Golf Courses and Traditional Crops: a Comparison of Inputs

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Introduction

As common opinion, turfgrasses, and specifically the golf courses, are often indicated as one of the most important source of pollution. Particularly in Southern Europe, the amount of fertilisers, pesticides and water used on turf is believed very significant in comparison with the most common crops, and sports turfs are generally considered quite dangerous for the environment (Caggiati et al., 1999). The object of this study is to demonstrate that golf course turf is providing less harmful inputs to the environment than the most common crops, and that golf courses turf can have the opportunity to reduce further its actual water consumption

The Po Valley study

In the Po Valley area of Italy there are 60 golf courses with at least 18 holes. Since 2005, a working group, formed by IGF (Italian Golf Federation) and GEE (Golf Environment Europe) technicians, is investigating the real consumption on Golf Courses turfgrasses in terms of fertilisers, pesticides and water. A representative sample of 16 golf courses (26.6% of the total) has been collected with the collaboration of the local Superintendents. In the sample are represented 12 golf courses with 18, 2 with 27 and 2 with 36 holes, with a average surface of about 77 ha. The collected data showed an average water consumption of 1339.9 m^3 ha^{-1} per year. About fertilisers and chemicals, the use was calculated as 39.8 kg ha^{-1} of N, 6 kg ha^{-1} of P_2O_5, 33.3 kg ha^{-1} of K_2O, 1.7 kg ha^{-1} of herbicides, 3.5 kg ha^{-1} of fungicides and 1.9 kg ha^{-1} of insecticides (Table 1).

Table 1. Total annual water, fertilisers and pesticides consumptions of 16 golf courses in the Po Valley. (mean of 2005 - 2007). Po Valley includes: Piemonte, Lombardia, Veneto, Friuli V.G. and Emilia Romagna.

N°	Golf Courses	Total Surface	Water	Consumptions					
				N	P_2O_5	K_2O	Herbicides	Fungicides	Insecticides
		(ha)	(m^3 ha^{-1})	(kg ha^{-1})					
1	Barlassina (CO)	62.85	1032.2	35.7	11.1	48.7	3.2	9.6	0.9
2	Biella	76.27	646.8	48.2	3.0	54.7	0.0	6.2	2.0
3	Carimate (CO)	56.00	785.7	48.3	4.2	42.4	0.6	6.4	1.2
4	D. I.Borromees (VB)	75.00	533.3	27.6	8.8	29.3	0.2	0.2	0.2
5	Ferrara	36.00	3750.0	26.8	1.7	11.2	3.0	1.0	0.1
6	Le Fronde (TO)	60.00	663.3	20.9	2.2	22.8	1.3	2.9	5.1
7	Margara (AL)	140.00	1101.2	31.6	11.5	25.3	0.7	4.7	0.6
8	Milano	94.00	1159.6	32.1	4.2	26.3	1.4	5.4	1.3
9	La Pinetina (CO)	101.45	1011.7	33.9	5.0	14.8	1.7	4.6	4.7
10	Le Robinie (VA)	115.00	1914.8	44.7	2.6	26.1	0.2	0.1	0.3
11	Torino	125.00	2480.0	57.4	7.1	18.7	3.2	5.4	7.3
12	Udine	58.00	605.3	37.5	4.8	54.2	3.2	1.8	1.9
13	Varese	62.20	908.0	55.9	8.4	55.9	0.7	0.6	0.6
14	Venezia	60.00	1166.7	35.0	4.8	20.4	1.9	1.7	0.0
15	Verona	59.60	2469.1	62.0	9.7	40.7	0.8	1.5	0.6
16	Villa d'Este (CO)	55.00	1210.3	39.0	7.7	41.3	3.4	3.7	1.7
Mean		77.27	1339.9	39.8	6.0	33.3	1.7	3.5	1.9

Then these data were compared with the most common crops growing in the same area, published by Statistic National Institute (ISTAT) and National Research Council (CNR). The comparison is positive for golf courses, as expressed also in the ratio column in table 2, with values including between 1.1 and 9.0.

Table 2 . Total annual pesticides, fertilisers and water consumptions and ratio between crops and Golf Courses in the Po Valley.

Consumptions	Crops	Golf Courses	C/G [4]
Herbicides (kg ha^{-1} yr^{-1})	3.6 [1]	1.5	2.4
Fungicides (kg ha^{-1} yr^{-1})	6.6 [1]	3.7	1.8
Insecticides (kg ha^{-1} yr^{-1})	2.3 [1]	2.0	1.1
Nitrogen (kg ha^{-1} yr^{-1})	155.8 [2]	40.2	3.9
Phosphorous (kg ha^{-1} yr^{-1})	56.8 [2]	6.3	9.0
Potassium (kg ha^{-1} yr^{-1})	72.8 [2]	31.5	2.3
Water (m^3 ha^{-1} yr^{-1})	2437.5 [3]	1330.0	1.8

[1]Data from: ISTAT 2007. [2] Data from: ISTAT 2006. [3] Data from: CNR – IBIMET Consorzio di Bonifica Canale Emiliano Romagnolo (Beet Root, Corn, Potato, Tomato). [4] C/G = ratio between products and water use for traditional and golf courses.

New options for turfgrass on Golf Courses in the Northern Italy

Despite the very positive results of the Po Valley study, it is certainly possible to get a further reduction in chemicals and water use on turf, using the appropriate warm-season turf species (Volterrani et al., 1997; Croce et al., 2001), even above the 45 ° North Parallel. These grasses are able to give additional environmental advantages, such as lower water and fertiliser inputs and higher wear and disease tolerance. Several research projects managed in collaboration with CeRTES of University of Pisa, are studying the adaptation of warm-season grasses above the 45° North Parallel. A recent study (De Luca et al., 2008) shows how much some warm-season grasses are able to obtain positive results in terms of turfgrass quality, shoot density and leaf blade width, even in a non-traditional growing area.

Conclusions

As already demonstrated by other researchers in Europe (Rodriguez Diaz et al., 2007), also in the Po Valley the presence of golf courses instead of the most common crops of the area can provide with positive influence in terms of total water, fertilisers and pesticides reduction.

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Literature cited

Caggiati, P., Di Pasquale, S., Gallerani V., Viaggi, D. and Zanni, G. 1999. Gli effetti ambientali delle attività ricreative sul territorio. Il caso del golf in Italia. CNR, GeSTA, Bologna. 129 p.

Croce, P., De Luca, A., Mocioni, M., Volterrani, M. and Beard J.B., 2001. Warm-season turfgrass species and cultivar characterizations for a Mediterranean climate. Intl. Turfgrass Soc. Res. J. 9:855-859.

De Luca, A., Volterrani, M., Gaetani, M., Grossi, N., Croce, P., Mocioni, M. and Lulli, F. 2008. Warm season turfgrass adaptation in Europe north of the 45° parallel. 5th World Scientific Congress of Golf, March 24-28 2008, Phoenix. (in press)

Istituto Nazionale di Statistica (ISTAT). 2006. La distribuzione per uso agricolo dei prodotti fitosanitari e dei fertilizzanti nell' Anno 2006. www.istat.it

Rodriguez Diaz, J.A., Knox, J.W. and Weatherhead, E.K. 2007. Competing demand for irrigation water: golf and agriculture in Spain. Irrig. and Drain. 56:541-549.

Volterrani, M., Grossi, N., Pardini, G., Miele, S., Gaetani, M. and Magni, S. 1997. Warm season turfgrass adaptation in Italy. Intl. Turfgrass Soc. Res. J. 8:1344-1354.