheme.
b) Wasteful ("non-beneficial") use of irrigation water can be limited and irrigation WUE improved by implementing efficient water supply management. This will require that the correct quantity of water must be available at the correct site (orchard) at the correct time, and correct quantities according to demand (irrigation scheduling). This is in contrast to the supply of water according to more rigidly fixed time scales. The quantity of water required at a specific site at a specific time (date) is determined by factors such as rainfall events, cool periods, heat waves, type of crop and stage of crop growth.

On-farm improvement of irrigation WUE – In most irrigated areas in South Africa there is substantial scope for on-farm improvement of irrigation WUE, despite the fact that many millions of rand have been spent on irrigation research in South Africa and thousands of pages of research reports have been written on it. However, the subtropical fruit industry is the exception. Means to achieve on-farm improvement of irrigation WUE include:

- ***Good construction and maintenance of on-farm irrigation water distribution systems*** – both the construction and the maintenance of on-farm irrigation water distribution systems are often lacking and lead to substantial water losses (waste of water) and / or have negative impacts like waterlogging and salinisation of irrigated land. This is true on both large scale commercial farm level and small-scale irrigation level.
- ***Selection of the best and most appropriate irrigation system for each specific situation***, according to:
  - the soil and climate;
  - available water (quality and quantity);
  - the specific crop requirements;
  - farmer (skills, experience, preferences) and the production unit economic considerations;
  - as well as the available infrastructure (physical, technical support, advisory services).

  The above, coupled with appropriate design, proper maintenance and correct management of the selected irrigation system, is essential for achieving high irrigation WUE.
- ***Improved irrigation scheduling***, including both selection of an appropriate irrigation scheduling approach and effective implementation thereof. Effective irrigation scheduling is a key factor for achieving high irrigation WUE and thus water saving without impacting negatively on yield and/or quality.
- ***Sound farm management***, includ-

ing soil management (physical, fertility and chemical), weed, pest and disease control, general horticultural and / or agronomic management. As indicated in the paper, one of the severe errors that has major impact on irrigation WUE is improper soil physical management. In some parts of the country farmers are well aware of this, but in other areas, including Mpumalanga and Limpopo, this is not often taken into consideration. The two critical aspects are (i) soil crusting (surface sealing) and (ii) sub surface compaction. The vast majority of irrigated soils in South Africa are susceptible to both of these (Laker, 2003).

The report states: "***The subtropical fruit industry is an area of great concern.*** There seems to be very little irrigation research data available on which to base irrigation scheduling. There seems to be basically no information related to strategies aimed at improving irrigation WUE. The seriousness of the matter is aggravated by the fact that most of these crops are grown in seriously water-stressed areas due to limited water resources and serious competition from other sectors. Irrigation scheduling is apparently basically based on thumb sucking. Research is urgently needed".

True or false, the fact remains that the subtropical fruit industry lacks accurate and scientifically sound information on crop water needs per growing area, soil type and plant phenology. And this is why SAAGA and SAMAC have initiated irrigation research in 2010. However, this needs to be expanded and capacity / hands is a big problem. Possible future collaboration with the Water Research Commission was discussed in January 2014 and future workshops will be held during the year to finalise this collaboration and funding of the irrigation research.

Even if a farmer is efficient in implementing all of the above, it is impossible to achieve high irrigation WUE, in terms of "crop per drop", if his farming is not based on high quality land suitability evaluation and land use planning. High quality, detailed resource surveys are in turn absolute requirements for high quality land suitability evaluation and land use planning. The soil with the best potential should be retained for irrigation farming, because they render the highest irrigation WUE and the highest water productivity. Non-irrigable soils should be eliminated.

Where water becomes scarce, it may become necessary to look at the water requirements of the different crops that are presently grown and alternative crops that could possibly be introduced. Economic considerations and the holistic management of labour, cash flows and markets must be taken into account.

Examples of water savings by crop and system changes based on the average values for six subtropical fruit producing areas, show that changing from litchi under drip irrigation to avocado, mango or macadamia under drip irrigation could bring about water savings of 15%, 19% and 23% respectively. In the Politsi area, changing from litchi to macadamia under drip irrigation could mean water savings of up to 31% and up to 42% if changing from litchi under micro-irrigation to macadamia under drip. These figures simply serve as examples and each production unit will have a different set of variables to take into consideration.

Overall for the country as a whole but also for individual farmers, a substantial irrigation water ***saving*** could be obtained with effective on-farm implementation of all these factors. It is difficult to quantify and it will differ between different areas and crops. In some areas virtually no water savings may be possible, because present water management levels are very high. In some other areas the saving could be as much as 30%. A recent Water Research Commission report indicates that water losses of up to 35 to 45% are common in irrigated agriculture.

It is well-known that there is a positive correlation between efficient irrigation and better / higher crop yields. Thus, by increasing yields through optimal management of the orchard nutrition, canopy and light, pest and disease pressures and irrigation, there will be a substantial increase in WUE and more miles will come from each liter of water applied.

References

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