



Evaluation of the effect of packaging method on postharvest quality of new seedless table grape varieties during cold storage

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The quest for novel grape varieties



In the Mediterranean region: strong impact of climate change on agriculture (increasing extreme heat events, droughts, biodiversity loss ...) thus request for novel grape varieties tolerant to climatic instability.

You can check our on-going breeding program: novel resistant varieties.
<https://www.valnuvaut.it/2022/09/26/kit-scaricabili/>



SIRIS	PUGLIESE	PEUCETIA	TURESE
NORBA	NETIUM	LUPIAE	APENEATAE
MESANIA	MAULA	JOHA	AIKA
JAPIGIA	ITRIA	MUREX	VIGILARUM
EGNATIA	DERTUM	DAUNIA	TRIVIANI
CELIAE	CANUSIUM	GENUSIA	URSI
LOCREUSE	JUVENATIUM	BUTUNTUM	VAAZ
BRUNDISIUM	BAROLUM	BARIUM	TARENTUM
BARESE	AZETIUM	APPIA	STURNI

Resistance would ensure the production of grapes.
But what about shelf life?

14 seedless white (n=6) and red (n=8) table grape varieties.

Two packaging methods during cold storage of new seedless white and red table grape varieties:



**Cardboard
Packaging
(boxes)**



**Plastic
Packaging
(clam shells)**

After harvesting, part of the bunches was packed in cardboard boxes and another part in plastic clamshells without SO₂ generating pads and stored at 2°C with 95% relative humidity.

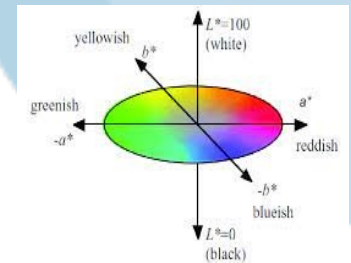
During storage change visual, mechanical, and organoleptic properties might affect: **consumer's acceptance** and **quality**.

Features evaluated:

chromatic characteristics (uniform color), hardness (associated with perceived crunchiness), and pedicel detachment resistance (a desirable feature to prevent product deterioration and improve shelf life).



The CIELab coordinates, hardness value, and pedicel detachment force of the berries were measured at harvest and after 14 (T1) and 21 (T2) days of cold storage.

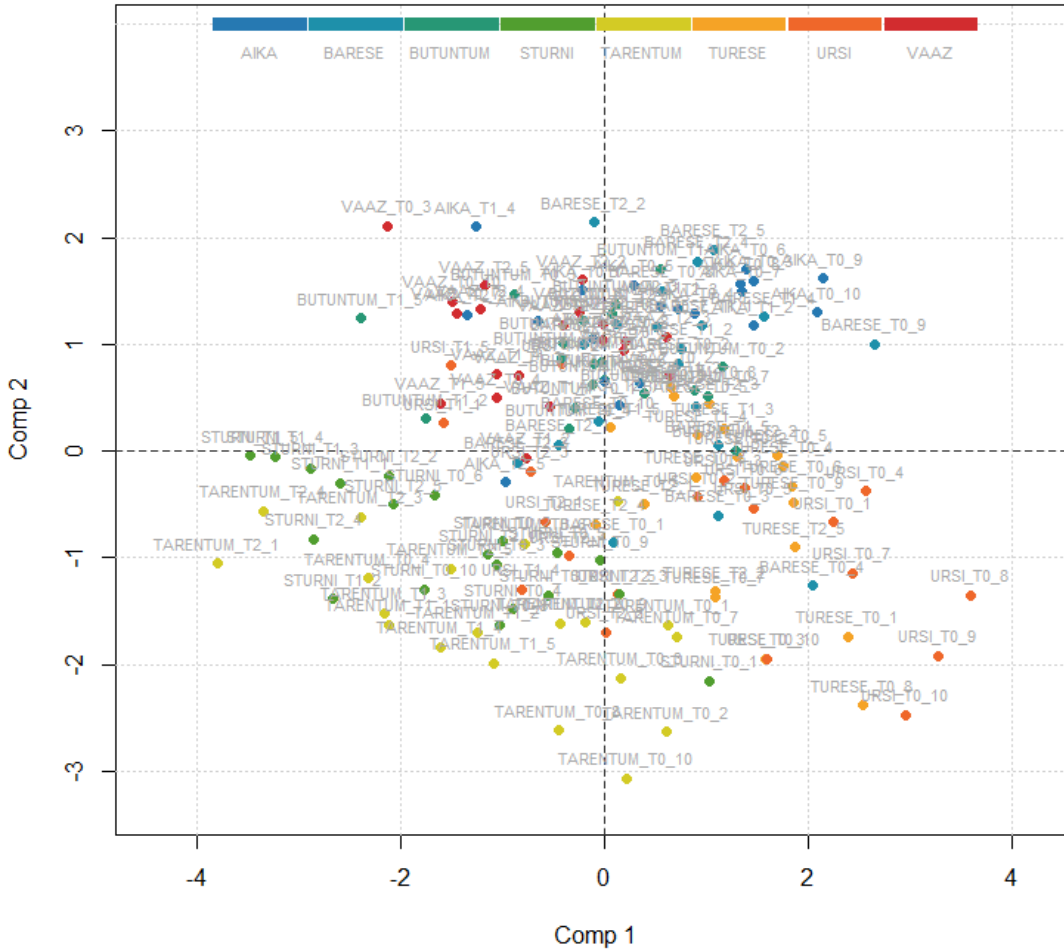




**Cardboard
Packaging**

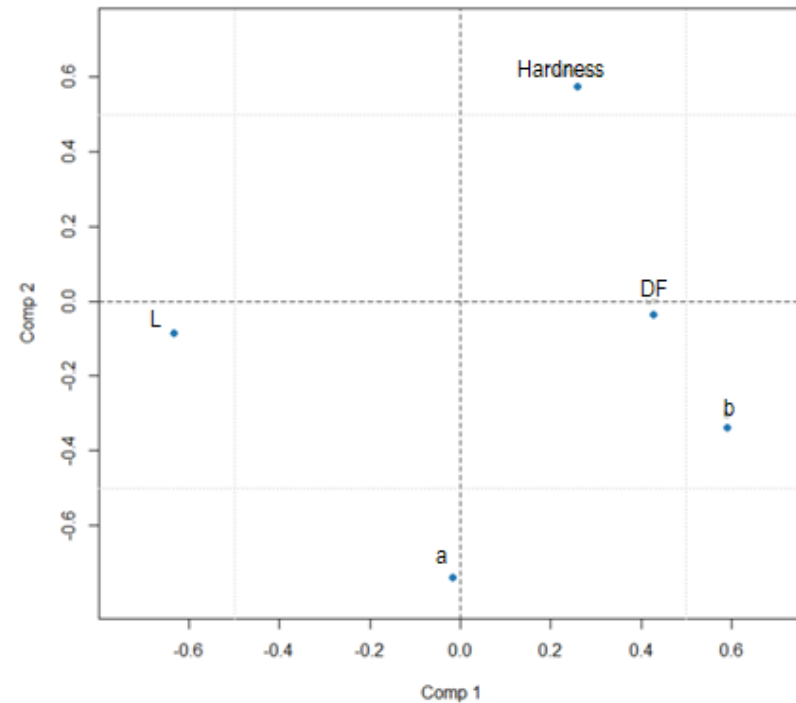
Total explained variance: 69.18%

Scores



DF=Detachment Force of pedicel from the berry, L=Lightness, a=+red/-green, b=+yellow/-blue

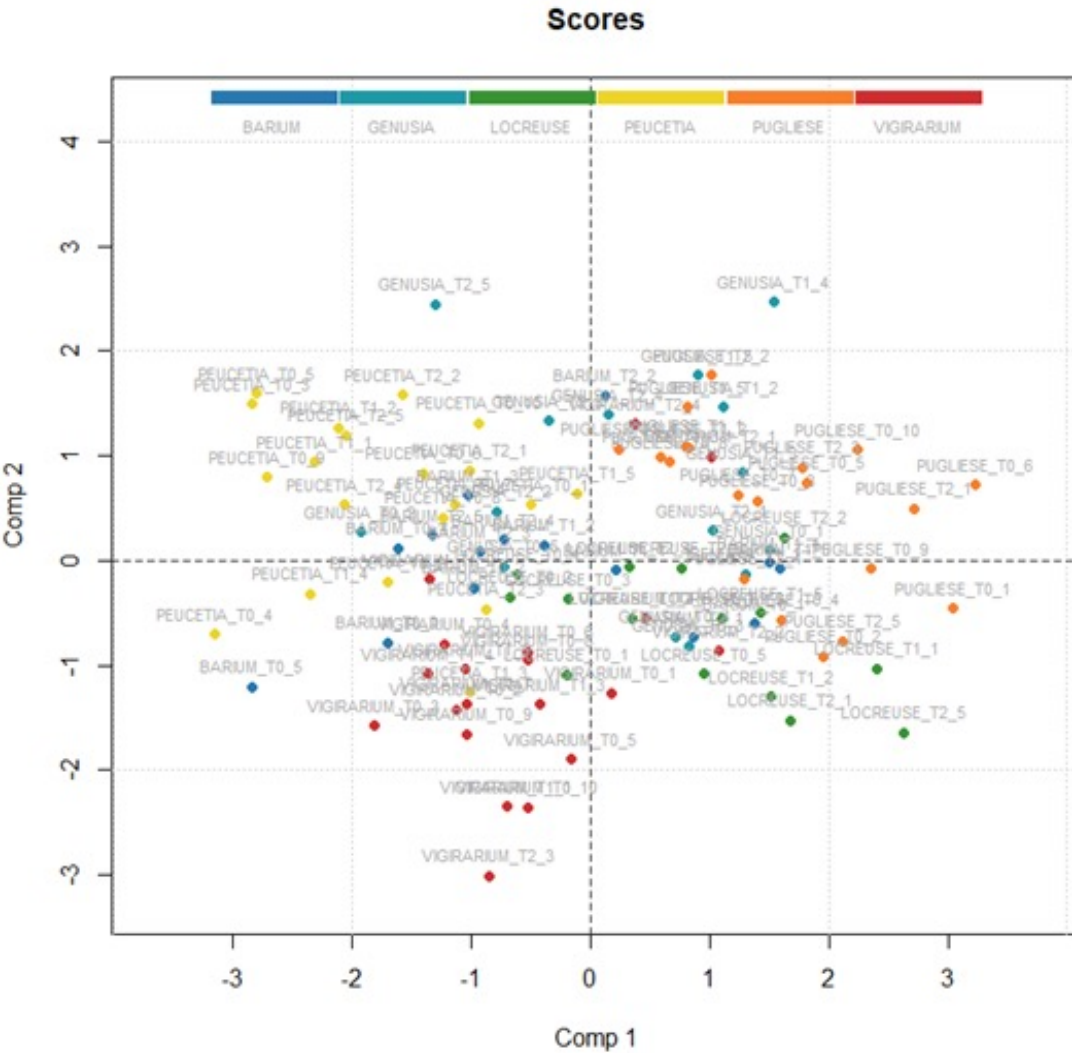
Loadings



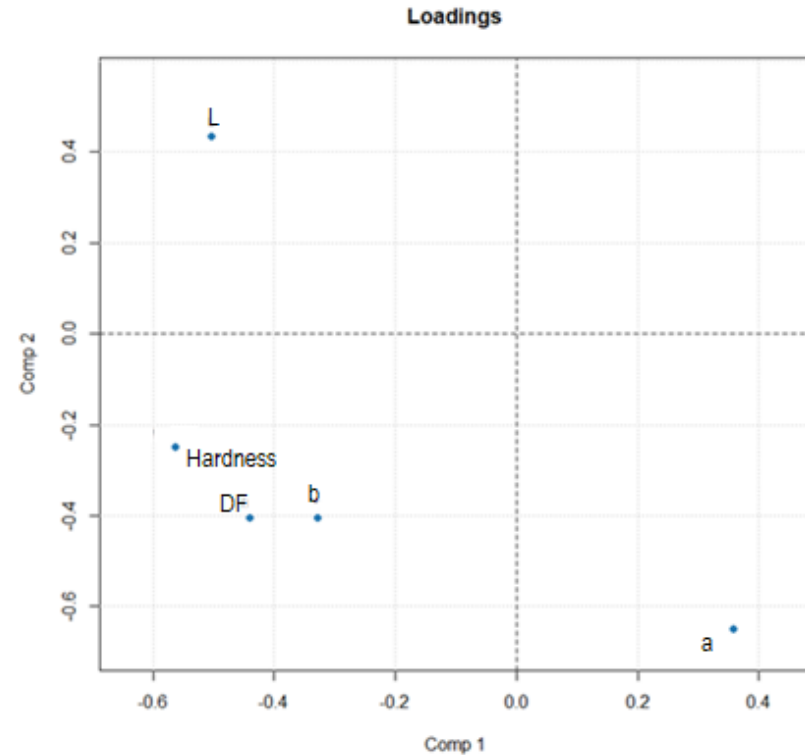


**Cardboard
Packaging**

Total explained variance: 66.34%



DF=Detachment Force of pedicel from the berry, L=Lightness, a=+red/-green, b=+yellow/-blue



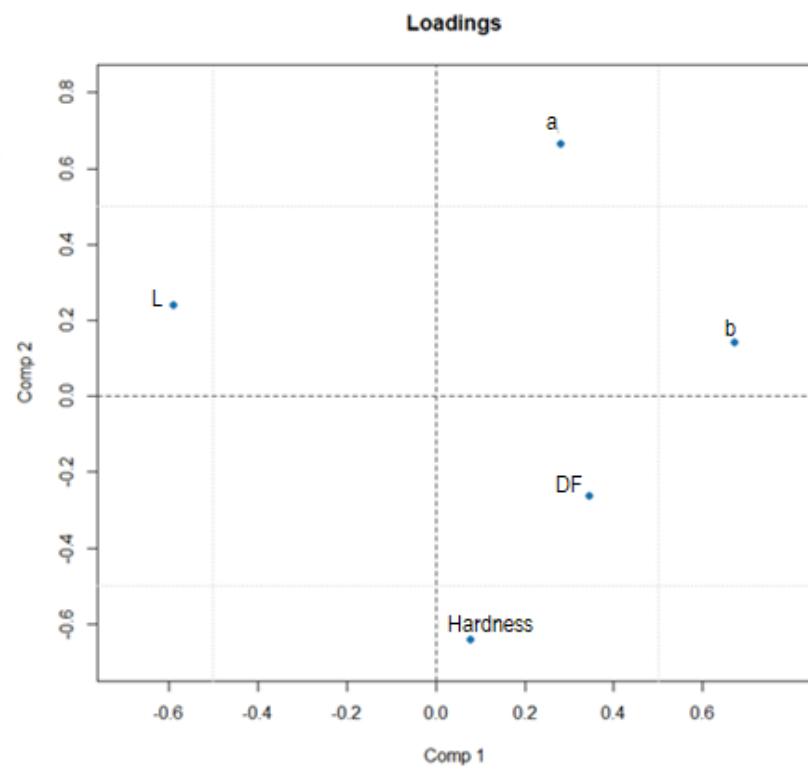
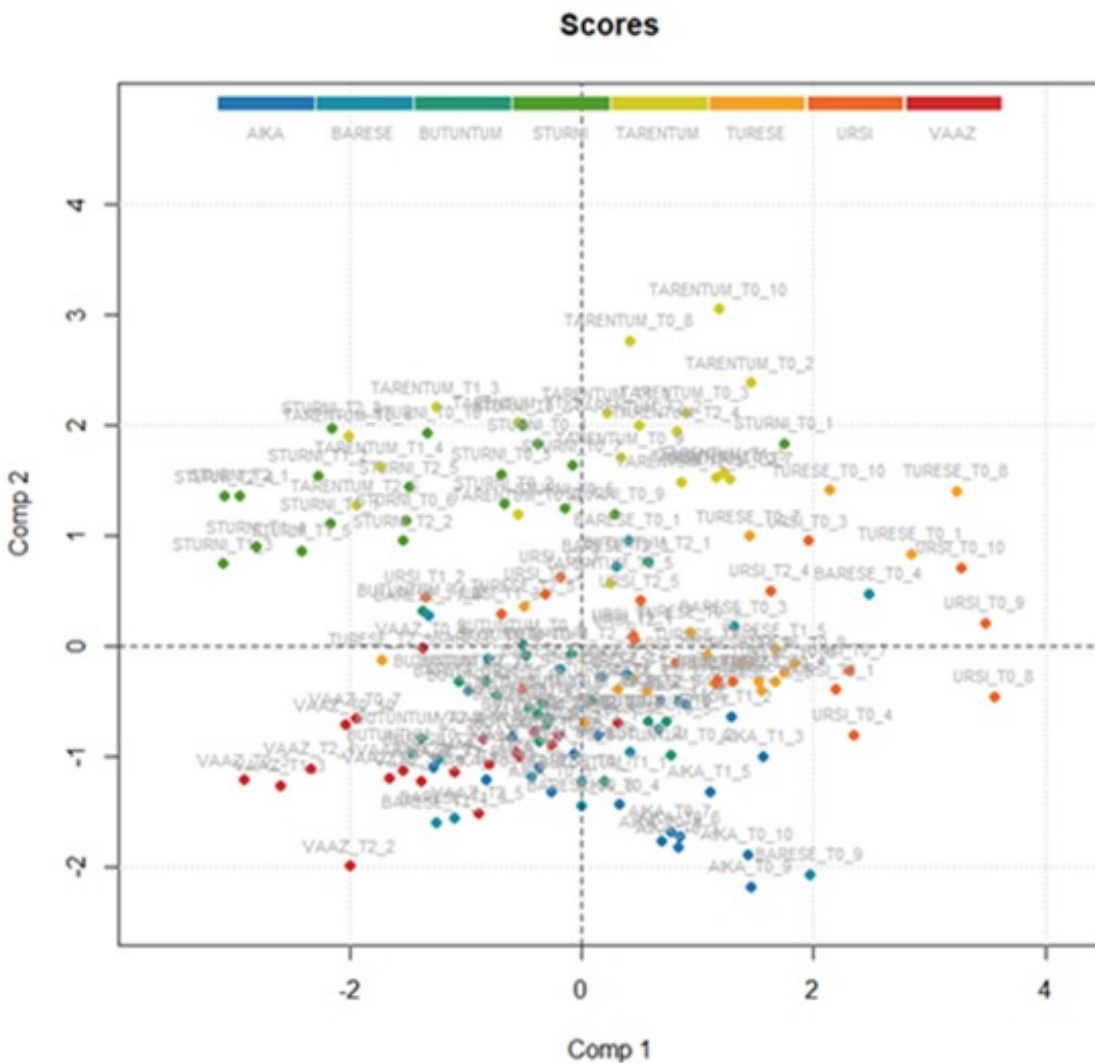
PCA score and loading plot of red table grapes.

Plastic Packaging

Total explained variance: 65.12%



DF=Detachment Force of pedicel from the berry, L=Lightness, a=+red/-green, b=+yellow/-blue

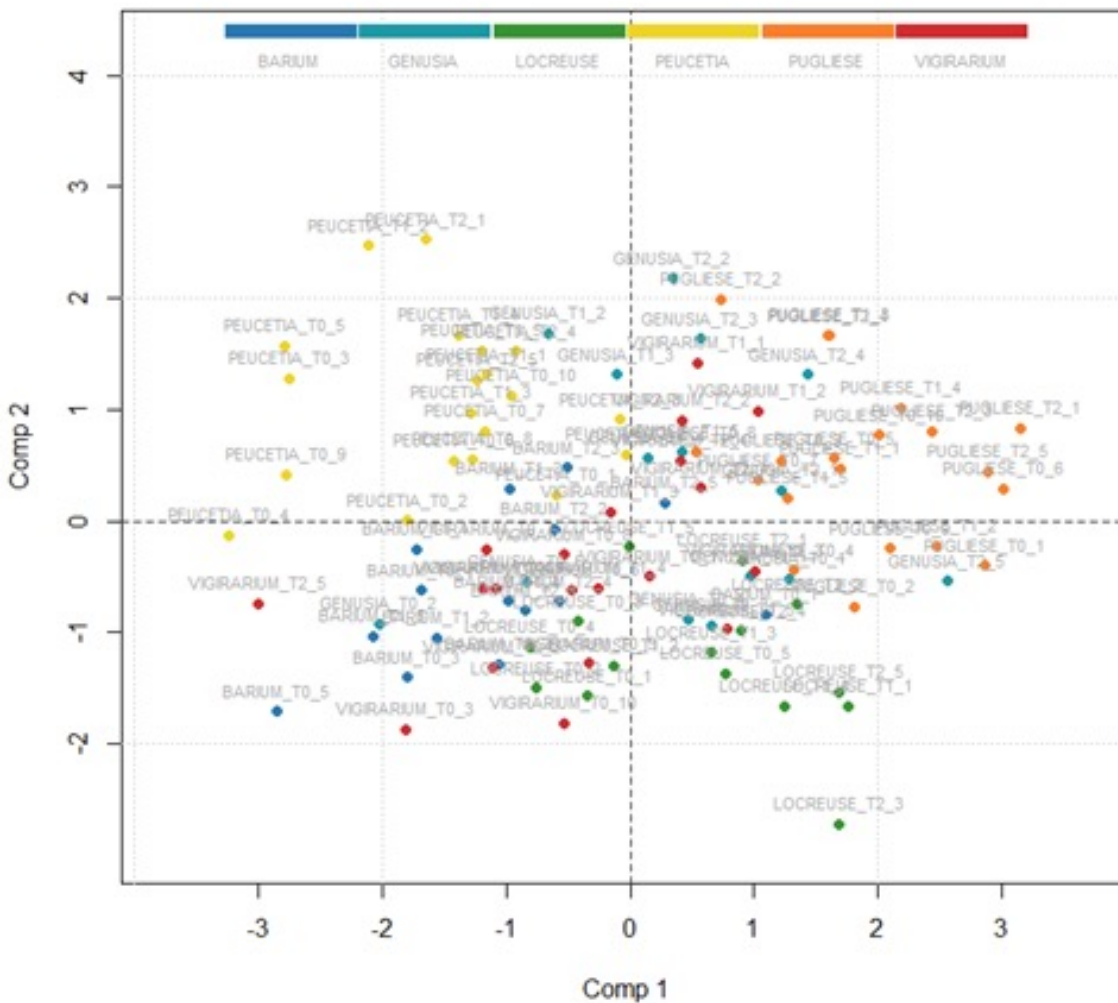




Plastic Packaging

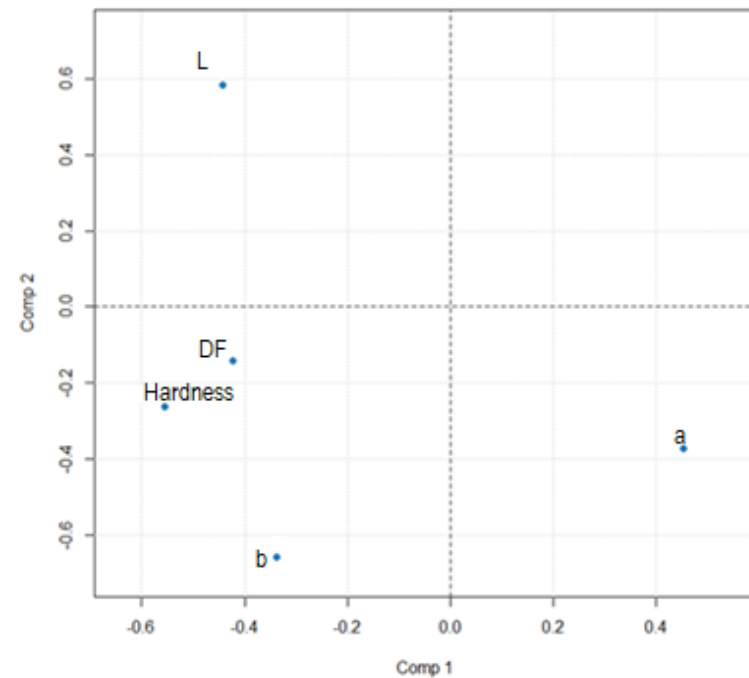
Total explained variance: 67.73%

Scores



DF=Detachment Force of pedicel from the berry,
L= Lightness, a=+red/-green, b=+yellow/-blue

Loadings



TURESE N. TARENTUM RS. URSI RS. AIKA N. BUTUNTUM N. STURNI RS. VAAZ RS. BARESE N. BARIUM B. GENUSIA B. LOCREUSE B. PEUCETIA B. PUGLIESE B. VIGILIARIUM B.

Barese N. packed both in carton boxes and plastic clamshells displayed a not significant difference in any of the parameters evaluated, showing a good cold storage aptitude.



What is Quality?

Definition of food **quality**

“a complex and multi-dimensional concept which is influenced by a wide range of situational and contextual factors”. The influencing factors include among others: safety, origin, nutrition, sensorial properties, authenticity, and convenience.

For the EC food quality is a complex, multidimensional concept including nine items related to nutritive, sensory, or ethical aspects .



Consumer's acceptance

Often consumers base their decisions on their personal perception of what “quality” means. It was found that the term “quality” often has a positive connotation of high value, class, or degree of excellence that can differ from “true” or measurable quality.

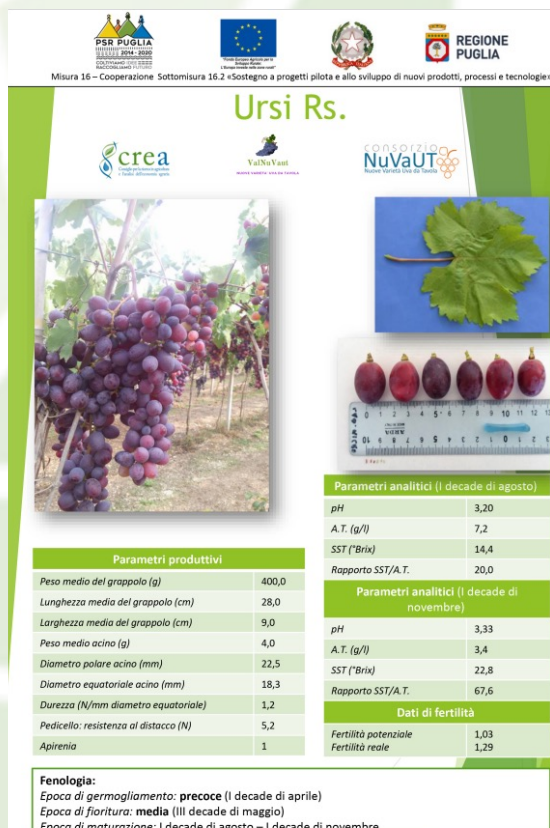
Therefore, if the value of conventional analytical techniques is unquestionable for the chemical and physical characterization of a product, the outcomes of these techniques must be correlated with sensory analysis.

Novel grape varieties: tolerant and tasty?

If resistance would ensure the production of grapes, this does not translate into consumers' acceptance of the new products.

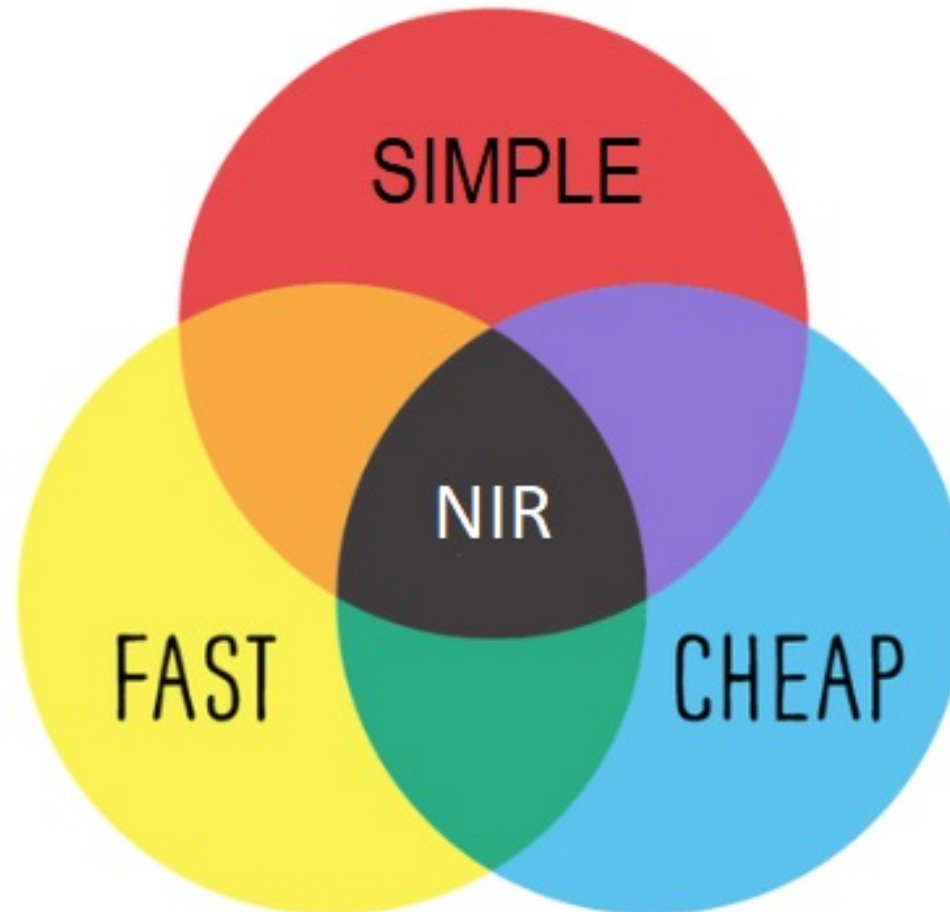
Who is going to like it (i.e., specific groups of consumers)?

Why (metabolic and texture features)?



Non-destructive sensory analysis based on NIR spectroscopy

Why NIR spectroscopy?

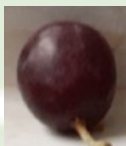


Step1

Laboratory

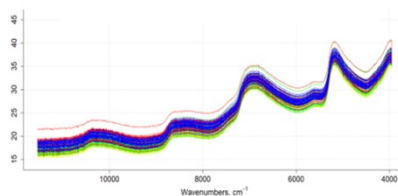


Grape
collection



NIR analysis

Spectra



Intact grape

Maturity &
Textural
characterization

*Destructive
analysis*

- TSS
- TA
- texture

Dataset

- NIR spectra
- TSS
- TA
- texture

Step 2

R software



Pre-treatments

PCA, iPLS, and
GA selection

PLS, ANN
models

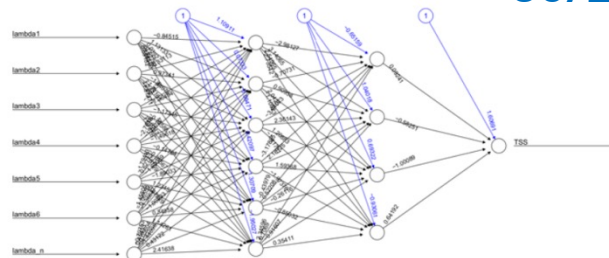
Prediction
models
(one for each
parameter)

Dataset

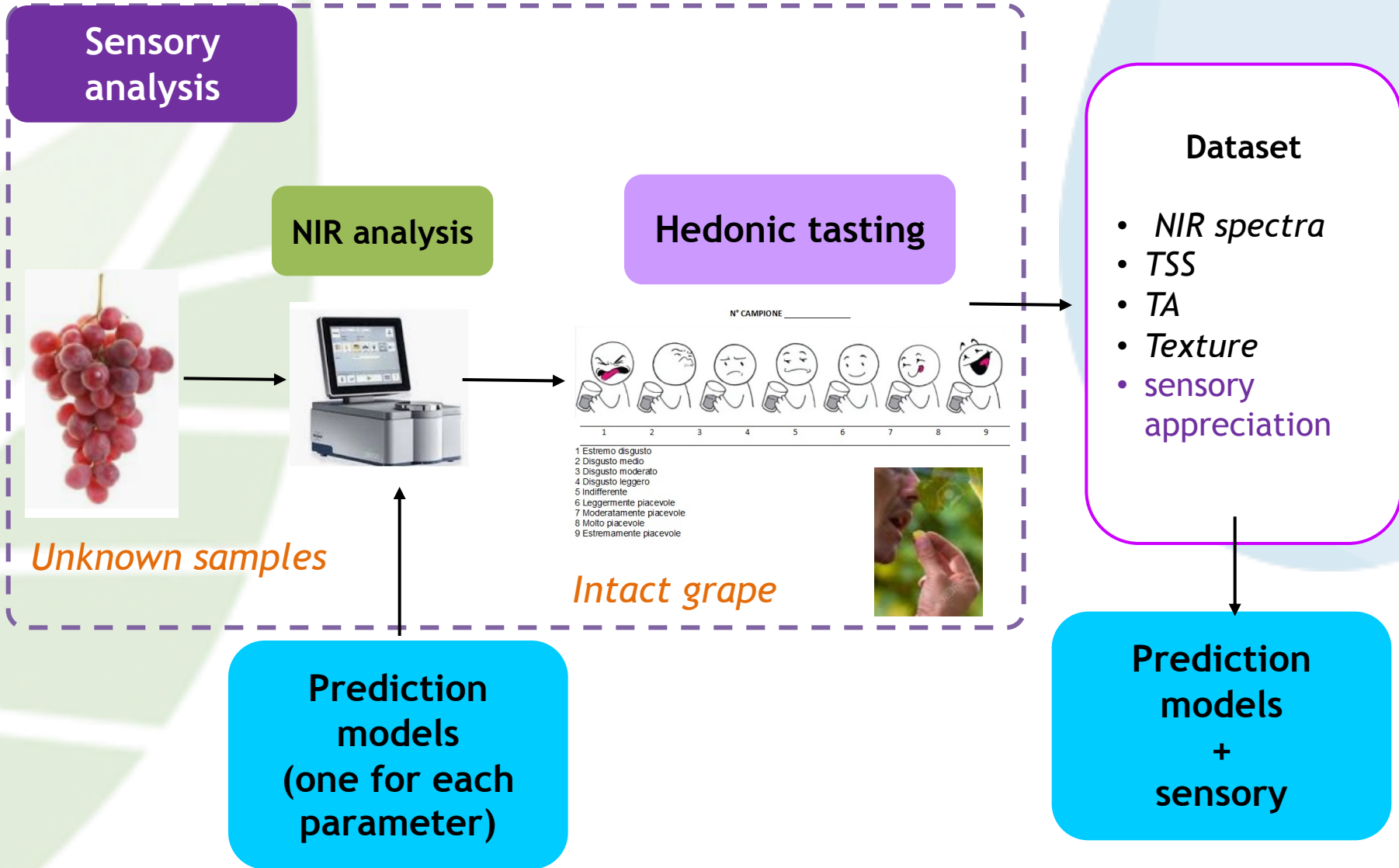
- *NIR spectra*
- *TSS*
- *TA*
- *texture*

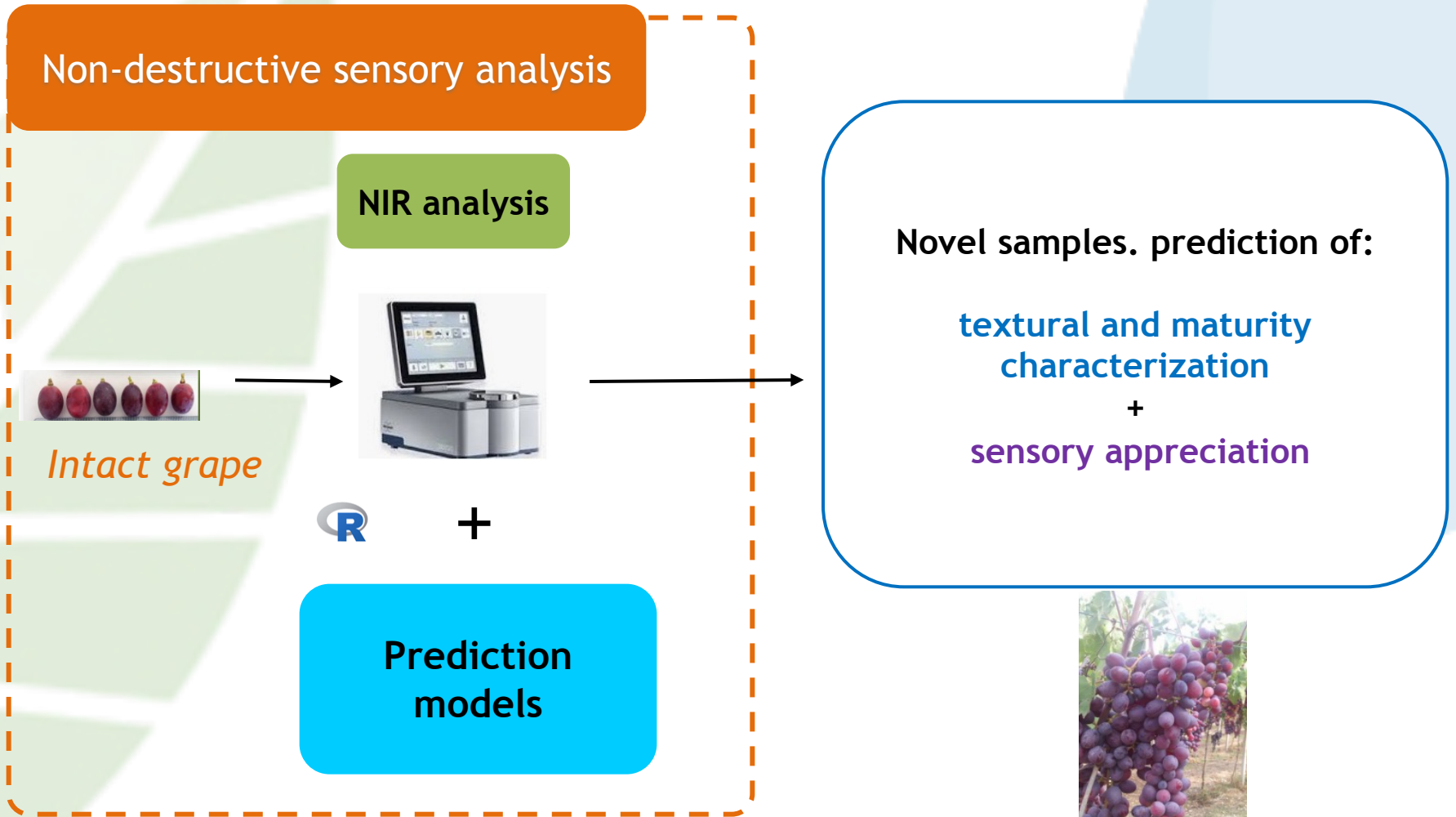
80/20 split

Modello di rete neurale artificiale (ANN) usato per la regressione di TSS



Step 3





Primary methods: database



Each bunch:
apical.
median and
distal
positions.

 **Maturity**
 **Texture**



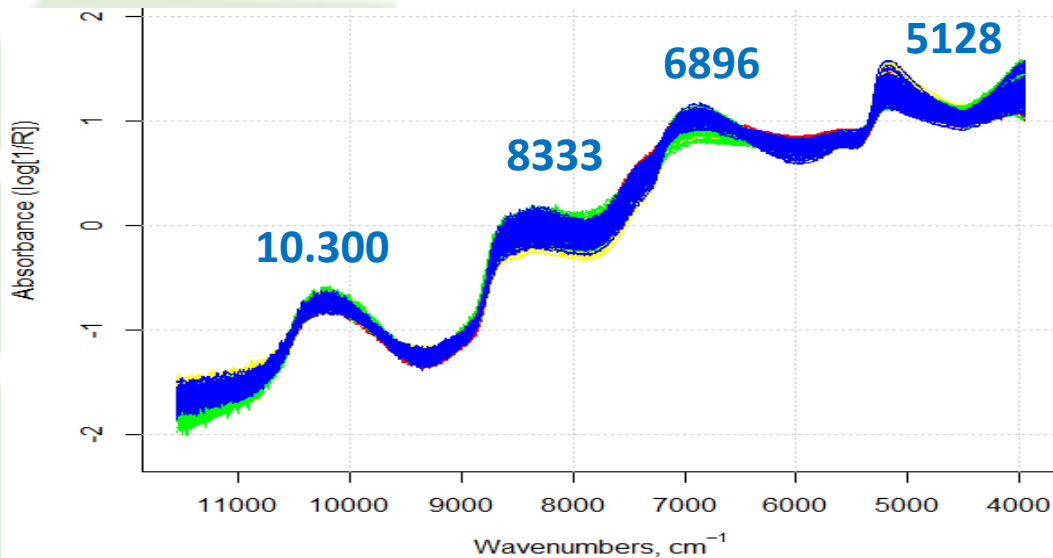
TSS, TA total soluble solids content (TSS, °Brix) and total acidity (TA, g/l as tartaric acid)

Texture Hardness (in N) linked to perceived crunchiness. equatorial diameter (in cm),

COLOR CIELab color coordinates L* (lightness), a* (+red/-green), b* (+yellow/ - blue), and the derived parameters C* (chroma) and H* (hue).

NIR spectroscopy

- If **H₂O** abundant (vegetables and fruits) covers other signals
- No identification of specific molecular peaks
- More intense peaks not responsible of differentiation
- Less intense signals than IR. broad bands.



NO direct interpretation
YES chemometric methods

Input:

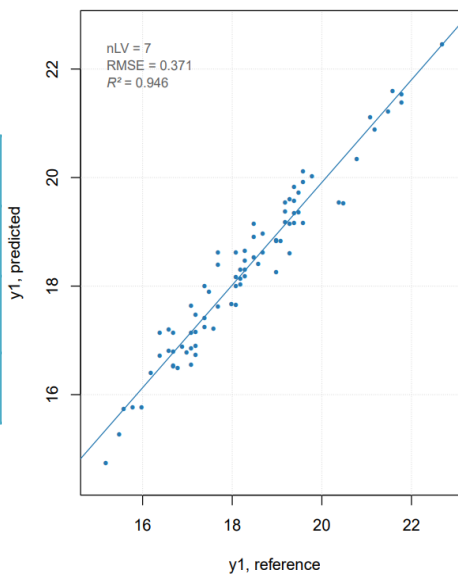
NIR spectra

texture normalized by the diameter (cm)*

weight (density class)



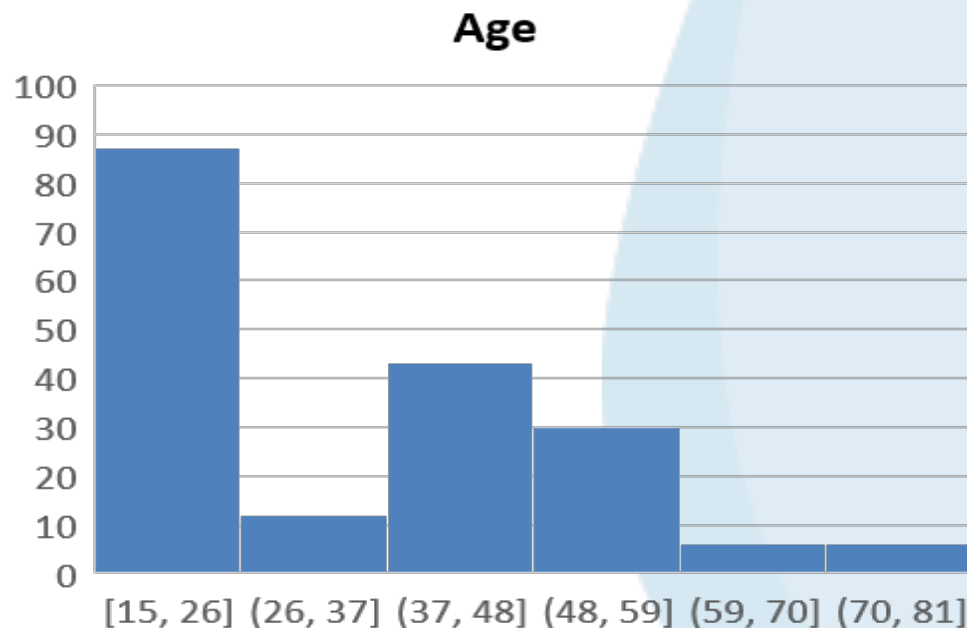
Parameter (reference)	Value
TSS (°Brix)	21.55 ± 1.34
TA (g/L tartaric acid equivalents)	5.43 ± 0.10
Hardness (N)*	6.35 ± 1.04



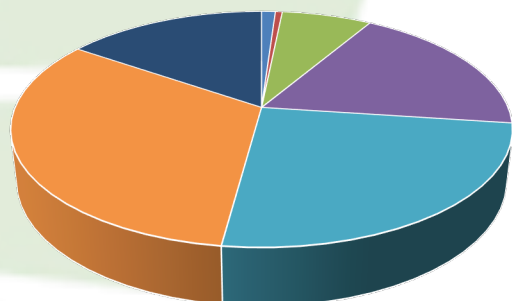
Parameter (predicted)	Value
TSS (°Brix)	21.96 ± 0.91
TA (g/L tartaric acid equivalents)	5.63 ± 0.53
Hardness (N)*	6.87 ± 0.46

Hedonic tasting

Tasters	Numbers
Tot	191
M	118
F	57
n.d.	16
Age	34 ± 18



Ranking



■ 3 ■ 4 ■ 5 ■ 6 ■ 7 ■ 8 ■ 9

Find the perfect composition for a target consumer panel:

Ideal sugar and acid content, crunchiness, chewiness, etc.

Choose the perfect harvesting time.

FUTURE APPLICATION

Who likes it? Young adults (30-40 years range)
How much? «Very much»

Who likes it? Adults (over 50)
How much? «Like extremely»



Who likes it?
Adults (over 50)
How much?
«Average»

Who likes it?
Young and sporty
adults (25-30 years
range)
How much?
«Like extremely»

Founding

Project “Conservabilità, qualità e sicurezza dei prodotti ortofrutticoli ad alto contenuto di servizio - ARS01_00640 – POFACS”. D.D.1211/2020 and 1104/2021.

Project “ VALNUVAUT. VaLorizzazione di Nuove Varietà di Uve da Tavola ottenute in Puglia. PSR Puglia 2014-2020. Misura 16 Cooperazione-Sottomisura 16.2.“



Other Authors

D. Mallardi, F. Ferrulli, B. Suriano, A. Salerno, A. D. Marsico, L. R. Forleo, M.F. Cardone, R. Perniola

<https://www.valnuvaut.it/>