ECONOMIC PARAMETER DEFINITION IN IRRIGATION INSPECTION MONTECASEROS, MENDOZA

ANTONIOLLI, ESTER ROSA & ALTURRIA, LAURA
Department of Socioeconomic Science, School of Agricultural Science, National Cuyo University, Almirante Brown 500, (5505) Chacras de Coria, Mendoza, Argentina.

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SUMMARY

The objective of this work is to measure, by means of economic parameters, the following: production value per m3 of irrigation water; production value per each $ (u$s) spent on irrigation water; relative value of irrigation water cost with respect to the total operative cost of production; gross margin obtained per m3 of irrigation water applied and amount of kg. harvested per m3 of water applied.

Parameter definition has been performed using averages of secondary data from the area and primary data obtained through questionnaires given to producers in a smaller area.

No significant differences were observed between both sets of parameters, except when the analysis was conducted by separating small farms with little technology from large farms with more technology and a better use of resources.

INTRODUCTION

In the province of Mendoza, Argentina, agricultural activity is practiced under irrigation and represents approximately 6% of the Internal Gross Product (IGP). The main crop is grapevines with about 60% of the total cultivated area in the Province.

Due to the importance of irrigation, a series of works have been carried out to evaluate the performance of one of the irrigation inspections: the Inspection of the Irrigation District of the Montecaseros Canal, located in San Martín County, to the east of Mendoza. Such evaluation has been conducted by means of physical, operational, sustainability, social, economical and administrative parameters. The present work corresponds to the economic parameter definition.

The importance of this definition is established by the need to assess the functioning of the different areas to compare them with each other and with those in other countries that irrigate their crops with surface water.

This need for assessment becomes obvious from the fact that water is a limited resource in arid and semiarid zones. Therefore, it is an economic good and it has to be treated as such.

METHODOLOGY

This work is divided in four stages:

1. **Collection and analysis of secondary data:**
   The source of primary data used was the last Agricultural National Census (1988), the National Viticulture Census (1991 and its updates) and the Fruticultural Census of Mendoza Province (1992).

2. **Economic Evaluation:**
To perform the economic evaluation of crops in the area under study, the cost data was provided by the Department of Socioeconomic Science, School of Agricultural Science, UNC; INCYTH, and key informants from the private sector. The data concerning prices paid to producers was obtained from the area farmers.

3. **Parameter calculation:**
The parameters chosen were those that came up during the discussion within the working team. They involve the following variables: the economic value of production, the cost of irrigation water, the amount of water applied, the volume produced and the operative costs of crop production.

4. **Field testing of parameters:**
In order to test and compare the economic parameters calculated from secondary data, field questionnaires were conducted in one sector of the area under study. This sector corresponds to the Chivilcoy district in San Martín County and corresponds to the area of study of the parameters in the other areas (social, accounting, technical, etc.)

Information Processing

The processing and Interpretation of the results was performed by the Department of Socioeconomic Science, School of Agricultural Science, UNC. The data obtained was transferred to spreadsheets designed in QPRO.

RESULTS

AREA UNDER STUDY: DISTRICTS: ALTO SALVADOR, CHAPANAY, MONTECASEROS, CHIVILCOY. SAN MARTIN COUNTY, MENDOZA, ARGENTINA. (analyzed with secondary data)

To have an overview of the area irrigated by the Montecaseros canal, secondary data from the different sources consulted was used, and a general parameter definition was carried out.

The cultivated area in each of these districts is approximately 16,000 hectares, whereas the area irrigated by the Montecaseros Inspection is 8,602 hectares.

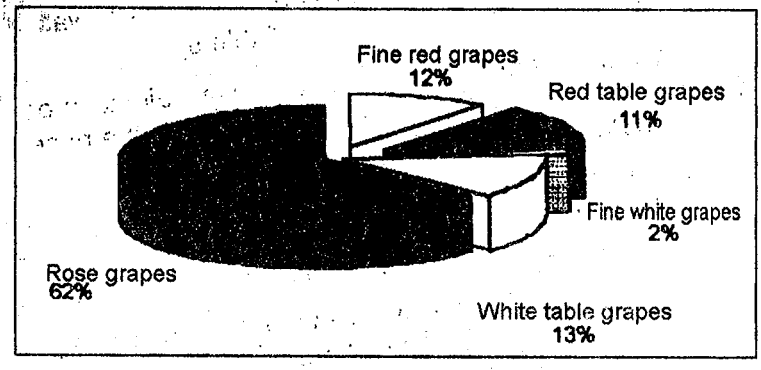
The most important crop in the Province of mendoza is grapes. Eighty percent of the surface of San Martín County is covered with vineyards, 10% with fruit trees, and the remaining 10% with other crops.

Since the agricultural activity of this zone is grape and fruit-growing, the economic analysis has been performed for these two crops.

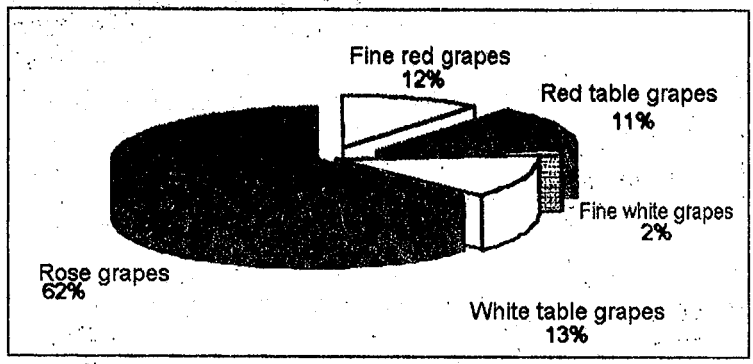
Viticulture Description

Graph #1 shows a predominance of rose grapes (higher yield, lower price), which is the raw material for table wines. These grapes are almost exclusively used to this end. A small percentage is destined to fresh consumption and concentrated musts.

Graph #2 shows that 70% of these vineyards are trellises. The average size of the farms is between 6 and 10 hectares with a higher frequency of farms between 1 and 10 hectares. (table 1)



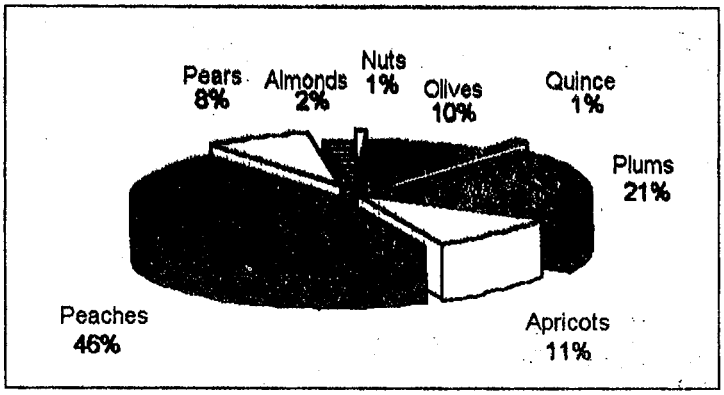
Graph 1. Surface with Vineyards



Graph 2. Vineyard Climbing Systems (in hectares)

Fruticultural Description

The most widely grown crops are peaches, plums and apricots (graph #3), but they are not as economically relevant as vineyards in this area.



Graph 3. Fruit-cultivated Surface (in hectares)

The average fruiticultural surface per farm is between 3 and 7.5 hectares with a larger number of small farms in the San Salvador and Chivilcoy districts.

Prices Paid to Producers and Production Value

a) Viticulture. The price considered is that of the product on the farm. Prices were provided by key informants from the Winers´ Association and the producers of the area. (Table 3) The difference in prices for the same variety in different grape-growing areas was always taken into

account. These prices multiplied by the estimated production result in the value of viticulture production shown in Table 4. The production of the area was obtained from the product of censed areas and the average estimated yield. (Table 5)

b) Fruticultural. Product prices correspond to those paid to producers in 1994/5, 1995/6 and 1996/7, taking into account an estimated average between the price paid by the industry and that paid for fresh consumption.. (Table 3)

Production was estimated from the cultivated surface and the average yields for the area, obtained from the estimations performed by the key informants from the Department of Fruticulture, School of Agricultural Science, UNC, and the producers of the area.

Production value was calculated multiplying the price paid per kg to producers times the total estimated production for each crop. (Tables 6 and 7)

Calculation of Operative Production Costs. The values considered correspond to the average costs per hectare estimated by the Department of Socioeconomic Science, School of Agricultural Science, UNC. (Table 8) These figures include supply expenses (agrochemicals, fuel, electricity, etc.), hand labor (including harvest), maintenance of machinery, property tax and irrigation fees. In the case of fruit crops, the fact that on 50% of the surface there is frost control has also been taken into account.

Amount of Water Supplied by the Montecaseros Inspection. This information, supplied by INCYTH, according to its flow measurements, was 99.036.205 m3/year for 8,602 registered hectares; that is to say, 11.513 m3/hectare/year.

Water cost. According to the calculations performed by the Inspection, the cost of water paid by producers is $100/hectare/year, and it includes: irrigation fees, inspection costs ($66) and two workers for canal cleaning (or cleaning quota = "limpieza de cupos") ($34).

ECONOMIC PARAMETERS

a. Gross Value of Production/Irrigation Water Cost. It indicates the gross income obtained from the sale of the products per each $ of surface irrigation water.

1. Viticulture Activity

$$\frac{\text{Gross value of production/hectare}}{\text{Irrigation water cost/hectare}} = \frac{\$2{,}417/\text{hectare/year}}{\$100/\text{hectare/year}} = 24$$

2. Fruticultural Activity

$$\frac{\text{Gross value of production/hectare}}{\text{Irrigation water cost/hectare}} = \frac{3{,}501\ \text{hectare/year}}{\$100/\text{hectare/year}} = 35$$

3. Viticulture and Fruticultural Activities. For the calculated parameter to reflect the situation of the area, a mean of grape and fruit production value was considered and estimated according to surface per crop.

$$\frac{\text{Value of total production/hectare}}{\text{Surface irrigation water cost/hectare}} = \frac{\$2{,}523/\text{hectare/year}}{\$100/\text{hectare/year}} = 25{,}23$$

b. Value of Production/m3 of Surface Irrigation Water: It indicates the gross production value obtained from the sale of the products per m3 of water applied.

1. Viticulture Activity

$$\frac{\text{Value of Viticulture production/hectare}}{\text{m3 applied/hectare}} = \frac{\$2{,}417/\text{hectare/year}}{11{,}513\ \text{m3/hectare/year}} = 0.21\ \$/\text{m3}$$

2. Fruticultural Activity

$$\frac{\text{Value of fruticulture production/hectare}}{\text{m3 applied/hectare}} = \frac{\$3{,}501/\text{hectare/year}}{11{,}513\ \text{m3/hectare/year}} = 0.30\ \$/\text{m3}$$

3. Viticulture and Fruticultural Activities.

$$\frac{\text{Estimated mean of total production value/hectare}}{\text{m3 of water applied/hectare}} = \frac{\$2{,}523\ /\text{hectare/year}}{11{,}513\ \text{m3/hectare}} = 0.22$$

c. Irrigation cost/hectare/operative cost/hectare of production: it shows the incidence of irrigation costs in the operative cost of production.

1. Viticulture Activity. The cost corresponds to the average cost/hectare estimated from the surface cultivated according to the vineyard climbing system.

$$\frac{\text{Irrigation cost/hectare/year}}{\text{operative cost of production/hectare/year}} = \frac{\$100}{\$\ 1{,}720} = 0.058\ (5.8\%)$$

The irrigation cost represents 5.8% of the total operative cost of grape-growing.

2. Fruticultural Activity

$$\frac{\text{Irrigation cost/hectare/year}}{\text{operative cost of production/hectare/year}} = \frac{\$100}{\$\ 1{,}500} = 0.066\ (6.6\%)$$

3. Viticulture and Fruticultural Activities

$$\frac{\text{Irrigation cost/hectare/year}}{\text{operative cost of production/hectare/year}} = \frac{\$100}{\$\ 1{,}698} = 0.059\ (5.9\%)$$

d. Volume produced/m3 applied: it shows the amount of kg. harvested per cm3 of water applied.

1. Viticulture Activity

$$\frac{\text{Volume produced}}{\text{m3 applied}} = \frac{21300\ \text{kg/hectare}}{11513\ \text{m3/hectare}} = 1.85\ \text{kg/m3}$$

2. Fruticultural Activity

$$\frac{\text{Volume produced}}{\text{m3 applied}} = \frac{8420\ \text{kg/hectare}}{11513\ \text{m3/hectare}} = 0.73\ \text{kg/m3}$$

3. Viticulture and Fruticultural Activities.

$$\frac{\text{Volume produced estimated average}}{\text{m3 applied}} = \frac{20040\ \text{kg}}{11513\ \text{m3/hectare}} = 1.74\ \text{kg/hectare}$$

e. **Gross margin/m3 applied:** it shows the gross margin per m3 of water applied.
Gross margin = income-direct costs
Income: production value
Direct costs: in this work all operative expenses are considered to be direct.

1. Viticulture Activity

$$\frac{\text{Gross margin/hectare}}{\text{m3/hectare}} = \frac{\$2417/\text{hectare} - 1720/\text{hectare}}{11513\ \text{m3/hectare}} = 0.06\ \$/\text{m3}$$

The gross margin per 100m3 applied is $6

2. Fruticultural Activity

$$\frac{\text{Gross margin/hectare}}{\text{m3/hectare}} = \frac{\$3501/\text{hectare} - \$1500/\text{hectare}}{11513\ \text{m3/hectare}} = 0.06\ \$/\text{m3}$$

The gross margin per 100m3 applied is $17

3. Viticulture and Fruticultural Activities.

$$\frac{\text{Gross margin/hectare(estimated average)}}{\text{m3/hectare}} = \frac{\$2523/\text{hectare/year} - \$1698/\text{hectare}}{11513\ \text{m3/hectare}} = 0.072\$/\text{m3}$$

The gross margin for the area is $7.2 per 100m3 of water applied.

AREA SURVEYED

The area covered by this work was presented in a blueprint followed by a land surveillance of the farms that would participate in the study. The area chosen for this study is located between Carril Costa Canal Montecaseros, Carril Chivilcoy, Calle Anzorena and Carril Buen Orden. The farms were selected by INCYTH and correspond to those were its experimental fields are located. No sampling of the area was performed, since all the area farms were surveyed. Seven farms were fully surveyed using a questionnaire, but this figure was extended to 20 in order to obtain a bigger corpus of economic data.

The design and review of the questionnaire was conducted by the Department of Socioeconomic Science, School of Agricultural Science.

Description of Productive Structure

The surveyed area included approximately 438 hectares corresponding to 5% of the total registered area with irrigation rights. Eighty tree percent of the soil is cultivated, whereas 1% is systematized land without definitive use and 16% is abandoned land due to soil salinization. Of the total cultivated area, 77% is grown with grapes and 23% with fruit trees (12% peaches, 11% plums). Seventy percent of the surveyed farms are presently registered as personal property, whereas the remaining 30% belong to some kind of society. Forty five percent of the farms are run by administration and 55% by a contract system. The mediation system is not significant. In all cases the landowners exercise direct control on the farm.

Technology

* **Crop support system:** The predominant system is the trellis in 83% of the area. The remaining 17% corresponds to espaliers, most of them low. Fruit trees are V-shaped since no other forms of support system have been found.

The quality of irrigation water is of particular importance in arid zones where temperature extremes and low relative humidity give rise to high evaporation rates, with the ensuing deposition of salts which tend to accumulate in the soil profile. The physical and mechanical properties of the soil, such as dispersion of particles, stability of aggregates, soil structure and permeability, are very sensitive to the type of exchangeable ions present in irrigation water. Thus, when effluent use is being planned, several factors related to soil properties must be taken into consideration (EPA, 1992).

Another aspect of agricultural concern is the effect on plant growth of dissolved solids (TDS) in irrigation water. Dissolved salts increase the osmotic potential of soil water and an increase in osmotic pressure of the soil solution also increases the amount of energy which plants must expend to take up water from the soil. As a result, respiration increases and plant growth and yields decline progressively as osmotic pressure increases. Although most plants respond to salinity as a function of the total osmotic potential of soil water, some plants are susceptible to specific ion toxicity.

Many of the ions which are harmless or even beneficial at relatively low concentrations may be toxic to plants at high concentrations, either through direct interference with metabolic processes or through indirect effects on other nutrients, which might be rendered inaccessible. Morishita has reported that irrigation with nitrogen-enriched pollution water can supply considerable excess of nutrient nitrogen to growing rice plants and can result in a significant loss of rice yields through lodging, failure to ripen and increased susceptibility to pests and diseases due to over-luxuriant growth. He further reported that non-polluted soil, having around 0.4 and 0.5 ppm cadmium, may produce about 0.08 ppm Cd in brown rice, while only a little increase up to 0.82, 1.25 or 2.1 ppm of soil Cd can produce heavily polluted brown rice with 1.0 ppm Cd.

Important agricultural water quality parameters include a number of specific properties of water that are relevant in relation to crop yields and quality, maintenance of soil productivity and protection of the environment. These parameters include certain physical and chemical characteristics of water. The following table presents a list of some of the most important physical and chemical characteristics that are taken into account in the evaluation of agricultural water quality and the main wastewater quality parameters from an agricultural viewpoint:

Parameters used in the evaluation of agricultural water quality

Parameter	Symbol	Unit
Physical		
Total Dissolved Solids	TDS	mg/l
Electrical conductivity	EC	dS/m[1]
Temperature	T	°C
Colour/Turbidity		NTU/JTU[2]
Hardness		mg. equiv. $CaCO_3$/l
Sediments		g/l
Chemical		
Acidity/Basicity	pH	
Type and concentration of anions and cations:		
Calcium	Ca^{++}	me/l[3]
Magnesium	Mg^{++}	me/l
Sodium	Na^{+}	me/l
Carbonate	CO_3^{2-}	me/l
Bicarbonate	HCO_3^{-}	me/l
Chloride	Cl^{-}	me/l
Sulphate	SO_4^{2-}	me/l
Sodium Adsorption Ratio	SAR	
Boron	B	mg/l[4]
Trace metals		ppm
Heavy metals		ppm
Nitrate-Nitrogen	NO_3 - N	mg/l
Phosphate Phosphorus	PO_4 - P	mg/l
Potassium	K	mg/l

[1] dS/m = deciSiemen/metre in SI Units (equivalent to 1 mmhos/cm)
[2] NTU/JTU = Nephelometric Turbidity Units/Jackson Turbidity Units
[3] me/l = milliequivalent per litre
[4] mg/l = milligrams per litre = parts per million (ppm); also,
mg/l ~ 640 x EC in dS/m

Source: Kandiah (1990a)

* **Average yield:** The average yield stated by producers is found in table 9. Vineyards are in full production. There are still some very old ones which contrast with young fruit plantations already in full production. However, in both cases the yield is far from ideal for a plantation, since farms are not worked using adequate technology or practices.

* **Agrochemicals**: Large farms carry out fertilization tasks programmed according to crop age and type. Phytosanitation treatment is preventive and healing when necessary. Herbicides are also used on farms (the product used is Glifosate). On small farms no necessary fertilization is carried out for each crop and sanitation treatment is healing; that is to say, there is no programming of tasks and there is only reaction before a certain plague or disease. Traditionally copper products are used on vineyards in an adequate concentration but with an insufficient number of applications.

* **Frost Control:** Sixty percent of the surveyed farmers perform no active frost control, only some passive measures (weeding). The most serious damage is to fruit trees (about 65%) Those farmers who perform active control, do it by means of atmospheric warming with gasoil. In this case the losses are no higher than 10% (large farms with fruit crops).

* **Trimming:** Those farmers who produce fruit for fresh consumption perform trimming. The results are good on large farms as opposed to small farms where the results are not satisfactory due to the fact that the trimming is carried out untimely.

* **Hail:** the damage caused by hail is variable. In Montecaseros it has been very little in the past three years (5 to 10%). One of the farms has a special system to cover the crops (plastic fabric) and thus protect them from hail. In the Chivilcoy district the incidence increases to 20%.

* **Soil Salinization:** Eighty percent of the surveyed farmers mention salinization problems. No exact percentage of damage can be established but it is estimated between 20 and 50% increasing toward the center of the area under study. Farmers have not stated this as a concrete problem this year, but it rather changes from year to year. This season subsurface water has not risen due to the water shortage Mendoza is undergoing. This situation has repeated itself in the last two seasons. However, irreversible damages can be observed in grapes and plums resulting from salinity and causing low yields, plant death, shriveling and early fall of leaves.

* **Irrigation:** The area surveyed is registered and has irrigation rights. The intervals between shifts show a variation of 10 to 15 days according to water availability. The farmers surveyed state that the water is insufficient, and that they need at least two shifts to complete the irrigation of the land. The most commonly used method is irrigation by borders. There are irrigation wells in 80% of the farms, but 40% of these wells have fallen in disuse. In the 40% that have an active well, the quality of water ranges from fair to bad. The pumping period extends from September to March and afterwards it is only used to supplement shift water. The average volume of water from the wells is 120,000 liters/hour; the average depth is 150 mts, and the power source is 100% electricity.

* **Machinery:** The average of tractors per farm is 1.6, with an average power of 45 hp. Tractors and machinery date from 1975-78. The farms have traditional tools and machines: plowshares, disc plows, weeders, border trimmers, graders, sprayers, atomizers and sprinklers. No tractor or any other machinery is rented.

* **Cultural Work:** The main soil work carried out consists of plowing vineyards, which consumes the most hand labor (6 hours/hectare). Plowing is another time-consuming activity both in vineyards and fruit crops, with an average of 4 hours/hectare. Spraying is performed in different ways according to how the land is cultivated.

Use of hand labor: The number of workers per hectare used for the different cultural tasks shows variations according to crop and management style. A mean was obtained of 32 permanent workers per hectare per year and 14 temporary workers per hectare per year. In the case of large fruit-cultivated farms, the work is carried out by administration, with 34 workers per hectare per year (18 permanent and 16 temporary per hectare per year.) Grape and fruit-cultivated farms devote 37 workers per hectare per year, whereas grape-cultivated farms devote 35 workers per hectare per year. The values are very similar and no significant differences were observed. Both grape and fruit-cultivated farms are worked by contractors. On small grape and fruit-cultivated farms, the workers per hectare per year go up to 50. As regards employed hand labor per cultivated hectare, there are 45 permanent workers per hectare per year and 19 temporary workers per hectare per year. This increase is due to the incidence of non-cultivated areas on each of the farms.

Marketing. Prices

Grapes: Mixed varieties are predominant. No clear varietal difference can be established. They are table grapes for wine-making with a higher proportion of red grapes. The average price for table grapes is $0.15/kg. There is a case of Bonarda grape at $0.28/kg. Third-party wine-making is predominant. The gross income per hectare is $2,790 on average.

Fruit crops: Peaches are marketed for fresh consumption and the average price is $0.20/kg. Plums are also sold for fresh consumption and the price is $0.35/kg, whereas for industrial processing the price is $0.12/kg.

Calculation of Operative Production Costs (Table 10). The operative production cost for each crop type was calculated from the primary data obtained through the questionnaires. The farms were divided in large (over 10 hectares) and small (less than 10 hectares). Within each group was calculated the cost for fruit-growing, grape-growing and fruit and grape-growing farms. Taking into account the prices and average yields of the area, the gross income was calculated for each crop type. The gross margin was calculated as the difference between the gross income and the operative cost of production.

ECONOMIC PARAMETERS (Calculated from primary data obtained through questionnaires given to farmers)

Farms were divided in large (over 10 hectares) and small (less than 10 hectares). For yields and prices of fruit crops the averages obtained in the questionnaires were considered. The cost of irrigation water is $100/hectare/year, taking into account the fees that each user pays the General Irrigation Department, the District Inspection and the payment of two workers for canal cleaning (or cleaning quota = "limpieza de cupos)($34). The volume of water received in the area is on average 11.513 m3/hectare/year.

Large Farms

a) Fruit-growing:

1) $\frac{\text{Production value}}{\text{irrigation water cost}} = \frac{\$3794}{\$100} = 37.94$

2) $\frac{\text{Production value}}{\text{Amount of water applied}} = \frac{\$3794}{11.513\ \text{m3}} = \$0.33/\text{m3}$

3) $\frac{\text{Production volume}}{\text{Amount of water applied}} = \frac{\$12941\ \text{kg}}{11.513\ \text{m3}} = \$1.12\ \text{kg/m3}$

4) Cost of irrigation water / Operative cost of production = $100 / $1800 = 0.056 (5.6%)

5) Gross margin / m3 water applied = $1994 / 11.513 m3 = 0.17 $/m3

b) Grape-growing

1) Production value / irrigation water cost = $3750 / $100 = 37.50

2) Production value / Amount of water applied = $3750 / 11.513 m3 = $0.33/m3

3) Production volume / Amount of water applied = $25000 kg / 11.513 m3 = $2.17 kg/m3

4) Cost of irrigation water / Operative cost of production = $100 / $1900 = 0.053 (5.3%)

5) Gross margin / m3 water applied = $1859 / 11.513 m3 = 0.16 $/m3

Small Farms

a) Fruit-Growing

1) Production value / rrigation water cost = $2300 / $100 = 23

2) Production value / Amount of water applied = $1800 / 11.513 m3 = $0.20/m3

3) Production volume / Amount of water applied = $7890 kg / 11.513 m3 = $0.69 kg/m3

4) Cost of irrigation water / Operative cost of production = $100 / $1700 = 0.058 (5.8%)

5) Gross margin / m3 water applied = $613 / 11.513 m3 = 0.05 $/m3

b) Grape-Growing

1) Production value / irrigation water cost = $2250 / $100 = 22.5

2) Production value / Amount of water applied = $2250 / 11.513 m3 = $0.20/m3

3) Production volume / Amount of water applied = $15000 kg / 11.513 m3 = $1.30 kg/m3

4) $\frac{\text{Cost of irrigation water}}{\text{Operative cost of production}} = \frac{\$100}{\$1320} = 0.076\ (7.6\%)$

5) $\frac{\text{Gross margin}}{\text{m3 water applied}} = \frac{\$900}{11.513\ \text{m3}} = 0.08\ \$/\text{m3}$

c) Total Surveyed Area (all farms)

1) $\frac{\text{Production value}}{\text{irrigation water cost}} = 36$

2) $\frac{\text{Production value}}{\text{Amount of water applied}} = 0.31\ \$/\text{m3}$

3) $\frac{\text{Production volume}}{\text{Amount of water applied}} = 1.83\ \text{kg/m3}$

4) $\frac{\text{Cost of irrigation water}}{\text{Operative cost of production}} = 0.059\ (5.9\%)$

5) $\frac{\text{Gross margin}}{\text{m3 water applied}} = 0.15\ \$/\text{m3}$

COMPARISON OF PARAMETERS IN THE TWO STUDIED AREAS:

Table 11 is a summary of all the calculated parameters, with little difference between both areas.

CONCLUSIONS

* The main activity in the area studied is grape-growing (80%) followed by fruit-growing with a much lower percentage (20%)
* In general the data obtained through questionnaires ratifies the parameters calculated using secondary data.
* The greatest difference was found in the parameters calculated on the basis of fruit-and grape-growing activities together. This is due to the fact that in the surveyed area, there is a larger amount of big farms with high MBs, both in the grape and in the fruit-growing activities.
* The cost of irrigation water represents approximately 6% of the operative production cost..
* Small farms have parameter values (calculated from primary data) lower than the average for the area (calculated from secondary data) , whereas large farms have higher parameter values.
* Fruit-growing farms have a larger gross margin per m3 of water applied because their MB/hectare are higher than for grape-growing farms with a larger amount of rose grapes (lower price per kg.)
* In the area where secondary data was analyzed, the general gross margin (grape and fruit-growing activities) comes close to the grape-growing gross margin since most of the cultivated area corresponds to this activity.
* In the surveyed area, the gross margins are similar for large farms, and they are lower for smaller farms with fruit-growing activities due to the lack of adequate technology.

Table 1. Distribution of grape-growing farms by area range. San Martín County

Districts / Strata (hectares)	Alto Salvdor		Chapanay		Montecaseros		Chivilcoy	
	Farm #	Vineyard surface (hectares)	Farm #	Vineyard surface (hectares)	Farm #	Vineyard surface (hectares)	Farm #	Surface
< 1	39	23	69	38	44	27	8	7
1 - 5	104	275	167	491	292	871	65	179
5 - 10	35	249	98	741	132	1008	26	188
10 - 15	14	178	55	698	68	853	9	106
15 - 25	14	256	56	1094	100	1942	5	94
25 - 50	6	215	34	1234	38	1249	4	139
> 50	1	70	12	835	13	825	2	128
x		**5.94**		**10.45**		**9,86**		**7.06**

Source: Viticulture Census 1991 and updates

Table 2. Distribution of fruit-growing farms per area range

Districts Strata	Number of fruit-growing farms		
	Alto Salvador	Chapanay	Montecaseros
0 - 5	10	9	13
5 - 10	7	9	10
10 - 15	2	9	6
15 - 25	4	19	9
25 - 50	5	21	18
> 50	2	14	10
Total	30	81	66
Average surface/farm (hectares)	3.31	7.51	6.99

Source: Fruticultural Census 1992

Table 3. Prices/kg paid to farmers

Grapes	$/kg	Fruit crops	$/kg
wine red	0.20	plums	0.21
white	0.17	peaches	0.28
table white and red	0.14	pears	0.18
rose	0.10	apricots	0.13
		olives	0.40

Source: Agricultural Administration and key informants

Table 4. Value of Grape Production

Varieties	Production (kg)	$/kg	Production Value ($)
wine red	16.570.000	0.20	3.314.000
table red	27.594.000	0.14	3.863.160
wine white	3.250.000	0.17	552.500
table white	32.994.000	0.14	4.619.160
rose	226.475.000	0.10	22.647.000
Total			34.824.320

Source: Tables 6 and 7

Table 5. Production of grapes for wine-making (thousands of kg.)

Varieties	Surface (kg)	Kg/ha	Production (thousands of kg)
wine red	1.657	10.000	165.700
table red	1.533	18.000	28.594
wine white	325	10.000	3.250
table white	1.833	18.000	32.994
rose	9.059	25.000	226.475
Total	14.407		

Source Viticulture Census 1991 and its updates. Key informants

Table 6. Total production of fruit crops (thousands of kg)

District	Plums	Peaches	Pears	Apricots	Olives
Alto Salvador	287	619		190	69
Chapanay	1.058	4.650	424	1.176	304
Montecaseros	1.576	3.552	2.820	464	44
Chivilcoy	3.924	1.980	1.780	156	345
Total	6.845	10.801	2.486	1.986	762

Source: Tables 9 and 4

Table 7. Total production and value of fruit production

Species	Plums	Peaches	Pears	Apricots	Olives	Total
Production (kg)	684500	10801000	2486000	1986000	762000	13160000
$/kg	0.21	0.28	0.18	0.13	0.40	
Production value ($)	1437450	3024280	447480	258180	304800	5472190

Source: tables 6 and 10

Table 8. Operative costs of production

	Grapes		Fruits crops					
	high espalier	low espalier	Trellis	Plums	Peaches	Pears	Apricots	Olives
Operative cost ($/hectare)	1.500	1.600	1.800	1.500	1.500	1.500	1.500	1.500
Yield (kg/hectare)	10.000	18.000	25.000	12.000	15.000	20.000	12.000	5.000

Source: Department of Socioeconomic Science and Department of Fruticulture

Table 9. Yield according to farm size (in kg/hectare)

	Large farms				Small farms			
Species	fruit growing	grape growing	Fruit and grape growing		Grape growing	Fruit and grape growing		Average
			fruit	grape		fruit	grapes	
Peaches	20.000		12.000			10.000		12.000
Plums	120.000		9.000			8.000		10.000 (*)
Grapes		30.000		25.000	14.000		15.000	15.000

Source: questionnaires to farmers

(*) 9000 kg/hectare for plums for industrial processing and 11000 for fresh consumption

Table 10. Production cost: estimation according to questionnaire

Type of exploitatio crops	Large Farms				Small Farms		
	Adm. fruit	Contract			Contract		
		Fruit and grape		Grape	Grape	Fruit and grape	
		grape	fruit			grape	fruit
1.OPERATIVE COSTS	1964	1826	1980	2032	979	1747	1663
1.1. Speciial Expenses (SE)	1233	399	326	527	88	387	315
1.1.1. Agrochemicals	331	175	102	199	9	256	110
1.1.2. Fuel	813	179	179	283	34	86	160
1.1.3. Electircity	90	45	45	45	45	45	45
1.2. Wages (W)	646	1332	1559	1394	812	1285	1274
1.2.1. Permanent	266	207	144	240	23	148	181
1.2.2. Commission	0	666	864	634	403	756	648
1.2.3. Temporary	192	240	324	264	252	216	252
1.2.4. Social Laws (40%)	158	179	187	202	110	146	173
.1.3. Maintenance (4%)	30	40	40	55	24	20	20
1.4. Taxes and fees	55	55	55	55	55	55	55
AVERAGE GROSS INCOMKE	6000	3600	3000	3600	2240	3000	2400
AVERAGE GROSS MARGIN	4036	1853	1337	1568	1261	1174	420

Table 11. Summary comparative chart of the calculated economic parameters

	All districts (secondaty data)					Surveyed area (primary data)									
	VP/water cost	VP/m^3 water	Irrig. cost/ CO prod.	kg/m^3 water	MB/m^3 water	VP/water cost		VP/m^3 water		Irrig.cost/ CO prod.		Kg/m^3 water		MB/m^3 water	
	$/$	$/m^3$	%	kg/m^3	$/m^3$	$/$		$/m^3$		%		kg/m^3		$/m^3$	
						Small farms	Large farms	Small farms	Large farms	Small farms	Large farms	Small farms	Large farms	Small farms	Large farms
Grape-growing	24	0.21	5.8	1.85	0.06	22	37	0.20	0.33	6.8	4.7	1.36	2.17	0.08	0.16
Fruit-growing	35	0.30	6.6	0.73	0.17	23	37	0.20	0.33	5.2	5.8	0.69	1.12	0.05	0.17
Grape and fruit growing	25	0.22	5.9	1.74	0.07		36		0.31	5.9		1.83			0.15