Application of Artificial Neural Networks to Evaluate Shelf Life of Virgin Olive Oils Produced with Innovative Technologies

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Introduction

How to assess VOO self-life? Standard labels declare 18 months, but actual range is 12–24 months. Over or underestimation leads to economic losses and that is why reliable predictive models are needed.

Aim

Develop ANN shelf-life prediction models for VOOs produced by conventional (Conv.) and innovative technologies (FTT, US, PEF, and their combinations (Comb.)) based on quality parameters (PV and K-values), oxidative stability index (OSI), and antioxidant capacity (AC).

Materials and Methods

- 95 VOOs from conventional and innovative treatments.
- Parameters: PV, K-values, OSI, and AC tracked for 24 months.
- MLP models in Statistica v.14.
- Inputs: quality + processing variables.
- Output: storage time.
- Model selected by R^2 and SOS.

Results

Indeks	Production				
	Conv.	FTT	US	PEF	Comb
Net. name	MLP 6-5-1	MLP 8-6-1	MLP 8-8-1	MLP 8-11-1	MLP 11-8-1
R^2 training	0,987	0,973	0,988	0,965	0,989
R^2 test	0,950	0,964	0,987	0,933	0,999
R^2 validation	0,910	0,965	0,957	0,949	0,960
Training error	1,023	1,646	0,802	2,421	0,379
Test error	2,303	3,057	1,102	3,361	0,489
Validation error	5,973	2,907	1,606	4,216	1,831
Hidden activation	Tanh	Log.	Tanh	Tanh	Log.
Output activation	Tanh	Exp.	Log.	Id.	Log.

Conclusions

- All models achieved $R^2 > 0.90$.
- Highest accuracy - US model
- Lowest accuracy - conventional model
- Key variables: variety, OSI, K_{232}.
- Limited influence of processing parameters .