ICID Young Professionals e-Forum (IYPeF)

https://www.linkedin.com/groups/6990321

Cost-effectiveness of Agricultural Field Drainage

Background Note for Discussion

15-31 May 2019

Introduction

Agricultural field drainage refers to the removal of excess water and/or salt from the soil zone occupied by roots of crops to allow adequate movement of air, mainly oxygen, which is essential for the crop's normal development. The process of field drainage provides a set of technical strategies and hydraulic structures to maintain a suitable relative proportion of water and air for favourable crop physiological growth as well as to ensure soil sustainability that supports continued productive crop conditions (Gurovich & Oyarce, 2015). Deficient drainage conditions in the soil root zone induces a number of physiological state of plants including reduction of shoot growth and development, and lowering the ability of roots to water and nutrient absorption (Palta, Ganjeali, Turner and Siddique, 2010). Ensuring a reasonable drainage situation is thus, a crucial factor for increasing crop productivity as an integral part of the effort to attain food security, for the alarmingly increasing world population, and dwindling availability of natural resources that are required to support sustainable crop production (Bruinsma, 2017).

Agricultural drainage has been practiced for centuries with continued advancement of techniques starting from a mammoth task of digging field ditches manually to much more automated systems available presently making the task easier. The innovative use of agricultural drainage systems in the current times has also allowed farmers to introduce more intensive and modern farming methods to increase productivity and further helped to shape the lives and habitats of wildlife through improving biodiversity (Shaw, Johnson, Macdonald, & Feber, 2015).

In view of sustainable agricultural intensification aimed at meeting the critically increasing global food demand, opportunities for modernization of farming systems have been accentuated to be explored widely at different scales (Fortier & Thi Thu Trang, 2013). However, not all of the emerging technological innovations can be realized as it is always vital for any farmer or investor in the sector to reduce costs in the whole production systems as much as possible. Cost-effectiveness has been one of the key criteria for most people when it comes to paying for essential technologies and services. Generally, people try to get the best deals they can in order to cut costs and maximize benefits/profits for their projects. Hence, it is important to explore the most cost-effective solutions for agricultural drainage at multi-scale, ranging from small subsistence farms to large-scale commercialized farms without compromising the desired quality and suitability in terms of meeting the purpose.

With these economic constraints in mind, a good agricultural drainage plan will have to look at a number of determining factors and carry out a thorough assessment to reach to an optimum drainage solution as per the desired level of automation and the question of affordability. That way; farmers can make the best possible budget for the work that needs to be done. As to the different forms and techniques applied, agricultural drainage can be commonly classified into two major types: (i) surface drainage which involves a network of open trenches to collect and convey excess water away from the affected areas; and (ii) sub-surface drainage that involves a series of interconnected buried pipe drains or deep open drains. Sub-surface drainage are meant mainly to control the groundwater table by allowing excess water from the root zone entering the pipes through perforations to be collected successively and discharged out of the vulnerable fields (Van der Molen, Beltrán & Ochs, 2007).

The former is known to be the most predominantly used form of drainage worldwide as it is relatively low-cost and for its ease of installation and maintenance. Whereas the latter involves more sophistication and is relatively expensive because of the materials, equipment and skilled manpower required. Therefore, depending on the extent of the problem and preferred type of drainage system, it is important to carry out cost-benefit assessments before installing or managing field drainage systems so that the socio-economic and environmental benefits are attained at a reasonable cost. Major costs associated with field drainage are related to site planning, design fees, installation of various control structures, capital expense of the structures and their installation as well as recurrent costs of operation and maintenance.

Objectives

This discussion on the topic “Cost-effectiveness of Agricultural Field Drainage” has the following objectives:

1. Highlight the evolution of agricultural drainage systems over the time and discuss current technological advancements (automation, modernization).
2. Develop a better understanding on the need of agricultural drainage for higher crop productivity in the context of rising global food demands.
3. Discuss the possibilities of improving the cost-effectiveness of drainage systems for better land management and increased crop production.
4. Share experiences at different scales and geographic settings of pragmatic and low-cost drainage (best) practices.
5. Gain insight of young professionals from around the world and outlining their role in research and development in terms of advancement in the field.

Expected outcomes

During the IYPeF e-Discussion, views of young professionals in the field of irrigation and drainage will be shared on several key areas of development for the drainage sector. Accordingly, the following questions will be explored:

1. What role can agricultural drainage play in the effort to meet the rising food demands of increasing population from local to global scale?
2. What are the up-to-date technological advancements in the field of agricultural drainage? What aspects/elements of drainage need more advancements?
3. What is the most suitable course of action in terms of agricultural drainage systems improvement that can best suit the purpose while at the same time is cost effective?
4. What are the factors determining the cost-effectiveness of drainage systems?
5. What indigenous knowledge and best practices can be shared for upscaling to improve cost-effectiveness without compromising the desired service quality?
6. What are the research needs for the drainage sector in terms of making it more attractive, beneficial and cost-effective? What are the roles and contributions of young professionals in the field of Irrigation and drainage?

Discussion Mentor

- Dr. Tena Alamirew Agumassie (Ph.D.) – Deputy Director and Head of Knowledge Generation Division, Water and Land Resources Center, Addis Ababa University, Addis Ababa, Ethiopia

Discussion Co-ordinators

- Mrs. Adey Nigatu Mersha – Ph.D. researcher, IHE Delft Institute for Water Education, Delft, The Netherlands
- Mrs. Kathleen Murray – Project Manager, Growcom Australia **<https://www.growcom.com.au/>**

SELECTED REFERENCES FOR FURTHER READING

- Bruinsma, J. (2017). *World agriculture: towards 2015/2030: an FAO study*: Routledge.

- Fortier, F., & Thi Thu Trang, T. (2013). Agricultural modernization and climate change in Vietnam's post-socialist transition. *Development and change, 44*(1), 81-99.

- Gurovich, L., & Oyarce, P. (2015). New approaches to agricultural land drainage: a review. *Irrigat Drainage Sys Eng, 4*(135), 2.
- Palta, J., Ganjeali, A., Turner, N., & Siddique, K. (2010). Effects of transient subsurface waterlogging on root growth, plant biomass and yield of chickpea. *Agricultural Water Management, 97*(10), 1469-1476.

- Shaw, R. F., Johnson, P. J., Macdonald, D. W., & Feber, R. E. (2015). Enhancing the biodiversity of ditches in intensively managed UK farmland. *PLoS ONE, 10*(10), e0138306.

- Van der Molen, W., Beltrán, J. M., & Ochs, W. J. (2007). *Guidelines and computer programs for the planning and design of land drainage systems* (Vol. 62): Food & Agriculture Org.

❖❖❖❖❖