ECRONICON OPEN ACCESS

EC AGRICULTURE
Guest Editorial

Land Drainage and its Importance in Agriculture

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Received: March 24, 2020; **Published:** April 21, 2020

Land drainage consists of the evacuation of excess water on the surface or within the soil profile in a suitable time, allowing optimum humidity to be maintained for the development of the roots of cultivated plants. This is achieved through the construction of works on agricultural land, such as drainage channels, perforated pipes, among other works.

Drainage limitations are generally grouped into two types: superficial and deep (sub-superficial or underground).

Surface drainage: This type of limitation occurs on the surface of the land, and can present due to flooding, waterlogging or puddling, that is, the presence of a sheet of water on the surface saturating the upper part of the soil. This phenomenon is generally located in the low or concave parts of agricultural lands where clay soils and areas of high rainfall usually predominate, exceeding the natural drainage capacity causing large losses in the crops.

Deep drainage (underground or subsurface): This type of limitation is associated with the presence of the water tables near the surface of the ground, saturating the soil profile causing very high humidity in the root zone of crops, developing conditions anaerobic causing rot. In addition, the most severe problems occur in arid or semi-arid areas with low irrigation sheets and where harmful salts accumulate for most crops due to poor or little or no drainage systems.

The main causes of drainage problems are of natural and anthropic origin, the first are inherent to geomorphological, topographic and agrological aspects; while the second ones are due to the influence of deficiencies in regional planning, arbitrary applications of water to the fields, humans ignorance of the soil properties, development of crops susceptible to drainage limitations and scarce or null drainage infrastructures or design of anti-technical works.

To avoid the impacts of bad drainage on crops, the main natural or artificial causes must be analyzed together, for this the problem must be approached in a quantitative way, since it must analyze, for example, the permanence of waterlogging and groundwater, therefore we must correct these limitations very quickly without affecting cultivated plants, while in other cases they remain for long periods of time, severely affecting agricultural projects even with good drainage networks but perhaps with poor maintenance and monitoring.

The main effects of the deficiencies of drainage on the crops are due to the fact that the permanent saturation of water suffocates the roots because the oxygen is replaced by the water causing the poor physiological functioning and finally severe rots. Besides, it affects the biological activity of the soil and its productive capacity due to the reduction in the absorption of water and nutrients.

To minimize the impacts of drainage deficiencies in agricultural projects, the following aspects must be fully analyzed:

- Have geological, geomorphological, topographic and soil studies (soil and sub-soil) of the project area).
- Climatic, hydrological studies have maps of soil, sub-soil, isobaths and iso-hypsas.

- Select the appropriate crop according to types of soil potential distributed in the sector and agro-ecological aspects of the region.

By knowing the properties of the soils and their hydrological behavior, especially its colors, the oscillations of the water table, the altimetry and the climatic behavior and the other mentioned studies, it is possible to preliminarily define the most critical areas with drainage problems, if they are of superficial or deep type and in this way implement the most appropriate works for the evacuation of excess water, only in the areas where such works are required, significantly minimizing the costs that they demand.

To identify areas with drainage limitations, we should follow the definitions described in the methodologies of the Soil Survey Staff Manual, 2017 and Keys to Soil Taxonomy, 2014 and FAO Classification System, 2016, which have their respective chapters focused on drainage behavior, must be followed, natural soil, starting from those well drained to very poorly drained.

In order to georeference the sectors with drainage limitations, it is necessary to describe modal soil profiles (trial pits), commonly called "Calicatas" up to a depth of 1.50 meters or more, where the main properties of the soils must be evaluated to know their morphology. The identification of soil colors is essential to define areas that require more or less intensity of drainage works, within soil studies one of the fundamental aspects is the description of different modal profiles (Calicatas) up to a depth of 1, 50 representative meters of each cartographic unit of soils starting from those well drained to very poorly drained, there the main properties must be taken to know their morphology. To take the colors of the soil, the Munsell table is commonly used (Munsell Soil Color Chart, 2017). With the morphological data obtained in the field, the soils are classified according to the drainage conditions, based on the depth and intensity of the gray colors as matrix and grayish and reddish mottling according to the parameters described by the USDA, 2014.

When a high presence of the previously mentioned colors is present in the soils in the superficial horizons, generally 0 - 60 cm deep, they are considered severe limitations for most crops because this depth corresponds to the rhizosphere area.

Another very important aspect to find poorly drained areas is by performing infiltration tests, when the values of these tests indicate that the water percolates very slowly these sectors are related to poor to imperfectly drained soils and otherwise correspond to those well to excessively drained. The different behaviors are associated with the physic-chemical properties of the soil types, the levels of compaction, altimetry, micro-geomorphology (micro-relief), the regime and intensity of the rains and, in general, soil hydrological properties.

In other cases, when the drainage problem is superficial, only with good land preparation can be solved this limitation, therefore is very important to study the soils in detail to establish the causes of these limitations in order to design the most adequate drainage system.

Drainage system designs should always be based on specialized technical studies and basic historical information and by expert professionals.

Once the crops are established, the functionality of the drainage systems must be evaluated through frequent monitoring with the installation of observation wells spatially distributed throughout the project area or at least in the areas defined as critical, with this information it is possible to elaborate the isobaths and isohypsas maps, which are the support to make the adjustments to the system only in the sectors where there are more limitations.

As a conclusion, it can be mentioned that in technified farms with large economic investments where drainage limitations are present, the most appropriate systems must be implemented, monitoring systems must be carried out for the respective corrections, and not wait for crops to appear once established suddenly very severe drainage problems that result in high economic losses and unfeasibility of the mentioned projects [1-6].

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Volume 6 Issue 5 May 2020