How You Can Prevent/Reduce Occurrence of Waterlogging in Agricultural Lands

Training Notes by Prof. Bancy Mati

Last week we saw the causes of waterlogging particularly in agricultural fields, the factors associated with the phenomenon and the effects. This week we look at some simple water management interventions you can use to prevent or at least reduce the occurrence of waterlogging. Here's how.

Agricultural lands become waterlogged or poorly drained mostly as a result of poor water management, either under rainfed or irrigated agriculture. By simply adopting various designs and proper land husbandry, waterlogging can be reduced or even eliminated. These measures are presented here categorized for both rainfed and irrigated systems.

1 Preventing Waterlogging in Irrigated Agriculture

Irrigation without proper drainage sometimes increases the total water held in a soil profile to an extent of causing poor drainage. This is controlled through reduction of excessive water inflow into the soil as follows:

1.1 Control of canal seepage:

Canal seepage is a major source of water losses, and waterlogging in irrigated areas. It can be controlled by:

- Lining of canals with impervious material e.g. concrete, clay, polythene, so as to control excessive seepage from unlined canals is a very important preventive measure.
- Lowering of designed full supply level to the canal, with a view to cut down the seepage losses.
- Increasing the gradient of the canal t enable faster flows hence less ponding
- Interception drains along the canals 15 to 30 metres away from the canal banks are effective to arrest seepage from the canals.
- If possible, convert water conveyance system from canals to piped systems.
- Regulating canal discharge: seepage losses can be minimized if canal discharge is regulated during non-irrigational period. Overuse of canal water is curbed if canal supply is regulated together with pumping of ground water.

Unlined canal can cause waterlogging of adjacent lands

Lined canal stops waterlogging by preventing seepage

1.2 In-field water management

This is perhaps the most important aspect of avoiding the percolation of unnecessary water in irrigated lands. It entails:

- Applying only the requisite amount of irrigation water (not to exceed the field capacity), so that all the water applied is used by plants
- Adopting more efficient irrigation methods e.g. drip irrigation
- Where feasible, convert from surface irrigation methods to sprinkler or drip irrigation.
- Restrict irrigation in areas with high water table to receive supplemental irrigation during dry season, or only a fraction of total command area,
- Economical use of water like leveling the fields and refraining from applying more water than the soil can hold.

1.3 Control of inflow from other water bodies

Flood water can overrun irrigated fields from overflowing rivers, flood plains and channel obstruction. Such flooding should be stopped from reaching the low-lying fields: This can be achieved through"

- Construction of dykes to train the river movement,
- On- stream dams, which act like regulating dams
- Off-stream dams,
- To conserve the catchment with run off collection and disposal systems.

1.4 Control of ground-water inflows.

Interflow water is mainly from sloping ground rivers, high infiltration rate and a can cause increased waterlogging. These are controlled by:

- Construction of an interceptor,
- Growing trees e.g. eucalyptus or crops) that have high water consumption rates (e.g. sugarcane, arrow roots).
- Construction of spring protection works

1.5 Control of water from higher ground into lower fields:

Excessive water inflows from higher ground can sometimes inundate irrigated lowlands through ground water recharge. The solution would be to:

- Obtain the water for irrigation from somewhere else, (
- Proper irrigation water management, and
- Incorporate fish or duck farming.

2 Preventative Measures in Rainfed Agriculture

Rainfed agriculture usually suffers from temporary waterlogging associated with excessive rainfall, flat topography or poor land and water management. Poor drainage can be controlled using preventative measures such as:

2.1 Reducing unnecessary percolation of rainfall

This involves efficient disposal of storm water in excess of crop water requirement. The excess water collects because of high seasonal rainfall (termed in-situ rainfall), concentrated over a short period, in an extensive flat land, or downstream channel obstruction, or soils of shallow impermeable barrier (planosols) or low infiltration rates (vertisols). The solution would be to have

(i) Cambered beds,
(ii) Leveling of flat areas to reduce depressions,
(iii) Sub-soiling to break the hard pans and improve infiltrations
(iv) Excavation of farm ponds to store water for later and use/ supplementary irrigation,
(v) Grow water loving plants e.g. sugarcane, and
(vi) Improving terrace outlets before the rains. A functional outlet is the most important part of the drainage system.

Excessive runoff onto flat areas causes waterlogging

Cambered beds can be used to reduce waterlogging

2.2 Controlling surface runoff

Surface runoff from large catchments or paved areas such as homesteads, urban areas and roads can be excessive to the point of causing waterlogging of receiving lowlands. The excess water can be due to high intensity storms on sloping ground, high ratio of catchment to receiving areas or poor land use and management practices in the catchment. The solution would be to:

(i) Construct diversion ditches/cutoff drains to intercept the runoff,
(ii) Conservation in the catchment areas to reduce runoff accumulation,
(iii) Water harvesting and storage in tanks, pans and other structures,
(iv) Developing a functional runoff collection and disposal system.

2.3 Tree planting

Tree planting, particularly of species that take up a lot of water, e.g. eucalyptus tree species, can be helpful in lowering water table. The trees further ameliorate the environment and can be used for commercial purposes. Deep rooted eucalyptus trees have roots extending up to 3 m but transpire water at a high rate and thus works as a biological pump. This they can take care of unwanted drainage water in irrigation schemes and temporary waterlogging in rainfed systems. But the bio-drainage is only effective if there is adequate aeration in the root zone and the roots extend up to ground water reservoir and draw water from capillary zone.

2.4 Other Preventative Measures

(i) ***Land grading***: land grading is useful for improving surface drainage in waterlogged soils, especially in irrigated lands.
(ii) ***Cropping patterns*****:** vegetation and crops which have high rate of evapotranspiration may be patronized to serve as natural drainage system.
(iii) ***Optimum water use*****:** conjunctive use of surface and ground water be encouraged by digging wells and sinking shallow tube wells.
(iv) ***Better irrigation methods:*** Improvements in water applications by giving only the optimum depth of irrigation water. Sprinkler and drip irrigation methods be introduced to reduce percolation losses.
(v) ***Punching underground barriers*****:** Geological formation such as buried ridges as may be interfering with the subsoil flow leading to waterlogging conditions may be punctured to lower the water table.
(vi) ***Efficient drainage system****:* an efficient drainage system is essential for the quick disposal of the storm water and excess irrigation water.
(vii) ***Removing obstruction in natural drainage:*** improved by removing debris from the water ways and providing adequate waterway under the road bridges and drainage crossings.