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THE ACORN DRYING PROCESS



WildFood

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Acorns harvesting

- Acorns are harvested between October and January
- The coincidence with the cold and wet season makes the drying process and conservation difficult

Drying acorns

- Critical process to future conservation of acorns
- A fast-drying process makes it possible to avoid fungal contamination and prolong the shelf life of whole acorns and acorn flour
- Winter season does not help to reach the right temperatures and moisture
- Energy-intensive process that needs to be improved





Goal and method

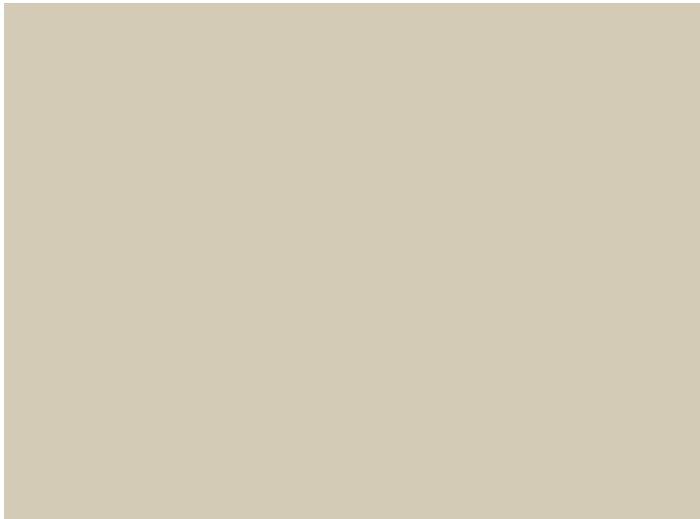
- Our goal is to develop a less expensive, faster and more efficient method to dry acorns through the study of the drying curves



Drying acorns

- At HFM we use two methods to dry our acorns:

- **Air Drying** - The first drying method is done by spreading the acorns on a dry and clean surface at a covered patio
- **Forced-drying** - After that, we use a system that imitates the old-fashioned ways of drying acorns in the smokehouse on a wooden platform



First test to water content in acorns

The first test to the total water content present in acorns was made using 3 samples with 3 Kg of acorns putted in the oven at 100 °C for 4 hours with ventilation

Average water 37 %

Sample	Initial weight (kg)	Final weight (kg)	% of water
1	3	1.940	0.353
2	3	1.880	0.373
3	3	1.855	0.382



Study of the drying process in both methods

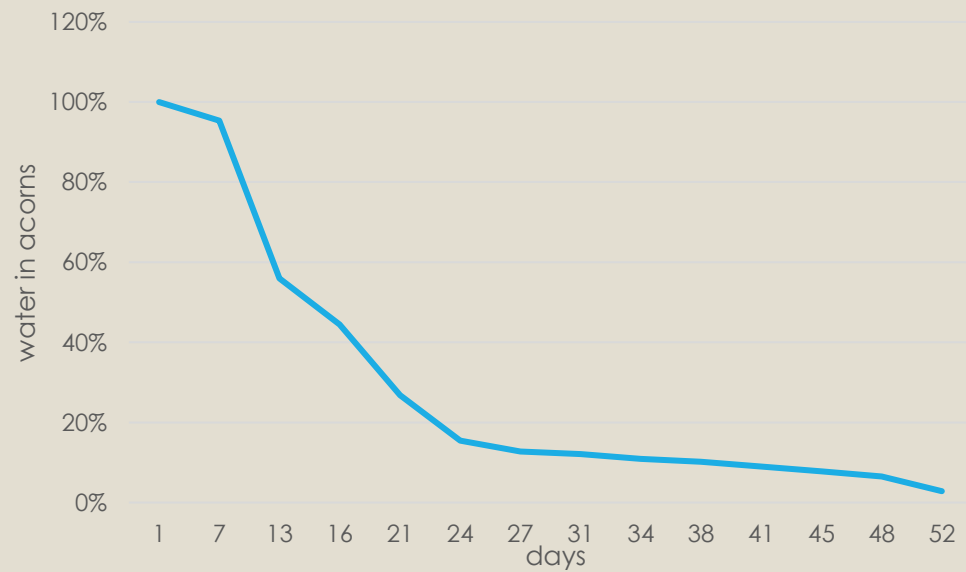
Perforated boxes - 5kg of acorns in each box - Tests on the wooden platform (Forced-drying) and at the covered patio (Air Drying)

Forced-drying	22-dec	28-dec	03-jan	06-jan	11-jan	14-jan	17-jan	21-jan	24-jan	28-jan	31-jan	04-feb	07-feb	11-feb
Box 1	5.000	4.910	4.270	3.960	3.630	3.450	3.405	3.390	3.375	3.365	3.350	3.330	3.305	3.24
Box 2	5.000	4.930	4.090	3.950	3.620	3.400	3.355	3.340	3.295	3.275	3.255	3.215	3.195	3.115
Box 3	5.000	4.900	4.195	4.010	3.690	3.460	3.400	3.395	3.385	3.375	3.345	3.340	3.315	3.255
Average weight	5.000	4.913	4.185	3.973	3.647	3.437	3.387	3.375	3.352	3.338	3.317	3.295	3.272	3.203
Water in acorns kg	1.850	1.76	1.04	0.82	0.50	0.29	0.24	0.23	0.20	0.19	0.17	0.15	0.12	0.05
% water in acorns	1	0.95	0.56	0.45	0.27	0.15	0.13	0.12	0.11	0.10	0.09	0.08	0.07	0.03
days	1	7	13	16	21	24	27	31	34	38	41	45	48	52
Max Temp °C	30	31	30	33	35	31	33	30	30	28	28	25	30	35
Min Moisture %	?	?	?	22	20	15	20	22	25	22	25	30	22	20
Avg Temp Outside	14	16	13	9	11	9	9	9	9	10	10	10	10	10
Avg Moisture Outside	93	98	92	93	89	69	72	65	78	62	61	90	65	

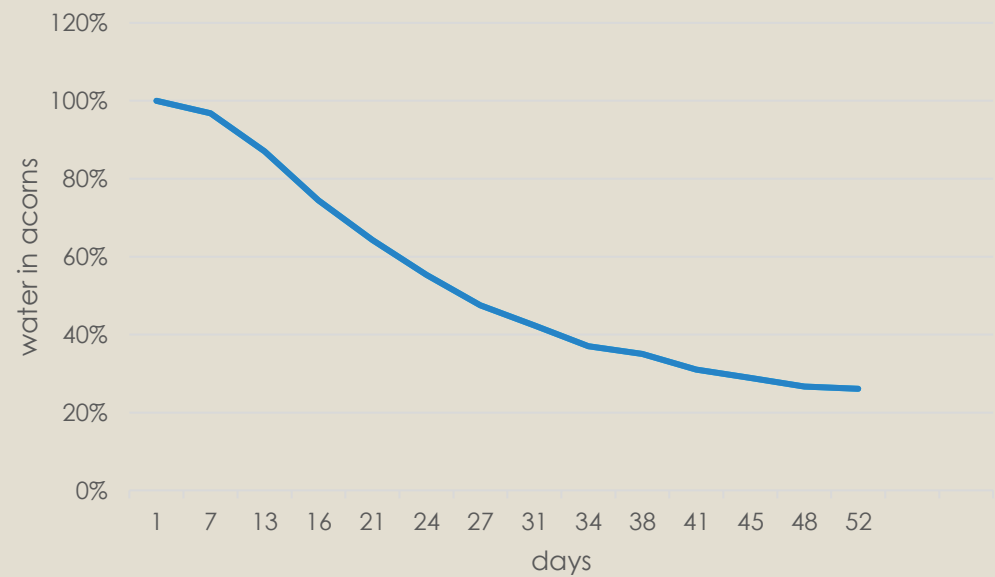
Air Drying	22-dec	28-dec	03-jan	06-jan	11-jan	14-jan	17-jan	21-jan	24-jan	28-jan	31-jan	04-feb	07-feb	11-feb
Box 1	5.000	4.940	4.755	4.475	4.355	4.180	4.030	3.925	3.830	3.790	3.675	3.625	3.585	3.550
Box 2	5.000	4.930	4.765	4.555	4.330	4.160	4.010	3.915	3.810	3.760	3.680	3.635	3.590	3.560
Box 3	5.000	4.950	4.760	4.550	4.330	4.180	4.050	3.960	3.865	3.845	3.815	3.795	3.755	3.790
Average weight	5.000	4.940	4.760	4.527	4.338	4.173	4.030	3.933	3.835	3.798	3.723	3.685	3.643	3.633
Water in acorns kg	1.850	1.790	1.610	1.377	1.188	1.023	0.880	0.783	0.685	0.648	0.573	0.535	0.493	0.483
% water in acorns	1	0.97	0.87	0.74	0.64	0.55	0.48	0.42	0.37	0.35	0.31	0.29	0.27	0.26
days	1	7	13	16	21	24	27	31	34	38	41	45	48	52
Max Temp °C	14	16	13	9	11	9	9	9	9	10	10	10	10	10
Min Moisture %	93	98	92	93	89	69	72	65	78	62	61	90	65	

Drying curves

Forced-drying method



Air Drying method



Conclusions

- Winter temperatures and humidity make it very difficult to extract more than 25% of water from acorns by the Air Drying method
- Extracting 27% of the water from the acorns took 48 days by the Air Drying process while achieving the same level of water content in the acorns by the Forced-drying method took less than half of the time
- The Forced-drying using heating and a wooden platform is a requirement for obtaining a good product



Future research

Other drying methods should be tested in order to save time and energy:

shelling acorns before drying by the Forced-drying method

using the solar greenhouse instead of the heating system should allow saving energy

Use a dehumidifier in a dry, closed room where the acorns to be dried are spread out

Other conservation methods can be tested to preserve acorns:

in brine as the ancient farm owners used to do

to extract the oil from the acorns in order to prevent they became rancid



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Thank you!



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