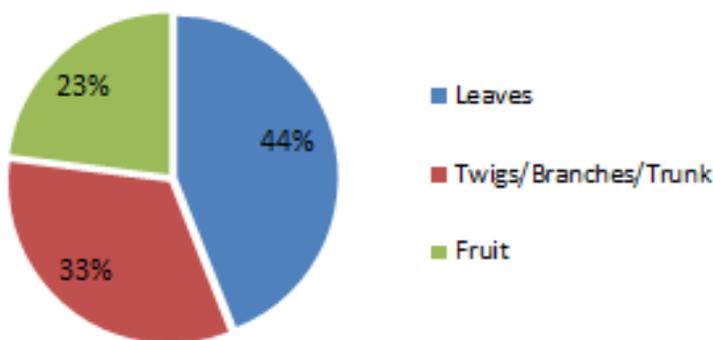


What values should olive growers use for estimating crop nitrogen removal at harvest?

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With the implementation of the Irrigated Lands Regulatory Program, olive growers have expressed interest in gaining a more comprehensive understanding of the amount of nitrogen (N) removed by the crop at harvest. There are two components to estimating the quantity of N removed at harvest: 1) the size of the crop, and 2) the amount of N incorporated in the fruit.

Nitrogen distribution in aboveground olive tree



Nitrogen distribution in olive fruit

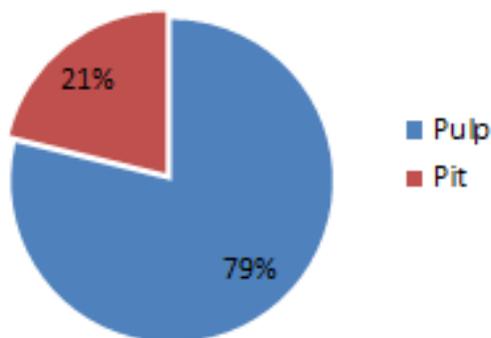


Figure 1. Pie charts illustrate estimates of distribution of nitrogen in the aboveground portion of the olive tree and the fruit. Data was gathered from Rodrigues, et al., based on studies conducted in a rainfed orchard of *Olea europaea* cv. Cobrancosa in northeast Portugal.

Distribution of nitrogen in the olive tree.

Leaves are the largest N sink of the olive tree. Approximately 44% of the tree's aboveground N is incorporated in the foliage. The twigs, secondary branches, main branches, and trunk account for approximately 33% of the N stored in the aboveground portion of the tree. Last, the fruit account for around 23% of the aboveground N, with close to 19% incorporated in the flesh. These estimates are based on research published in *Scientia Horticulturae* (Rodrigues, et al) (Figure 1). The published data was gathered from a dry-farmed *Olea europaea* cv. Cobrancosa orchard in north-eastern Portugal.

Interestingly, the estimated N removal rates in fruit from the test-orchard in Portugal are similar to values estimated by Rosecrance and Kruger for three oil olive cultivars in California. An estimate of N removal from the dryland crop in Portugal is 8.23 lbs N/ton fruit; similar estimates for irrigated Arbosana, Arbequina, and Koroniki in California are 6.30, 6.81, and 7.45 lbs N/ton fruit, respectively. The main consideration when comparing crop N removal between the dryland and irrigated systems is the anticipated yield. For example, the test-orchard in Portugal had an anticipated average annual yield of 1.11 tons/acre; both table and olive oil growers in the central valley anticipate an annual average yield of 5

tons/acre. Although anticipated N removal per ton of fruit may be similar in irrigated vs. dryland systems, the N-use efficiency (NUE) will likely vary considerably between systems. In dryland systems, NUE is estimated

at 50-75%; however, the N is applied near the conclusion of the winter/spring rainy season, ensuring less N loss due to leaching. I've heard grower reports of N use ranging from 50 lbs/acre to 90 lbs/acre in California olive orchards. If we assume a crop removal rate of 35 lbs N/acre (5 ton/acre x 7 lbs N/ton), then NUE's may range from around 39%-70% in irrigated, California olive systems.

Timing of fruit demand for nitrogen. Fruit is only an important N sink during the initial phase of growth. As fruit size increases, the N concentration decreases (Fernández-Escobar et al., 2011). In fact, the pulp is a higher sink for all nutrients than the pit (Rodrigues, et al).

Summary. Estimated N removal by the crop at harvest will likely range from 6.3-8.2 lbs N/ton. To estimate the total N removed per acre, simply multiply the total tons/acre by a reasonable estimate of lbs N/ton (ie. 7.2 lbs N/ton). Alternately, oil growers in CA may prefer using the online 'Olive Calculator' tool produced by Richard Rosecrance, Professor, CSU Chico and Bill Kruger, Emeritus Farm Advisor, Glenn and Tehama Counties. The 'Olive Calculator' website can be accessed at the following URL:

<http://www.csuchico.edu/~rrosecrance/Model/OliveCalculator/OliveCalculator.html>

The 'Olive Calculator' website additionally addresses the total suite of nutrients lost from the orchard at harvest and allows growers to access estimates from each of three cultivars: Arbosana, Koroniki, and Arbequina.

Select References:

Fernández-Escobar, R., Garcia-Novelo, J.M., Restrepo-Díaz, H., 2011. Mobilization of nitrogen in the olive bearing shoots and after foliar application of urea. *Scientia Horticulturae* 127:452–454.

Irrigated Lands Regulatory Program: http://www.swrcb.ca.gov/water_issues/programs/agriculture/

Olive Calculator: <http://www.csuchico.edu/~rrosecrance/Model/OliveCalculator/OliveCalculator.html>

Rodrigues, M.A., Isabel Q. Ferreira, I.Q., Claro, A.M., Arrobas, M. 2012. Fertilizer recommendations for olive based upon nutrients removed in crop and pruning. *Scientia Horticulturae* 142:205-211.

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Olive Notes

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