



TECHNOLOGICAL CHARACTERISTICS OF THE IRRIGATED AGRICULTURE IN THE VILLA JUÁREZ AQUIFER, DURANGO. NORTH OF MEXICO

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INTRODUCTION

The present study is product of documentary investigation and field work carried out in the Comarca Lagunera region, located within the Villa Juárez aquifer, in the state of Durango, Mexico, in the middle-low part of the Hydrological Region 36, Nazas river watershed. The study was part of a broader project "Calibration of water and nitrogen flow simulation models to predict the risk of underground water contamination by nitrates".

The Comarca Lagunera region is considered as a drinking water reserve for of a population of nearly one million inhabitants. It was necessary to perform a general characterization of the agricultural cropping systems. We describe with some detail the crop yields, amount and type of fertilizers, and water depths that are being applied to the crops in this region. Finally, we show the economic efficiency of the water applied by crop.

METODOLOGY

Firstly, a survey was applied to farmers to obtain information about management practices and products been used. The questionnaire caught information of a 3 889.5 ha which represented 27% of the planted area in 2003 in the Municipality of Lerdo, Durango, site where the Villa Juárez aquifer is located. Twenty six surveys were applied, corresponding 21 to private properties and the rest to ejidos (communal properties). The survey was carried out at the end of 2004 and once the information was available, it was processed in Excel, in preparation for the analysis.

The data collected by the survey was validated against the information reported in statistics published in the region by SAGARPA. The correct identification of the agrochemicals used for the control of insects and pests was carried out with the aim of a dictionary of agrochemical specialties published in 2003.

RESULTS

The situation of the water in this region is as it follows: the number of wells in operation is 3 823, which extract a volume of 1 251.89 Mm³ per year. The estimated recharge is 760.57 Mm³ with a net over extraction of 491.32 Mm³. Of this water, 87% is used for agriculture, 11% for public use and only 2% for industry (CNA, 1999).

Table 1. Situation and uses of underground water in the Comarca Lagunera Region.

Activity	Number of wells	Extraction
Agriculture	2 707	1 031.4
Domestic rural	573	57.06
Public	459	136.60
Industry	84	26.83
Total	3 823	1 252.89
Recharge		760.57
Deficit		491.32

The Villa Juárez aquifer.

In this aquifer there are 55 wells used to measure twice a year the phreatic level depths. One of the measurements is taken when the water is flowing throughout the Nazas river (March to October) and the other during the dry period (November to February). This zone is located in the municipality of Lerdo in the State of Durango and a great part of this valley is considered as the drinking water reserve for the whole Comarca Lagunera region: This was published in the Federal Government Official Newspaper on August 13, 1991. Also, since April 1958 and 1965, the Federal Government prohibited the perforation of new wells in this zone. The uses of water extracted from this aquifer are shown in Figure 1.

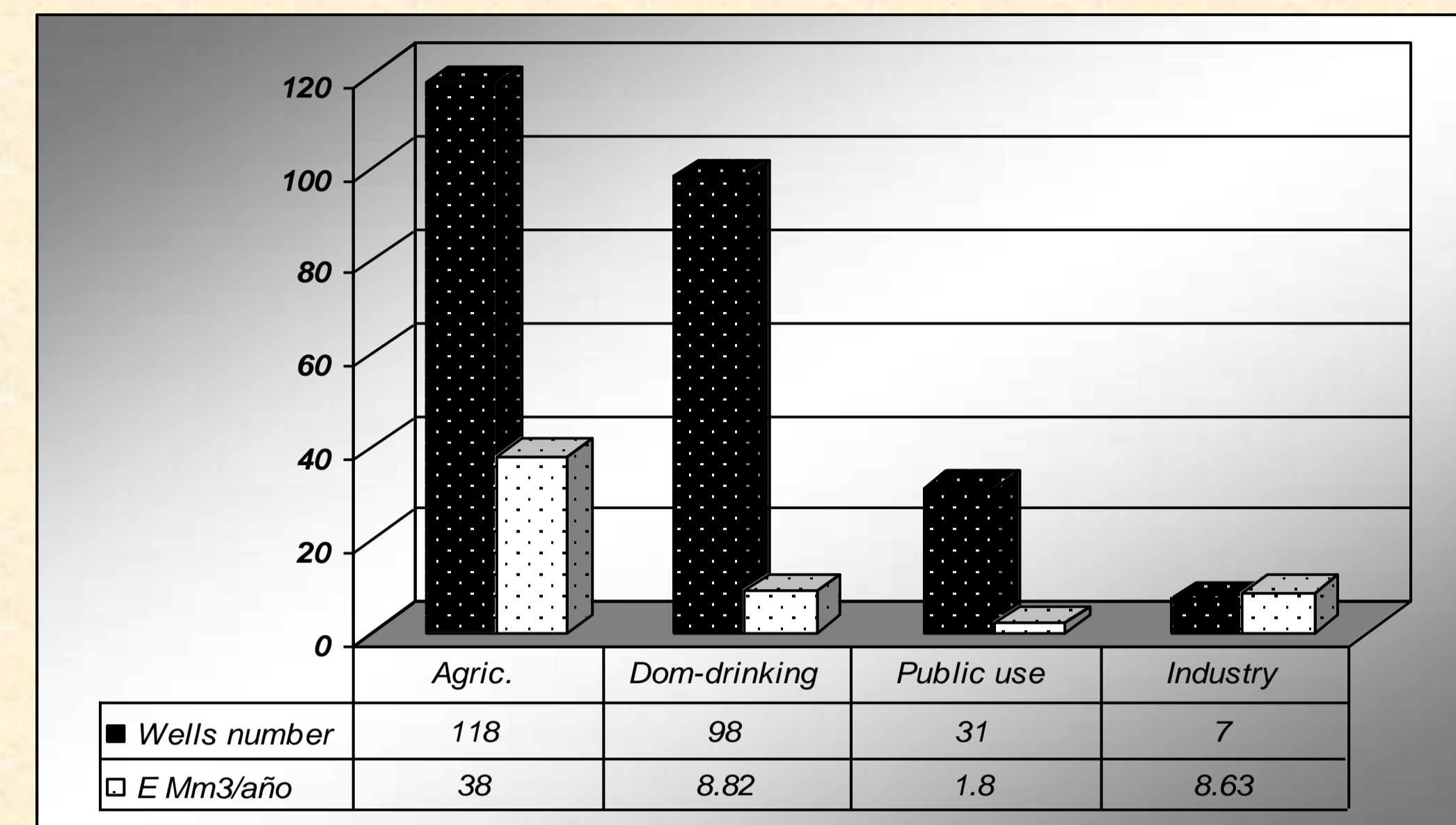


Figure 1. Uses of water extracted from the Villa Juárez aquifer, Municipality of Lerdo, Durango, Mexico.

In this aquifer, underground water is used as follows: 66.4% agriculture, 15.4% for drinking and domestic services, 3.1% public use, and 15% for industrial production.

The initial hypothesis that the nitrate concentration in underground waters came only from fertilizers and other agrochemical products used to produce forages for dairy cattle feeding has been challenged by other studies and a final conclusion has not been reached yet. Castellanos (1982) mentioned that in addition to the fertilizers applied it was very common the application of dairy cattle in amounts above 100 t ha⁻¹, by-product that has been characterized in diverse studies, in which has been determined to contain significant amounts of nitrogen, phosphorus, potassium, calcium, magnesium, micronutrients but also of soluble salts.

The agricultural surface reported by official institutions for the Municipality of Lerdo Durango, indicates that 14594 ha were planted in 2001 (SAGARPA, 2001); 51% for the spring-summer growing season; 38.6% was established with perennial crops and 10% with winter crops.

The most important crops in this zone are: alfalfa, forage maize, vegetables and flowers, forage triticale, pecans, forage oats and forage sorghum. Of these, the most common production system includes alfalfa, followed by forage maize, oats, triticale, and sorghum, present in 73, 80, 42, and 16% of the productive units of the study.

CONCLUSIONES

The forage production in Villa Juárez, Durango, main drinking water reserve for the Comarca Lagunera region occupy more of 90% of the agricultural surface. These forages are consumed mainly by a population of 87740 of dairy cattle.

Eighty percent of the producers used chemical fertilizers. However, only 16% of them do it based on technical recommendations. The rest of them use fertilizers by tradition or based on their "own experience". This situation could represent two things: obtaining low yields due to lack of nutrients or applying them in excess. The second option may reduce the producer profitability but also may be causing contamination of underground waters.

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