Fourth Minnesota/Padova Conference on

Food, Agriculture, and the Environment

Proceedings of a Conference Sponsored by

University of Minnesota
Center for International Food and Agricultural Policy

Università degli Studi di Padova
Dipartimento Territorio e Sistemi Agro-forestali

Regione Veneto
Ente di Sviluppo Agricolo

Spring Hill Conference Center, Wayzata, Minnesota
September 4-10, 1994

Fourth Minnesota/Padova Conference on Food, Agriculture and the Environment
Minnesota, 6-8 September 1994

QUALITY OF IRRIGATION WATER IN VENETO REGION: NITRATES AND PHOSPHOROUS CONTENTS

Agostino Consalter, Placido Bertin, Paolo Giandon
ESAV Agrochemical Centre - via Baciocchi, 9 - 31033 Castelfranco (TV) - ITALY

INTRODUCTION

Surface water pollution caused a growing concern for environmental damages (algine bloom, waterlife reduction, etc.) mostly for some aspects connected to public health (through the food chain or directly to water management), to crops and to soils (loss of fertility and foodstuff production capacity) especially given by the accumulation of toxic substances.

In 1991 the Veneto Region Land Reclamation Union began to cooperate with ESAV in order to carry out an investigation on water quality conditions to optimize its use and to prevent pollution.

The results emerging from this enquiry are taken into consideration in this study-case, as regards the main soluble nitrogen (nitrates) and phosphorus (ortophosphates) forms to know the level of nitrogen and phosphorus enrichment risk of surface water in Veneto Region.

METHOD

The water samples were taken from 20 Land Reclamation Consortia (see figure 1), organizations that have the task of managing irrigation and reclamation water. The personnel in charge of sampling was apprpriately trained in order to guarantee homogeneous sampling procedures.

Sampling was performed weekly during the first year (30 March 1991-22 March 1992) and fortnightly during the remaining period (up to December 1993)

Agrochemical Centre laboratories performed for each sample the following tests: suspended solids, pH, conductivity, total nitrogen, ortophosphates, nitrates, nitrites, chloride, sulphates, sodium, calcium, magnesium.

Each Consortium handled in 2 samples per each collection - shift for a total of 40 samples for each sampling time and 165 for each Consortium in the three considered years.

Three reference levels have been defined for nitrates for the data processing:

- 50 mg/l, (NO_3) representing the limit for drinkable water in Italy and the limit set by the EEC/91/676 Guideline as for polluted waters threshold;
- 25 mg/l, representing the limit set by the EEC/91/676 Guideline as for water monitoring;
- 10 mg/l, representing the best quality goal for EEC.

In order to process data regarding ortophosphates, indications supplied by the Region of Veneto for surface water monitoring programs have been taken into consideration:

- 0.4 mg/l, (P) representing the limit above which water can be used only for irrigation and industrial use;

- 0.2 mg/l, representing the limit not to exceed for the conservation of the more tolerant water species;
- 0.1 mg/l, representing the limit not to exceed for the conservation of the least tolerant water species.

RESULTS AND DISCUSSION

Nitrates

The results of the nitrates test in surface waters obtained after three years of study can be classified as represented in figure 1.

Quite two thirds (61%) of the analyzed samples have a nitrate content lower than 10 mg/l whereas one sample out of 100 has an excessive nitrate content (>50 mg/l); 9% of the cases highlight the need for continuous monitoring (>25 mg/l) and for searching the possible polluting sources, especially of farming and civil origin.

During this three years the situation has remained rather constant and no improvement was reported as we can see in figure 2.

In 1992 there was a slight general improvement whereas in 1993 there was a shift from higher nitrate content classes (>25 mg/l) to average content ones (10-25 mg/l); maybe this improvement is related to the reduction of livestock and a decreasing trend in fertilizer use in order to limit production costs, besides a further enlargement of areas covered by civil sewage water collection network and conditioning plants.

Looking at the detailed results (table 1) it is possible to see how the situation is not homogeneous within the region.

It is rather evident that the western regional area (Consortia 1, 2, 3, 4, 8 and 11) comprising the province of Verona and part of the provinces of Padua and Vicenza have considerably less cases (from 22.1 to 43.9%) of nitrates well below 10 mg/l as against the general average (61.8%); other two Consortia in similar conditions - 14 and 18 - comprise areas with high population density and a production activity charachterized by small and medium size enterprises.

Two Consortia - 13 and 16 - emerge from the others because almost all cases (98.8%) are comprised in the <10 mg/l nitrates class since they draw their irrigation waters directly from the Veneto Pre Alps and therefore their quality is surely high.

In order to highlight the trend in time of the nitrate content in surface water the analyses results of samples fortnightly collected from a point situated in the upper province of Verona in the period from 20 May 1991 to 30 March 1992 was taken into consideration (figure 4).

The maximum nitrate concentrations occur in the winter period; from 2 December 1991 to 3 February 1992 the level of nitrates remains constantly above 50 mg/l.

Ortophosphates

The results of the ortophosphates tests in surface water samples obtained during three years of study can be classified as represented in figure 5:

Quite three fourths (74%) of the tested samples have an ortophosphates content lower than 0.1 mg/l, whereas three samples out of 100 have an excessive content (>0.4 mg/l); 10% of cases highlight a non optimal situation for water life (>0.2 mg/l) and call for the singling out and control of possible polluting sources, especially of farm and civil origin..

During the past few years the situation has worsened, considerabily from 1991 to 1992, slightly from 1992 to 1993 (figure 6).

Considering the detailed results it is possible to see how the situation is not homogeneous inside the Region of Veneto (table 2).

For some Consortia (4, 6, 8, 17), distributed in an apparently random way, the ortophosphates cases which are lower than 0.1 mg/l are considerably less (da 49.4 a 52.4 %) as against the general average (73.9 %).

As in the nitrates case, also in ortophosphates two Consortia - 13 and 16 (together with 12) - emerge from the rest because almost all cases (97.5 and 92.8% respectively) are comprised in the class with ortophosphates lower than 0.1 mg/l.

In order to highlight the trend in time of the ortophosphate content in surface water the analyses results of samples fortnightly collected from a point situated in the lower plains of Treviso in the period from 25 March 1991 to 30 March 1992 was taken into consideration.

The trend is erratic; three peaks occur in the months of July, October and February-March.

On the basis of these results it will be necessary in the future monitoring activities to place the sampling of surface water in such a way so as to concentrate the efforts in greater problem-areas in order to single out the pollution causes and to adopt the necessary measures to reduce the nitrates and ortophosphates release in water.

REFERENCES

Regione Veneto, 1987. Piano per il rilevamento delle caratteristiche qualitative e quantitative dei corpi idrici della Regione Veneto: censimento dei corpi idrici - acque dolci superficiali (Program for water quality and quantity monitoring of river of Veneto Region). Giunta Regionale, Dipartimento per l'Ambiente

EEC, 1991. The protection of waters against pollution caused by nitrates from agricultural sources. EEC Directive n. 676, 12 December 1991.

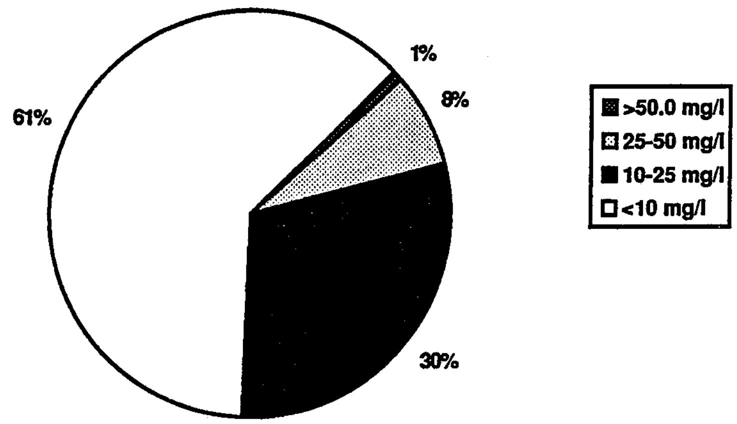

Figure 2 - Classification of nitrate content of nitrate in irrigation water detected in 1991-93.

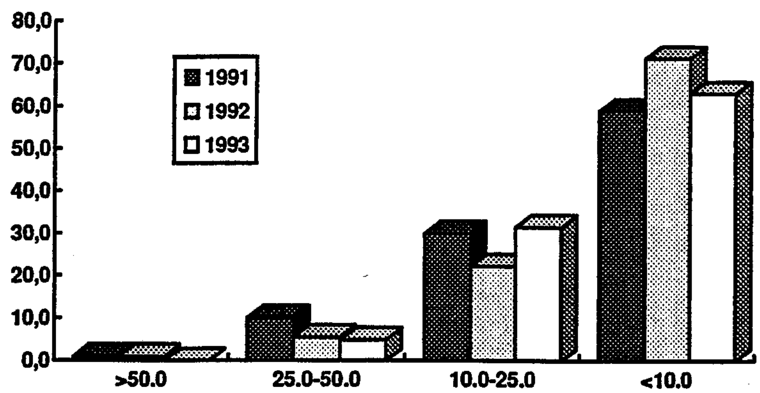

Figure 3 - Trend of nitrate content of irrigation water from 1991 to 1993.

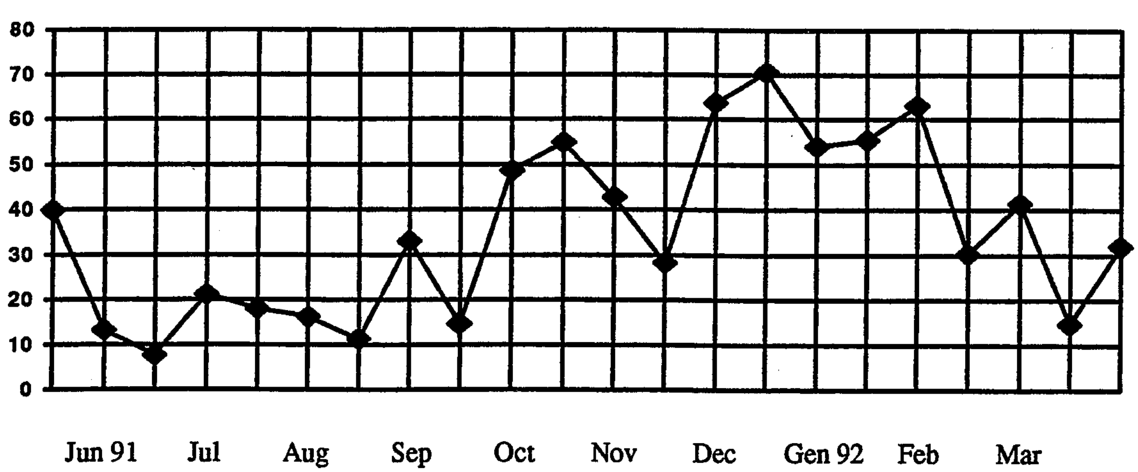

Figure 4 - Trend of nitrate content of irrigation water in a point of upper Verona Province.

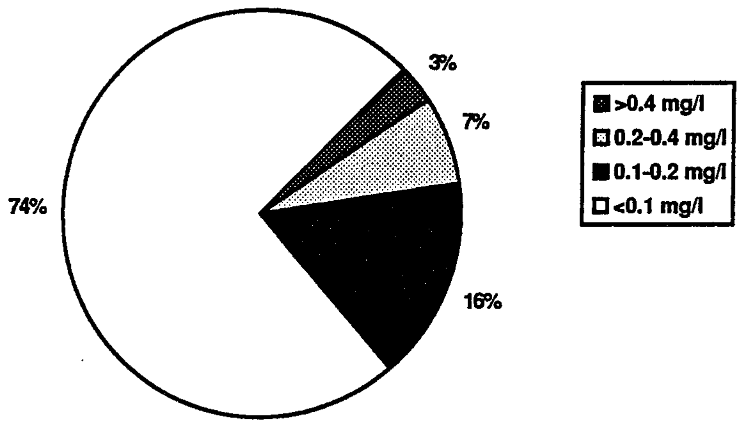

Figure 5 - Classification of nitrate content of ortophosphates in irrigation water detected in 1991-93.

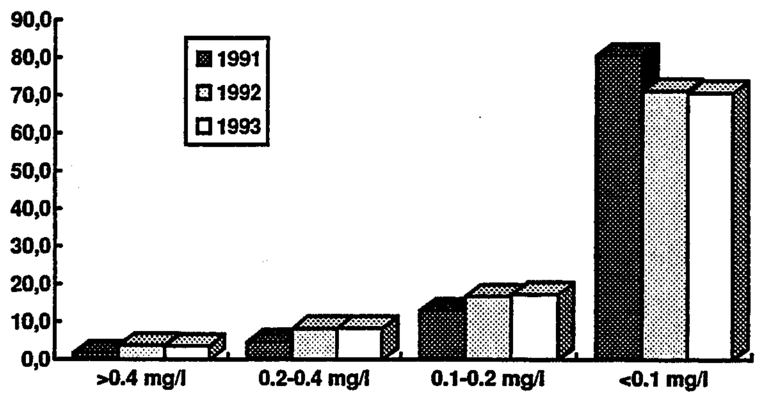

Figure 6 - Trend of ortophosphates content of irrigation water from 1991 to 1993.

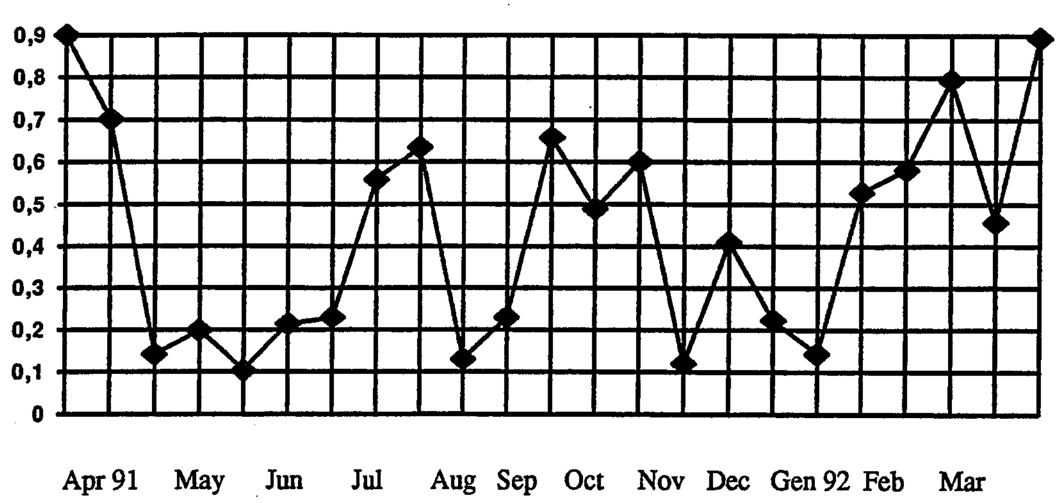

Figure 4 - Trend of nitrate content of irrigation water in a point of lower plain of Treviso Province.

Consortium	N. of samples	>50 *mg/l*	%	25-50 *mg/l*	%	10-25 *mg/l*	%	<10 *mg/l*	%
1	160	19	11.9	56	35.0	32	20.0	53	33.1
2	168	0	0	35	20.8	96	57.1	37	22.1
3	162	0	0	15	9.3	97	59.9	50	30.8
4	169	0	0	3	1.8	105	62.1	61	36.1
5	155	0	0	10	6.5	15	9.7	130	83.8
6	164	1	0.6	6	3.7	21	12.8	136	82.9
7	158	0	0	6	3.8	19	12.0	133	84.2
8	164	2	1.2	29	17.7	61	37.2	72	43.9
9	166	0	0	12	7.2	37	22.3	117	70.5
10	165	0	0	6	3.6	41	24.8	118	71.6
11	164	3	1.8	41	25.0	73	44.5	47	28.7
12	159	0	0	2	1.3	53	33.3	104	65.4
13	162	0	0	0	0	2	1.2	160	98.8
14	166	0	0	6	3.6	76	45.8	84	50.6
15	169	2	1.2	2	1.2	41	24.3	124	73.3
16	170	0	0	0	0	2	1.2	168	98.8
17	154	0	0	3	1.9	34	22.1	117	76.0
18	165	0	0	5	3.0	86	52.1	74	44.9
19	169	3	1.8	10	5.9	56	33.1	100	59.2
20	168	0	0	4	2.4	24	14.3	140	83.3
TOTAL	*3277*	*30*	*0.9*	*251*	*7.7*	*971*	*29.6*	*2025*	*61.8*

Table 1 - Classification of nitrate content of irrigation water detected in every single Land Reclamation Consortium, i.e. in different areas of the Veneto Region..

Consortium	N. of samples	>0.4 mg/l	%	0.2-0.4 mg/l	%	0.1-0.2 mg/l	%	<0.1 mg/l	%
1	160	5	3.1	19	11.9	32	20.0	104	65.0
2	168	0	0	4	2.4	26	15.5	138	82.1
3	162	1	0.6	1	0.6	22	13.6	138	85.2
4	169	4	2.4	33	19.5	45	26.6	87	51.5
5	155	1	0.6	2	1.2	13	8.4	139	89.8
6	164	21	12.8	24	14.6	36	21.9	83	50.7
7	158	0	0	13	8.2	44	27.8	101	64.0
8	164	1	0.6	18	20.0	59	36.0	86	52.4
9	166	0	0	2	1.2	17	10.2	147	88.6
10	165	2	1.2	11	6.7	29	17.6	123	74.5
11	164	0	0	10	6.1	41	25.0	113	68.9
12	159	0	0	2	1.2	6	3.8	151	95.0
13	162	0	0	2	1.2	2	1.2	158	97.5
14	166	14	8.4	26	15.7	26	15.7	100	60.2
15	169	2	1.2	9	5.3	27	16.0	131	77.5
16	170	6	3.6	3	1.8	3	1.8	158	92.8
17	154	31	20.1	23	14.9	24	15.6	76	49.4
18	165	0	0	2	1.2	15	9.1	148	89.7
19	169	4	2.3	11	6.5	28	16.6	126	74.6
20	168	9	5.3	16	9.5	30	17.9	113	67.3
TOTAL	*3277*	*101*	*3.1*	*231*	*7.0*	*525*	*16.0*	*2420*	*73.9*

Table 2 - Classification of nitrate content of irrigation water detected in every single Land Reclamation Consortium, i.e. in different areas of the Veneto Region..