Water footprint of Catalan fruit sector as efficiency indicator

Vinyes Elisabet[1*], Gasol Carles M.[1,2] Asin Luis,[3], Alegre Simó3 Muñoz Pere[1,3]

[1]Sostenipra Research Group. Universitat Autònoma de Barcelona, 08193 Bellaterra, Barcelona, Spain
[2]Inèdit Innovació s.l. Research Park of UAB. UAB Campus. 08193 Bellaterra(Spain)
[3]Institute for Research and Technology in Food and Agriculture (IRTA), 25198 Lleida, Spain
[1,4]Institute for Research and Technlology in Food and Agriculture (IRTA), 08348 Cabrils, Barcelona, Spain

Corresponding author: Elisabet Vinyes elisabet.vinyes@gmail.com http://www.sostenipra.cat

1.Introduction

According to FAO statistics (2013) Spain is the second apple producer in the European Union with 962,000 tones of apple. Catalonia (North East of Spain) is the first region of apple production in Spain (54% of total Spanish apple production) [1]. This study is part of a PhD thesis that tries to analyse the environmental performance of the Catalan fruit sector focused in apple and peach production.

2.Goal and scope

This study aims to analyze the water footprint of Catalan apple production over a period of nine years using real data, considering the three color components of the water footprint: green, blue and, in order to provide useful information to producers understand water requirements of crops and introduce new opportunities for water efficiency alternatives.

3.Materials and methods

The water footprint (WF) is an indicator of freshwater use that looks at both direct and indirect water use of a consumer or producer [3].

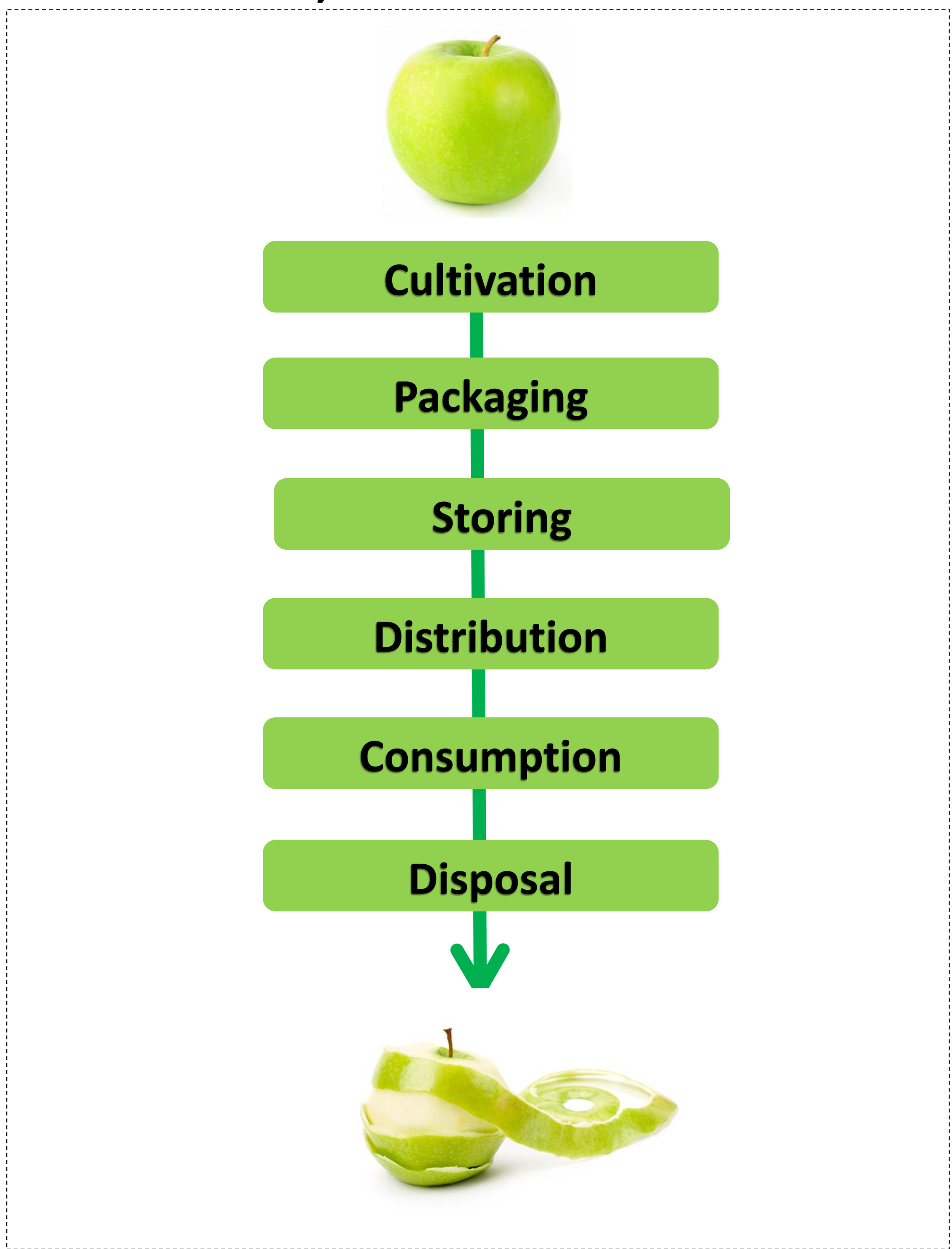
Components of WF:

- **Blue WF:** volume of surface and groundwater consumed (evaporated).
- **Green WF**: rainwater evaporated from the field.
- **Grey WF:** volume of freshwater that is required to assimilate the load of pollutants.

Methodology applied WF:
FAO Water Footprint Manual [2].
Drainage manual nº 56 FAO [3].
Software: CROPWAT 8.0 [4].

Functional Unit used (FU): production of one kg of apples

- **System boundaries**

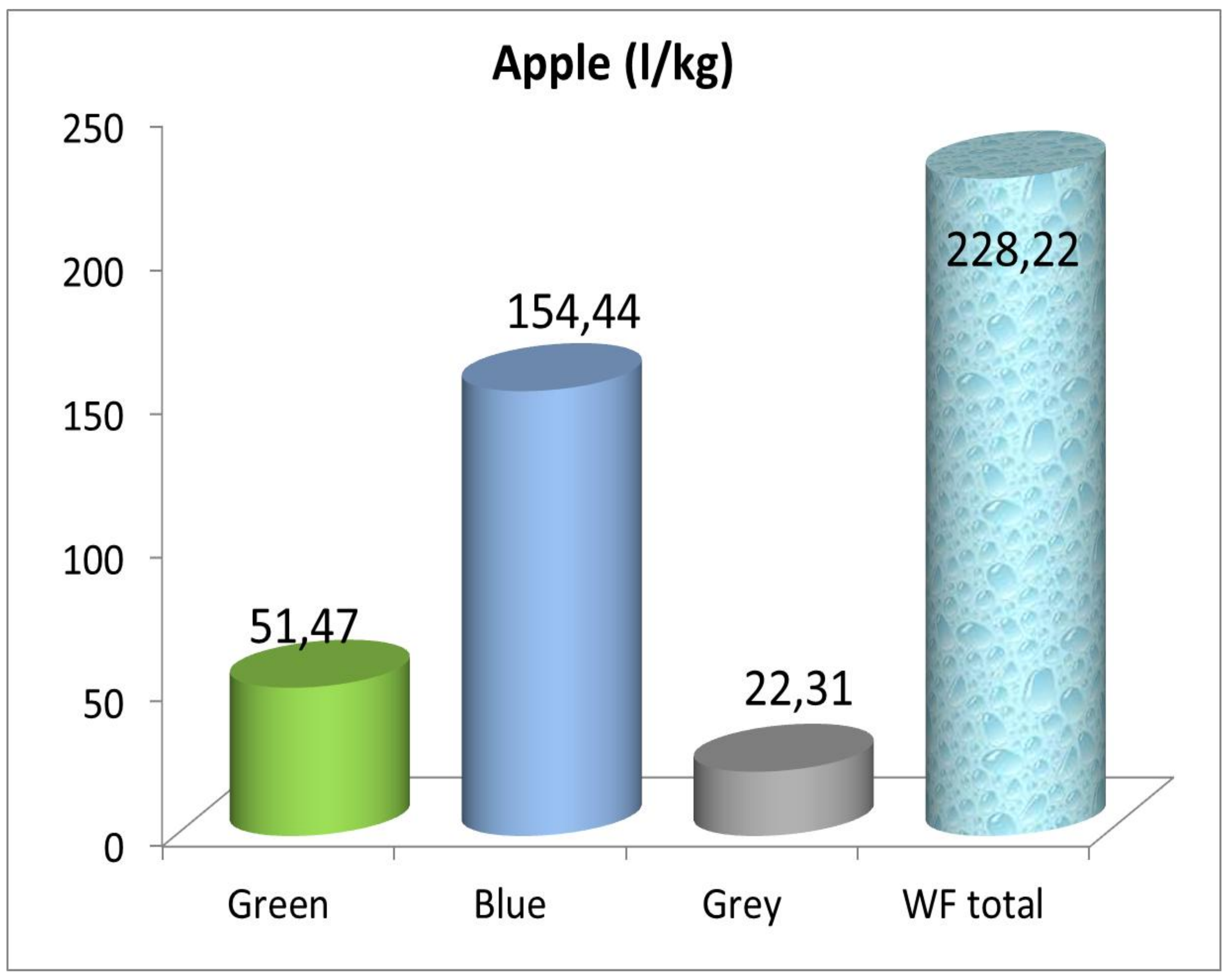


- **Data source:**
  Experimental plot from IRTA of 10,5 ha

Data	Apple	Units
Fertiigation system	dropping	-
Water	201.00	m^3/ton
Yield	514	ton/year
Fertilizers:		
N	2.66	kg/ton
P_2O_5	1.33	Kg/ton
K_2O	6.00	Kg/ton
Machinery	1.50	Kg/ton
Phytosanitary	0.22	Kg/ton
Fuel consumption	13.09	l/ton
Infraestructure:		
wood	1.21	Kg/ton
iron	0.35	Kg/ton
polyethylene	1.08	Kg/ton

Table 1. Inventory data

3.Results



- Depending on the fruit the green component has a contribution between 16-21%, the blue component between 68-73% and the grey component between 9-10%.
- Of the all stages studied agricultural production accounted (97-98%) of the total water footprint, followed by distribution stage (2-3%) and consumption stage (0.11-0.22%).
- Only around 2% of the product water use occurred in the distribution stage and packaging materials and less than 0.5% occurs in consumption stage.
- The main factors influencing the WF values are: geographic crop area, climatic factors and rainfall and irrigation volume.
- calculate the water footprint per unit of fruit produced can illustrate the efficiency of water consumption in relation to crop production.

4. Further research

Deficit irrigation strategies will play an important role in farm-level water management strategies, with consequent increases in the output generated per unit of water used in agriculture. Farmers must choose crops and irrigation strategies carefully to maximize the value of their crop and livestock production activities, while ensuring the sustainability of agriculture. The development of irrigation software or algorithms can help farmers to find strategies for improving water use and orchard productivity, Nevertheless, this applications presents some disadvantages such as: reduce the amount of labor involved in scheduling irrigation, are expensive to acquire and are not generally available to growers, rescheduling irrigation patterns, get ability to acquiring and processing data, as well as by the knowledge

[1]MAGRAMA 2014. Spanish Ministry of Environment and Agriculture. Annual statistics 2011. Spain 2012. [2] The Water Footprint Assessment Manual, Arjen Y. Hoekstra, Ashok K. Chapagain, Maite M. Aldaya, Mesfin M. Mekonnen 2011. [3] FAO Irrigation and Drainage Paper No. 56. 2010. [4] Software CROPWAT 8.0 http://www.fao.org/nr/water/infores_databases_cropwat.html