“GEOTHERMAL GREENHOUSE HEATING AT BAHÍA BLANCA AREA, COLORADO BASIN, BUENOS AIRES PROVINCE, ARGENTINA”

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Abstract

The Colorado basin is located at the south-western of Buenos Aires province and is characterised by its low temperature (55°-80° C) artesian aquifers, Ground water resources are abundant and of good quality, being exposed in more than 70 deep wells. Main use of thermal waters at Bahia Blanca area, the commercial center of the region, is for domestic supply, but during the last few years other uses such as space heating, mineral wafer, food processing, fish farming and more recently greenhouses have been developed. Climatic conditions at this region makes Bahia Blanca an area difficult for greenhouses management, but the use of geothermal fluids in heating installations provided a good alternative for this purpose. Results obtained in a first pilot experience, with a heated area of 660 m^2, encouraged producers to develop this as an industrial activity. The present production area reaches 2,500 m^2 geothermally heated, attempting to increase to 5,000 m^2 in the next years. Techniques employed allowed to get a more efficient and profitable productive cycle and to extend the commercialisation area.

1 INTRODUCTION

The Colorado or Bahia Blanca - Pedro Luro sedimentary basin, is located at the southwestern margin of Buenos Aires province, extending more than 37,000 km^2 in its continental area (Fig. 1). The Cretaceous-Cenozoic basin is characterised by the quality and availability of its thermal aquifers (Muradas *et al.*, 1967; Bonorino *et al.*, 1988), exposed in more than 70 deep wells (with productive levels between 600 and 1,200 meters deep) drilled since 1911, whose main objective was to supply potable water to different populations located in the basin domains, especially to Bahia Blanca city.

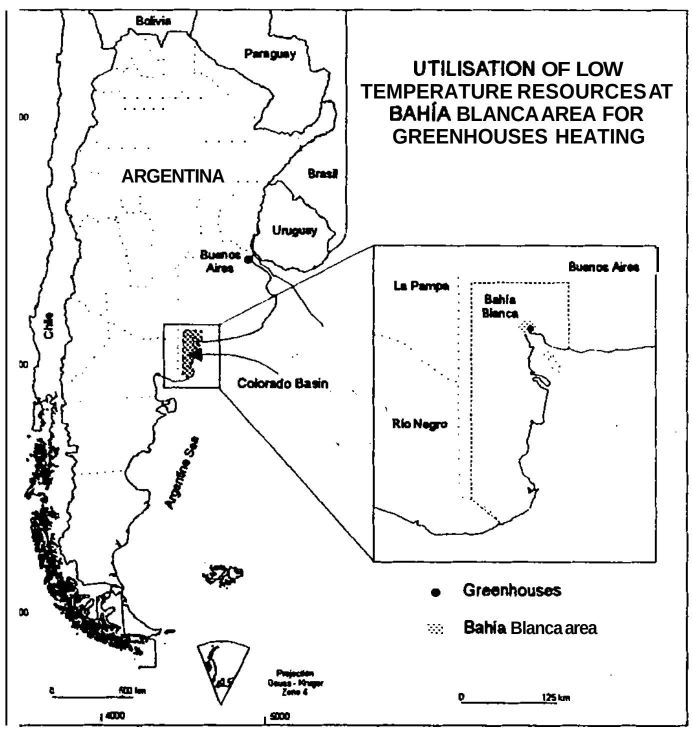

Fig. 1: Location map of the Colorado basin **and greenhouses area.**

At the beginning, water temperature (60” C average) was seen as a problem because it had to be cooled, by way of cooling-ponds and mixing with surface waters, before entering to the public distribution system (Coccia, 1968). Dike constructions in surface streams, as a new way of fresh water supply, partially relegated the use of groundwater resources and wells, which, as time went by, were closed or abandoned.

Presently the vision has changed through new studies that allowed utilising the thermal fluids in diverse economical enterprises such as domestic use, wool washing, food processing, space heating, fish farming and more recently greenhouses heating.

Bahia Blanca region belongs to a transitional climatic zone between temperate and semiarid, with lack of water during summer season. This feature makes this region a difficult area for greenhouses management. Winter conditions do not allow reaching necessary indoor temperatures in the greenhouses for off-season production, unless it could be raised artificially. Studies concerned with the thermal potential and availability of the resource allowed contemplating the use of thermal water as an excellent alternative for this aim (Pesce et *al.*, 1996).

2 GREENHOUSES

The first experience in the region consisted in a simple plastic-covered greenhouse whit a total surface of 660 m^2 internally heated by geothermal fluids. The greenhouse was used to cultivate plant cuttings and seeds of inside and outside plants (shrubs, ornamentals, trees and herbs), flowers and vegetables.

Thermal water for heating came from an artesian well, 745 meters deep, situated 350 meters away from the greenhouse area, which produces 25 m^3/hour of 56° C water. The low mineral content (TDS 390 mg/l) of the fluid permitted to adopt a direct connection as hot water transmission system. The water was collected in two open tanks installed atop a hill close to the greenhouse, so that it could flow by gravity through the heating installations.

The greenhouse heating installations consisted in a soil and soil-air (bench heating) systems. Pipe design was made of soft plastic (PVC) finned (1.27 cm diameter) tube pipes buried 10 cm deep below groundsurface and separated 12 cm each other. Appropriate temperatures around this system were acheved by manual regulation of water supply.

This simple, but effective system was applied in the early stages of plant cultivation, allowing an optimal development of plant root system, necessary condition for its commercialisation in different areas of the argentine patagonian sector (Neuquén, Río Negro, Chubut, Santa Cruz and south of Buenos Aires provinces) dominated by strong winds during all the year.

3 FUTURE EXPECTATIONS

Results obtained in this experience encouraged local producers to expand their facilities. The present production area, distant 5 km away from Bahia Blanca city, comprises a six hectare area who has a deep artesian well (1,599 meters) that produces 20 m^3/h of 54" C water. Water is delivered directly from the geothermal well to a settling tank to eliminate suspended solids. The tank has various outlets to direct waters towards buildings and greenhouses and to two storage tanks, where water is allowed to cool for later use.

Due to chemical characteristics of the water -specially carbonate content- a plate heat exchanger was connected at the inlet to the buildings and greenhouses, in order to avoid scaling deposits in the pipes. Heated destilled water with an inlet temperature of 32"-35" C is carried through a pipe network to the soil and bench heating installations.

The main complex (Fig. 2) consists of two houses 24 m by 40 m composed by four greenhouses, 6 meters wide, each. Old plastic-covered style has been replaced by movable glass windows that allow a better regulation of the greenhouses climate, controlling additional ventilation according to the different seasons and even more during daily climatic fluctuations. Nowadays, the total surface geothermally heated reaches 2,500 m^2, attempting to increase to 5,000 m^2 in the next years.

Disposal of thermal waters produces no pollution risks. Due to its quality, waters are delivered to two storage tanks, with a total capacity of 720,000 litres, that after cooling are used for irrigation and domestic supply in nearby houses.

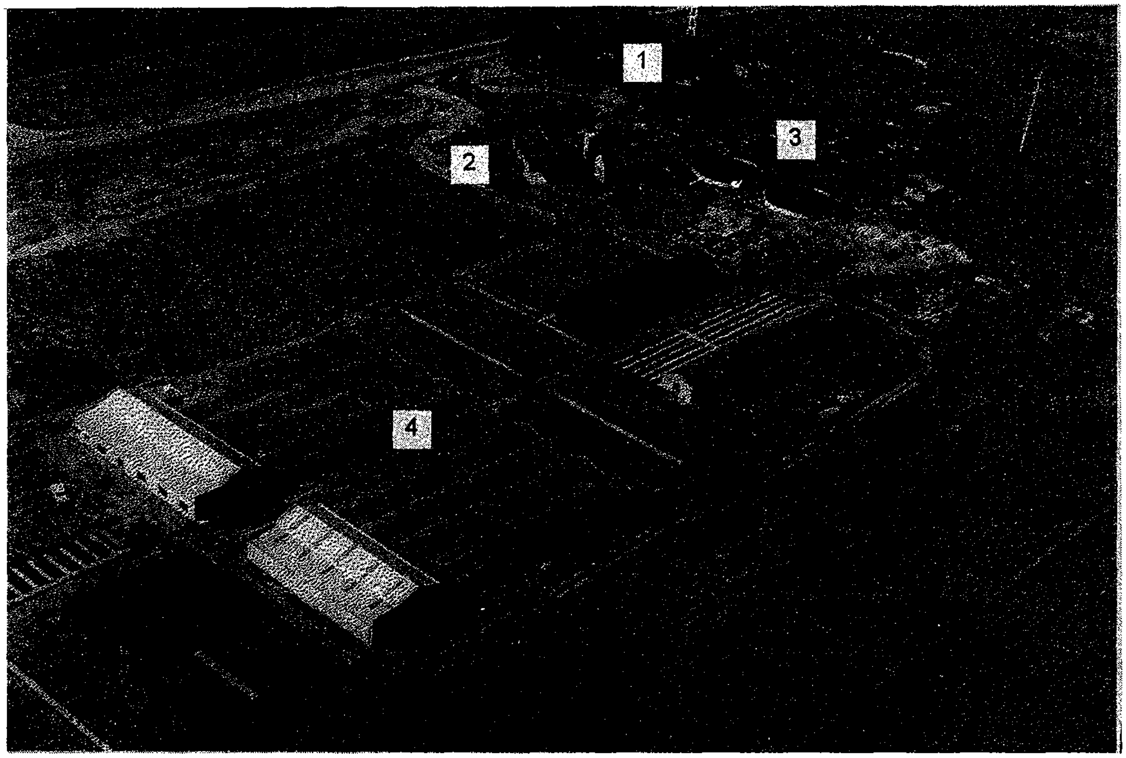

Fig. 2: Aerial view of greenhouses complex
(1- Production well, 2- House heating, 3- Water storage tanks, 4- Greenhouses heating)

4 CONCLUSIONS

Greenhouses heated by geothermal fluids have several economical advantages in marginal agricultural regions like Bahia Blanca. Heating installations allowed reducing by half the time for optimal foliar and root system development of plant cuttings before their final transplant and on the other hand production of vegetables during off-season commands higher market prices. This experience has demonstrated that cultivation under these controlled conditions reduced costs and crop losses obtaining a more efficient and profitable productive cycle, thus allowing committing future delivery contracts with more confidence.

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