

Introduction

Knowing both the actual nutrient status and the real nutrient demand of a crop is a basic requirement for a reasonable management of fertilization. In this work, the annual nutrient budget of macro and micro-elements (N, P, K, Ca, Mg, Fe, Cu, Zn and Mn) has been estimated in a peach tree orchard. Losses due to output of nutrients from the tree at different removal events, including wood pruning, flower loss, fruit thinning, fruit harvest and leaf fall have been evaluated. Also, an estimation of the amounts of macro and micro-nutrients immobilized in wood has been carried out.

Material and Methods

Samples were taken from an orchard (Peñaflor-Spain) with two peach varieties. The first variety was Babygold 5, with trees 3.5 m high and a trunk diameter of 11 cm. The second variety was Catherina, with trees 3.25 m high and a trunk diameter of 13.3 cm. Both varieties were grafted on GF677 and were 15 year-old.

The dry mass and the amounts of macro and micro-nutrients in the different tree materials was measured after each removal event (Fig. 1). Also, the mass of the tree aerial part and the contents of nutrients were assessed after excavating two trees from each variety.

Leaves fallen in the autumn season were collected by using a net in four trees from each variety (Fig. 2).



Fig. 2. Net structure to collect fallen leaves

Results

Nutrient output

- The larger biomass quantity was removed at fruit harvest (0.3-3.0 and 0.2-3.1 kg/tree for Catherina and Babygold 5, respectively; Table 1).
- In the case of Catherina, macro-element losses were largest for N (in flowers, thinned fruits and leaves from leaf pruning), Ca (in fallen leaves and one year-old wood) and K (in harvest fruits and old wood). With Babygold5, the only difference compared to Catherina was for Ca, which accounted for the largest loss in old wood (Table 1).
- Among micro-elements, Fe showed the largest losses in all the materials in both varieties (Table 1).
- Immobilized wood accounted for 81 and 85% of the total mass in Babygold 5 and Catherina, respectively. In this material the largest contents were for Ca among macro-elements, and for Fe among micro-elements (Table 1).

Contribution of removal events to the annual nutrient budget

- Leaf fall was the event most important for macro-nutrient outputs (23-68% of the totals) (Fig. 3).
- Considering micro-nutrient outputs, fallen leaves and one-year pruning wood constitute the two major removal factors (Fig. 3).
- Fruit harvest leads to a significant loss of all micro-nutrients studied (5-13% of the total; Fig. 3).



Fig. 2. Removal events during a cycle and immobilized wood in a peach tree

	Element	Flower abscission	Fruit Thinning	Fruit Harvest	Green pruning leaves	Green pruning One-year old wood	Fallen leaves	Winter pruning One-year old wood	Winter pruning Old wood	Immobilized wood	Total
		April	May	July	August	August	September	January	January	November	One year
Catherina	N	0.7-2.6	0.4-10.2	2.0-34.5	0.1-13.7	0.8-3.7	8.8-28.1	1.6-31.6	0.2-1.9	7.8-23.3	22.5-149.5
	P	0.1-0.4	0.1-1.2	0.3-4.6	0.1-0.8	0.1-0.5	0.6-2.1	0.1-3.4	0.1-0.9	4.9-12.8	6.3-26.8
	Ca	0.2-0.7	0.1-0.9	0.3-4.2	0.1-12.4	1.7-9.1	19.3-55.7	2.6-54.5	0.7-3.5	94.4-167.2	119.3-308.1
	Mg	0.1-0.2	0.1-0.5	0.2-3.2	0.1-2.3	0.1-0.7	3.2-9.2	0.2-3.8	0.1-0.5	7.7-10.8	11.5-31.0
	K	0.4-1.8	0.6-7.3	3.8-53.6	0.1-13.0	0.5-2.4	5.7-25.7	0.8-14.9	0.2-4.2	30.4-46.9	42.5-169.8
	Fe	5.5-24.0	2.2-27.5	11.6-181.3	0.4-65.6	5.5-32.3	106.5-499.1	9.8-250.5	5.0-25.9	6.4-11.7	6.6-12.8
	Mn	1.0-3.8	0.6-6.3	1.8-30.7	0.1-29.4	1.7-7.9	40.9-60.7	1.7-39.8	0.8-12.0	0.2-0.3	0.2-0.5
	Cu	2.6-9.3	0.6-7.7	2.6-42.4	0.1-6.1	2.5-10.3	9.4-41.5	7.0-115.9	3.2-21.3	0.4-0.7	0.4-1.0
	Zn	1.4-6.0	0.8-11.5	1.9-36.9	0.1-10.6	3.5-15.6	8.5-27.8	2.9-105.6	2.3-14.1	2.2-2.7	2.2-2.9
	Total dry mass	0.03-0.1	0.03-0.4	0.3-3	0.1-1	0.1-0.5	0.5-1	0.1-2.2	0.1-1	21.0-27.1	22.1-35.5
Babygold5	N	0.2-1.7	0.1-4.1	1.5-28.5	5.2-14.7	0.7-2.7	13.2-40.5	3.0-28.3	0.6-8.5	9.9-22.4	34.5-151.4
	P	0.1-0.3	0.1-18.7	0.3-5.5	0.2-0.9	0.1-0.4	1.4-2.3	0.3-3.7	0.1-0.9	4.3-7.2	6.8-39.8
	Ca	0.1-0.6	0.1-0.3	0.2-4.0	5.0-12.9	1.3-5.4	48.4-79.6	6.9-74.1	1.5-10.1	129.7-217.7	193.0-404.7
	Mg	0.1-0.2	0.1-0.2	0.1-3.1	1.0-2.8	0.1-0.5	7.7-12.3	0.3-4.5	0.1-0.4	6.4-9.7	15.7-33.7
	K	0.2-1.1	0.1-3.1	3.2-63.2	3.4-11.2	0.3-1.7	16.9-27.2	1.4-17.4	0.2-3.9	32.6-59.7	58.3-188.6
	Fe	2.1-17.4	0.4-13.6	7.1-194.2	22.4-58.9	6.3-24.3	282.5-510.2	26.2-252.4	7.0-46.7	8.1-57.7	8.4-58.9
	Mn	0.3-2.6	0.1-2.4	1.0-23.8	11.1-27.1	1.1-5.5	61.9-127.9	3.6-47.7	1.8-9.8	0.1-0.5	0.2-0.7
	Cu	1.0-11.6	0.1-4.0	1.4-48.5	1.9-5.6	1.5-6.7	27.4-43.1	17.0-114.9	2.7-29.7	0.6-1.0	0.7-1.3
	Zn	0.4-3.7	0.2-5.3	1.3-38.4	3.2-8.7	2.3-9.5	16.9-29.5	10.6-87.5	4.3-27.5	2.5-5.0	2.6-5.2
	Total dry mass	0.01-0.1	0.01-0.2	0.2-3.1	0.2-0.6	0.1-0.4	1.4-2.3	2.5-2.7	0.2-1.5	18.0-26.2	20.4-37.1

Tab. 1. Tissue biomass (in kg dry mass/tree) and nutrient outputs in each removal event and in immobilized wood (during cycle) (N, P, Ca, Mg, K in g/tree and Fe, Mn, Cu and Zn in mg/tree).

Conclusions

Our results give a first insight of the principal nutrient removal events during a peach tree cycle.

This work will be continued by monitoring the tree cycle in following years and in additional orchards.

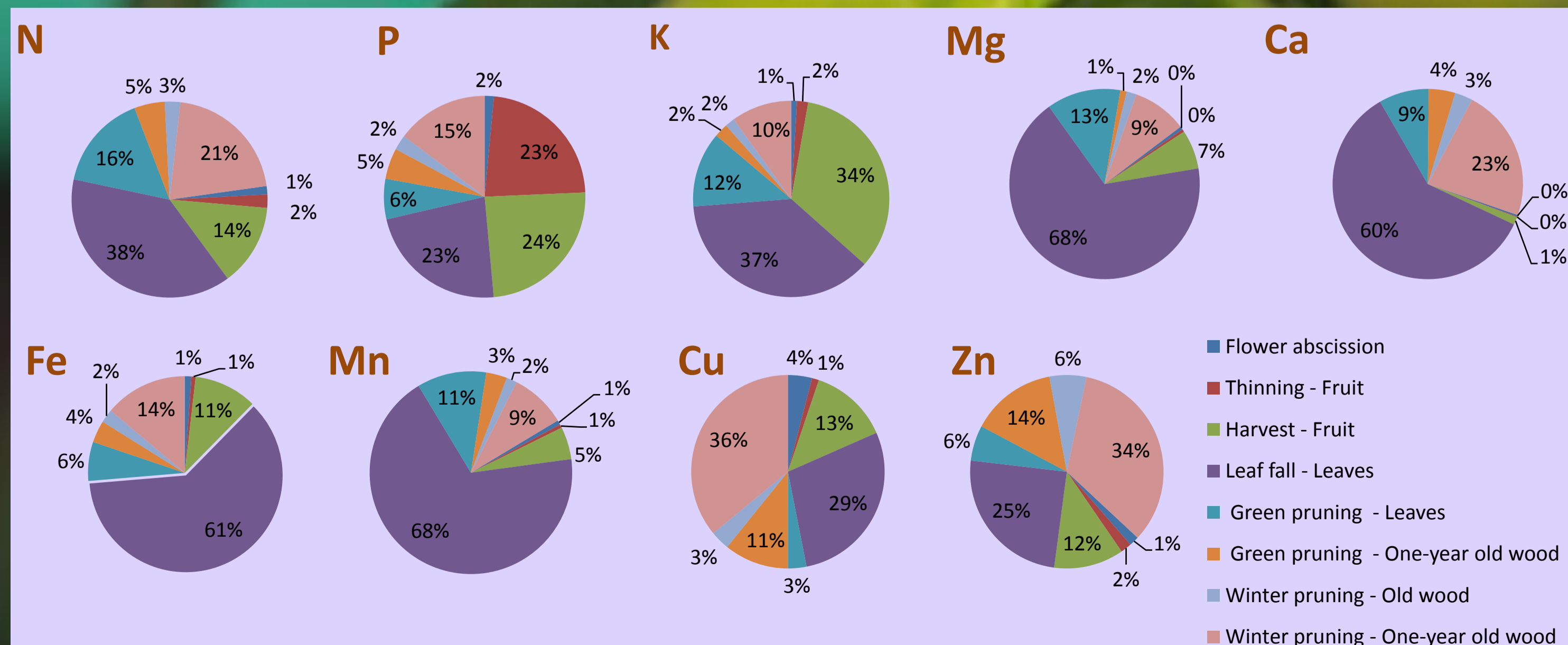


Fig. 2. Contribution of each removal event in macro and micro-nutrient outputs during the year for the variety Babygold5