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Soil assimilation study for drip irrigation. A case study of Central Chile

Abstract

The soil classification studies have different utilities such us, farm appraisal, crops selection, land use changes, farm subdivisions and designs of irrigation and drainage projects. In this paper a methodology soil classification or assimilation with the objective to postulate irrigation projects for government irrigation subsidies, is presented. This allows the incorporation of soils non arable for fruit and horticultural production intensive with drip irrigation, by the soil description physical and morphological characteristics and applying agronomic practices for permanent sustained production.

Keywords: cartographic unit, stoniness, subsidy, Chile

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Introduction

There are different classification systems to evaluate the soil natural aptitude for agricultural production based in their limitations of texture, stoniness and slope. However, with irrigation technology it is possible irrigate dry land and to apply agronomic recommendations to avoid soil degradation. Among these systems, the taxonomic classification for 7th Approximation 1 divides the soils in several Orders, Suborder, Large Group, Great Group, Subgroup, Family and Series. Another taxonomic classification is World Reference Base for Soil Resources (WRB) of FAO_2 (Food Agricultural Organization, identifies 30 groups of reference soils, that is an international system for classification of soils more used in the European countries. Classification of soils by use capacity u is a systematic arrangement of different kinds of lands according to those properties that determine its capacity for permanent sustained production. This system categorizes land into eight classes according to its limitations for agricultural production. Class I – IV is land suitable for arable cultivation; land in classes V – VII is not suitable for arable cultivation but to pastoral or forestry use; and class VIII is land suitable only for tourism and protective purposes.[1-3] In Chile, the classification by land use capacity of the USDA (United States Department of Agriculture) is mainly used. Sometimes the soil is bad classified but in another cases it is possible improve the soil use capacity but under specific conditions of site management. In the case of Class VI-VII of an irrigation project, it is necessary to carry out a study of soils assimilation or reclassification that technically justify that soils of classes VI or VII of capacity for use due to limitations of soil, stoniness or slope can be used for the production of fruit trees and vegetables but exclusively with high-efficiency pressurized irrigation. The objective of this paper is to present the characteristics that must be consider a soil assimilation study, to transform traditional agriculture from dry land to irrigation or incorporate unproductive soils into intensive agricultural production.

This study of 18.95 hectares is located at the Central -Zone of Chile (34021´20.3´´ S, 71007´45.2´´ W). The farm is planted with cherry trees orchard and plantation frame of 4 m between rows x 2 m on rows, being necessary to carry out the assimilation study of soils in 12.82 hectares of class VI and VII of soil use capacity, to postulate a drip irrigation project for the subsidy awarded through competitions of the National Irrigation Commission of Chile.

Materials and Methods

The soil study used topographic map of the farm, with contour lines every 0,5 m in a 1:2,500 or 1:5,000 scales, photos or satellite images, design of the irrigation sectors, certificate of the actual soil classification and soil map of Chile. On this surface, the excavations for soil profile description, in a proportion of 1 every 4 hectares or depending on the soil spatial variability must be executed. This excavations can be built manually or with a backhoe and the following measures: wide 0.8 m, long 1.5 m and depth 1.0 to 1,2m. In each soil profile, by difference in consistency, the thickness of the horizons is determined with a knife and the physical and morphological characteristics of the soil are described: horizon depth, color, texture, structure, dry and wet consistency, roots presence, mottles and concretions, porosity, root activity, biological activity, presence of gravel and boundary between horizons. This information is analyzed to determine: cartographic unit, the actual and potential soil use capacity, irrigation category, erosion class, drainage class, fruit and agricultural aptitude.[4] Classes VI and VII of soil use capacity are the most common that must be assimilated to class IV.

Besides, for each cartographic unit it is necessary to determine its physical-water characteristics by laboratory analysis: texture, field capacity, permanent wilting point, bulk density, particle density, water holding capacity (WHC), and the time and irrigation frequency. It is also very important install rhizotrons in irrigation sectors with similar physical characteristics, to evaluate the dimensions of the wetting bulb and so precise the irrigation scheduling determined by WHC, irrigation threshold, crop evapotranspiration and the rate of drip irrigation application.

On the other hand, some agronomic practices must be recommended for improve the soil limitations in this farm due to sandy texture, stoniness, and lower WHC, such as mulch, stone removal, and compost application.[5] Mulch and compost applied in the rows of trees, improve the soil moisture retention that the rocks fragments underestimated the AWC between 15 -20 %.[6] Besides, drip irrigation and woodchip mulch improving the yield and homogeneity of the soil with compost and removal stones will allow obtaining wet bulbs that are more uniform in width and depth in the root zone.[7]

Results

This assimilation soil study was conducted in 18.95 ha of alluvial soils, showing that 12.82 hectares belong to class VI and VII of soil use capacity that were assimilated to Class IV. Actual and potential soil use capacity, cartographic unit formula, irrigation category, drainage class, agricultural and fruit aptitude, were determined, based on cartographic material, description of soil profile and farm visit. The cartographic units were described using the USDA methodology by the following formula.

Sandy loam surface texture:

$$\uparrow$$

$$\frac{San\ Lorenzo\ Serie \leftarrow SLR - F\ 4 \rightarrow Soil\ depth\ (15 - 40cm)}{Slope \rightarrow A\ 1 - 1 \rightarrow Slight\ erosión}$$

$$\uparrow$$

Slight undulating

Figure 1 Cherry sweet orchard in alluvials soil, San Vicente de Tagua Tagua commune, Central-Zone of Chile.

Figure 2 Excavations for soil profile description with a backhoe.

The simbology description according USDA soil taxonomy showed in Table 1 is the following:

Table 1 Results of the soil assimilation study

Land Use Capacity		Cartographic Unit	Irritation Category		Drainage Class		Aptitude		Area
Act	Pot		Act	Pot	Act	Pot	Agric.	Fruit	Hectares
VIIs	IVs7	SLR-F5 ————————P3 A1-1	6ªs	5ªs	W6	W6	8	D	11.06
VIs	IVs5	SLR-D5 ————————W4P2 A0-1	6ª s	5ªs	W_4	W_4	2	C	1.76
								Total	12.62

Land use capacity: VI y VII non arable; IVs arable with severe limitations.

Use capacity unit: 5 fine textures, 7 high stoniness.

Limiting factors: s soil.

Irrigation category: 5ªs special condition for drip irrigation, 6as not suitable for irrigation

Stoniness: P2 moderate, P3 abundant

Drainage Class: W6 excessive, W4 moderate.

Slope: A flat

Undulating: 1 slight

Erosión: 1 Slight

Agricultural aptitude: 2 crops of the zone, 8 pasture and forestall.

Fruit aptitude: C moderate, D limitations severes

Final Considerations

The soil assimilation study allows the incorporation of soils not suitable for traditional agriculture to fruit and horticultural production with drip irrigation, by the description physical and morphological characteristics to justify that soils classes VI and VII due to limitations in sandy textures and stoniness, are assimilated to class IV of soil use capacity. Besides, it is key to apply agronomic practices to improve the available water content (AWC) by the application of compost, mulch in tree rows, and stone removal from the soil surface.

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None

Conflicts of interest

All authors declare that there is no conflicts of interest.

References

1. Smith GD, Kellog CH. Soil classification: a comprehensive system. 7th approximation. Soil survey staff, soil conservation service, United States department of agriculture, washington D.C, USA. 1960. 265pp.
2. FAO. World Reference Base for Soil Resources (WRB). International soil classification system for naming soils and creating legends for soil maps.Rome, Italy. 2014. 203pp.
3. Bolawaqatabu 0. Land use capability classification system. A Fiji guideline for the classification of land for agriculture. Land Resource Planning and Development. Department of Agricuture. Fiji. 1977. 41p.
4. CIREN. Centro de Información de Recursos Naturales. Estudio agrológico: descripciones de suelos materiales y métodos. Publicación 114, Tomo 1. Santiago, Chile. 2002. 595pp.
5. Shepherd TG. Visual soil assessment. Volume 1. Field Guide for cropping and pastoral grazing on flat to rolling country horizons.mw α Landcare Research, Palmerston North. New Zealand. 2000. 84p.
6. Tetegon M, de Forges R, Verbeque AC, B, et al. The effect of soil stoniness on the estimation of water retention properties of soils: A case study from central France. *CATENA.* 2015;129:95–102.
7. Feldmane D. Response of young sour cherry tres to woodchip mulch and drip irrigation. *Environmental Technology Resources.* 2011;2:252–259.

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