Instituto de Ciencias de la Vid y del Vino

Gobierno de La Rioja

CSIC CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

UNIVERSIDAD DE LA RIOJA

Characterization of the reproductive performance of a collection of grapevine varieties

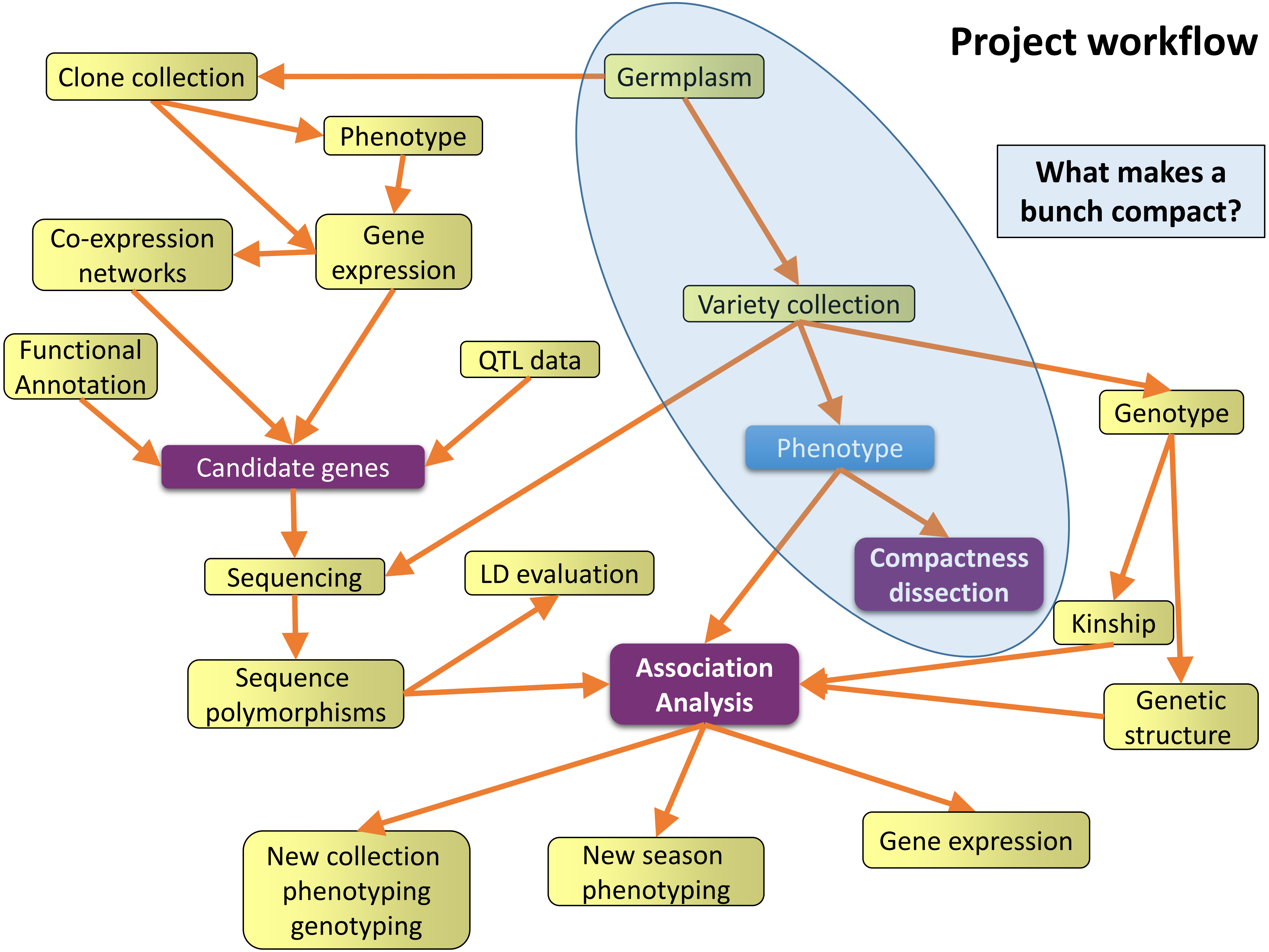
Ibáñez, S., Grimplet, J., Baroja, E., Hernáiz, S, **Ibáñez, J.**

Importance of bunch compactness

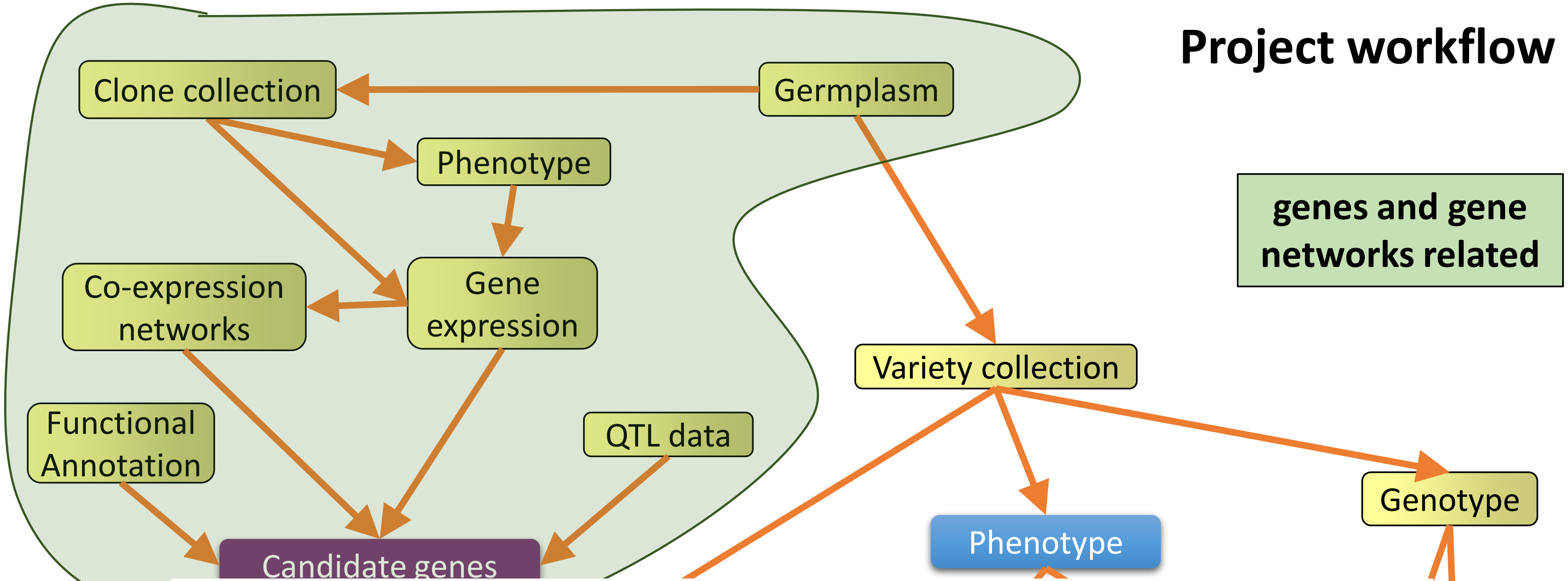
- Compact bunches show favorable conditions for the development of pests and diseases
- Compactness may increase heterogeneous maturation in the bunch
- Compact or very loose bunches are not acceptable by the table grape market

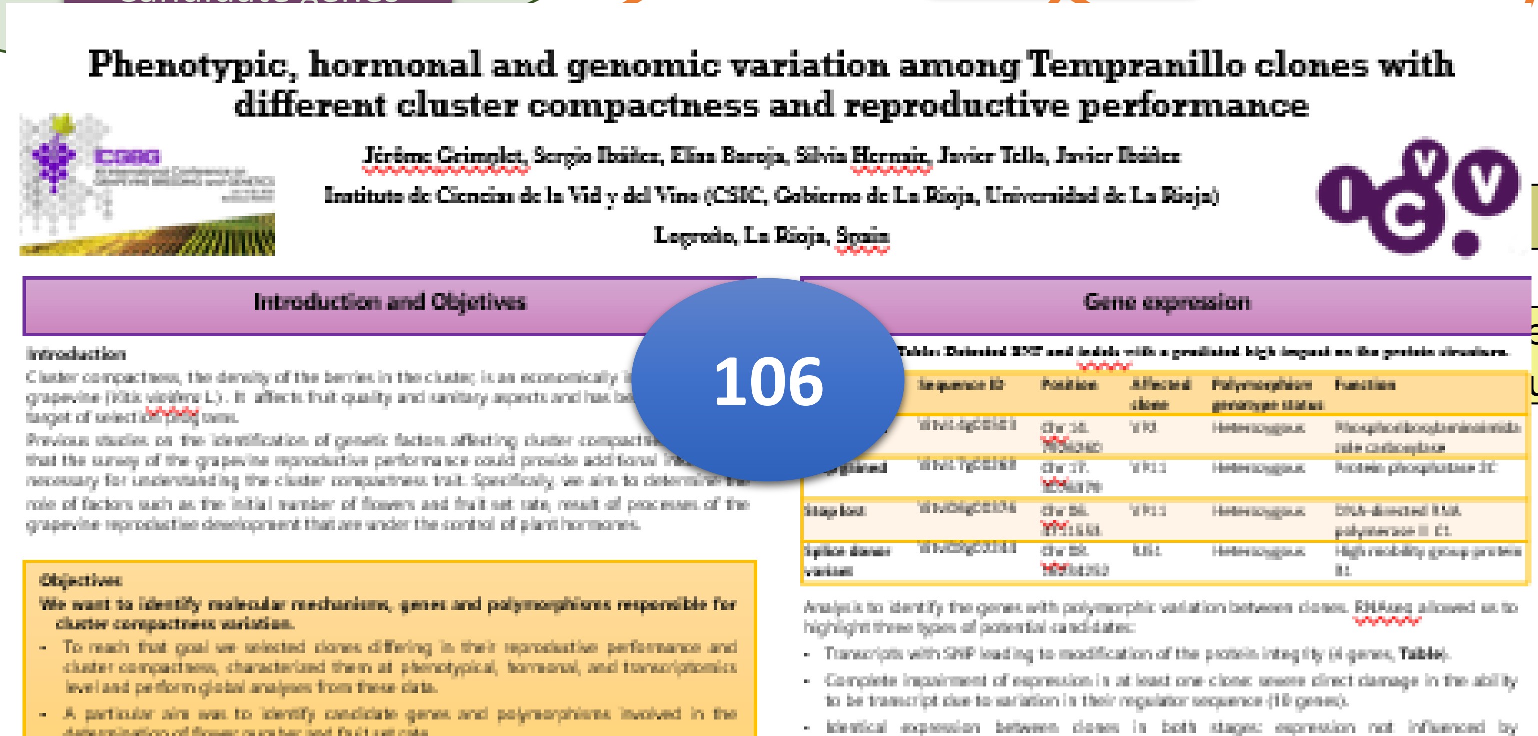
Project workflow

What makes a bunch compact?



Project workflow




Phenotypic, hormonal and genomic variation among Tempranillo clones with different cluster compactness and reproductive performance

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Logroño, La Rioja, Spain

Introduction and Objectives

Introduction

Objectives

We want to identify molecular mechanisms, genes and polymorphisms responsible for cluster compactness variation.

Gene expression

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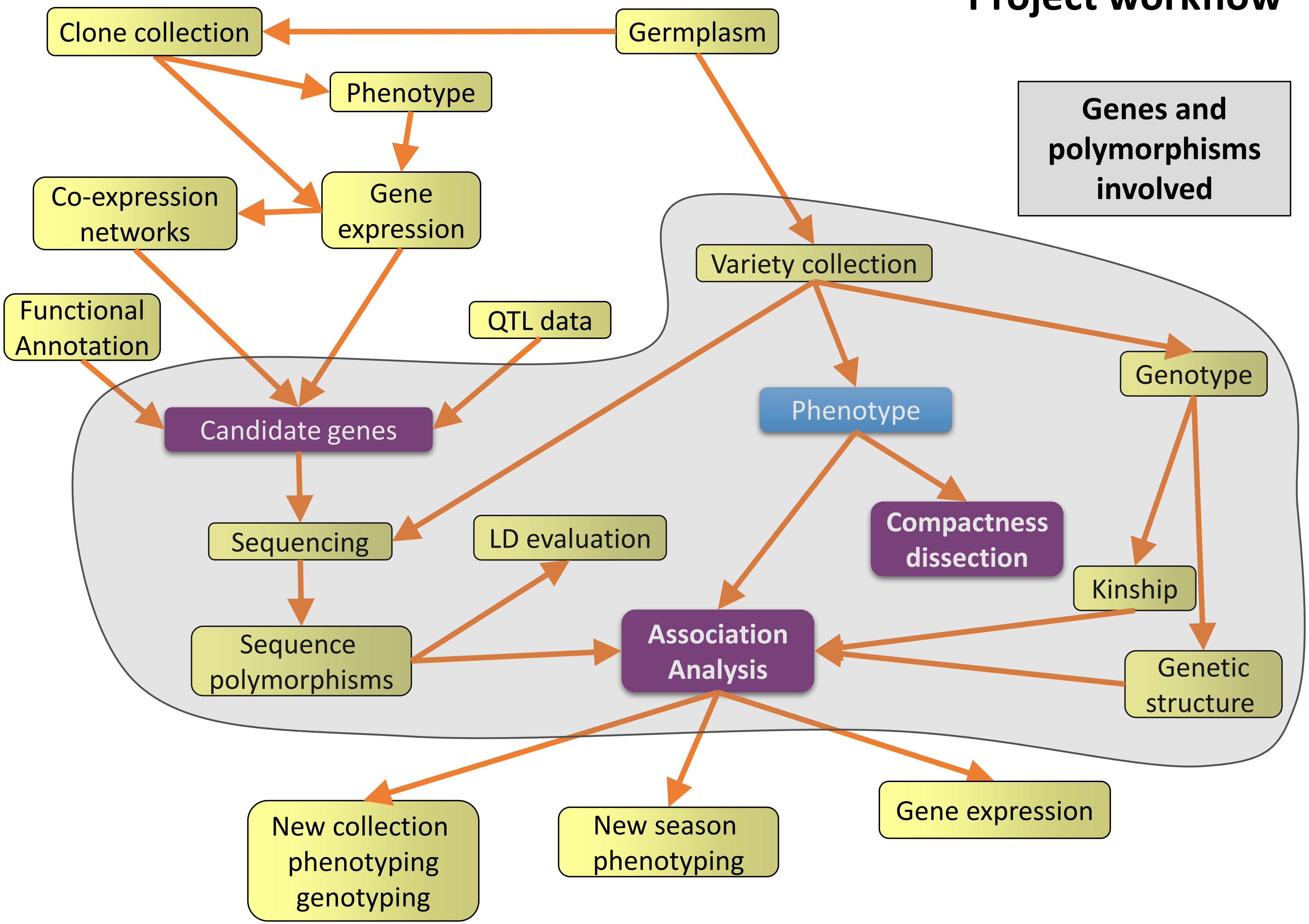
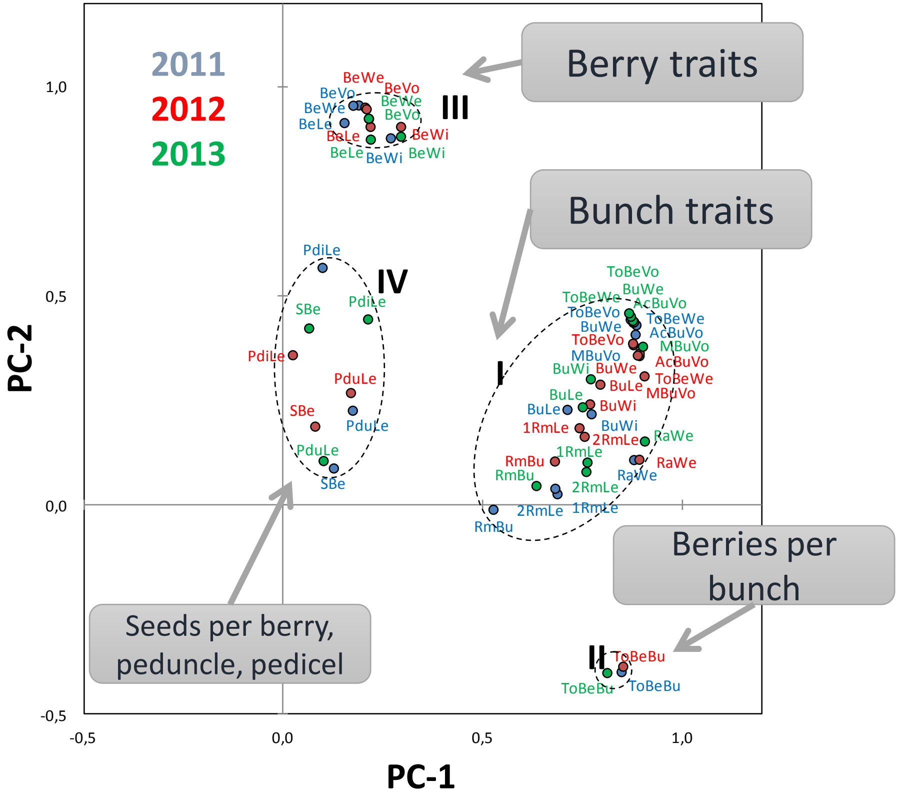
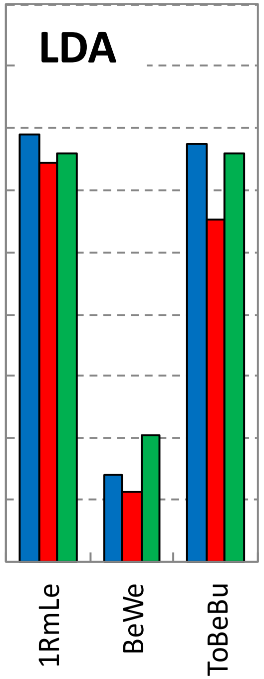
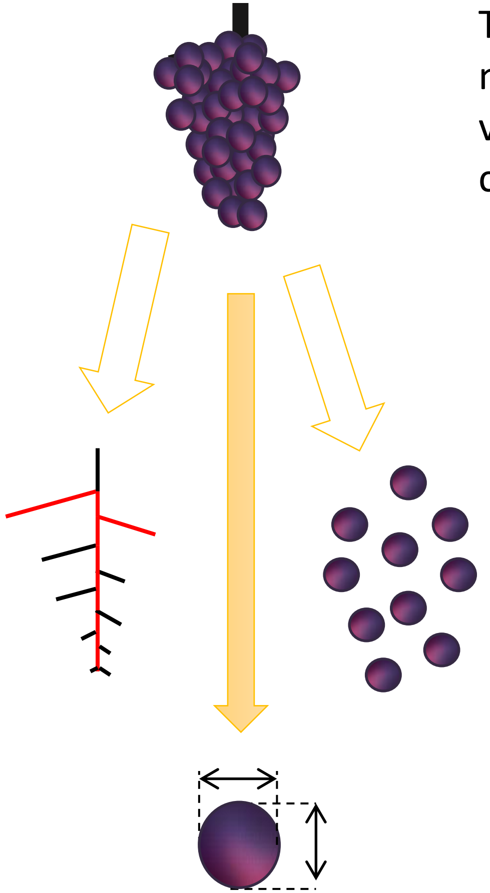
Project workflow



What makes a bunch compact?



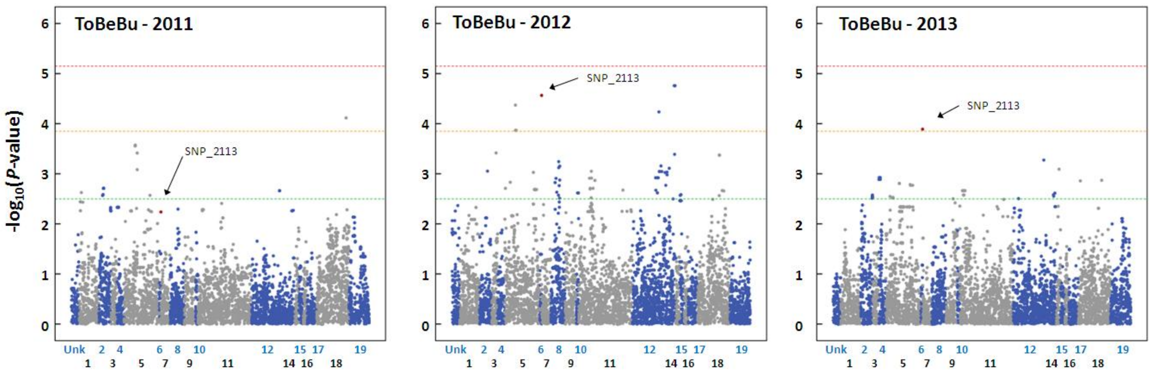




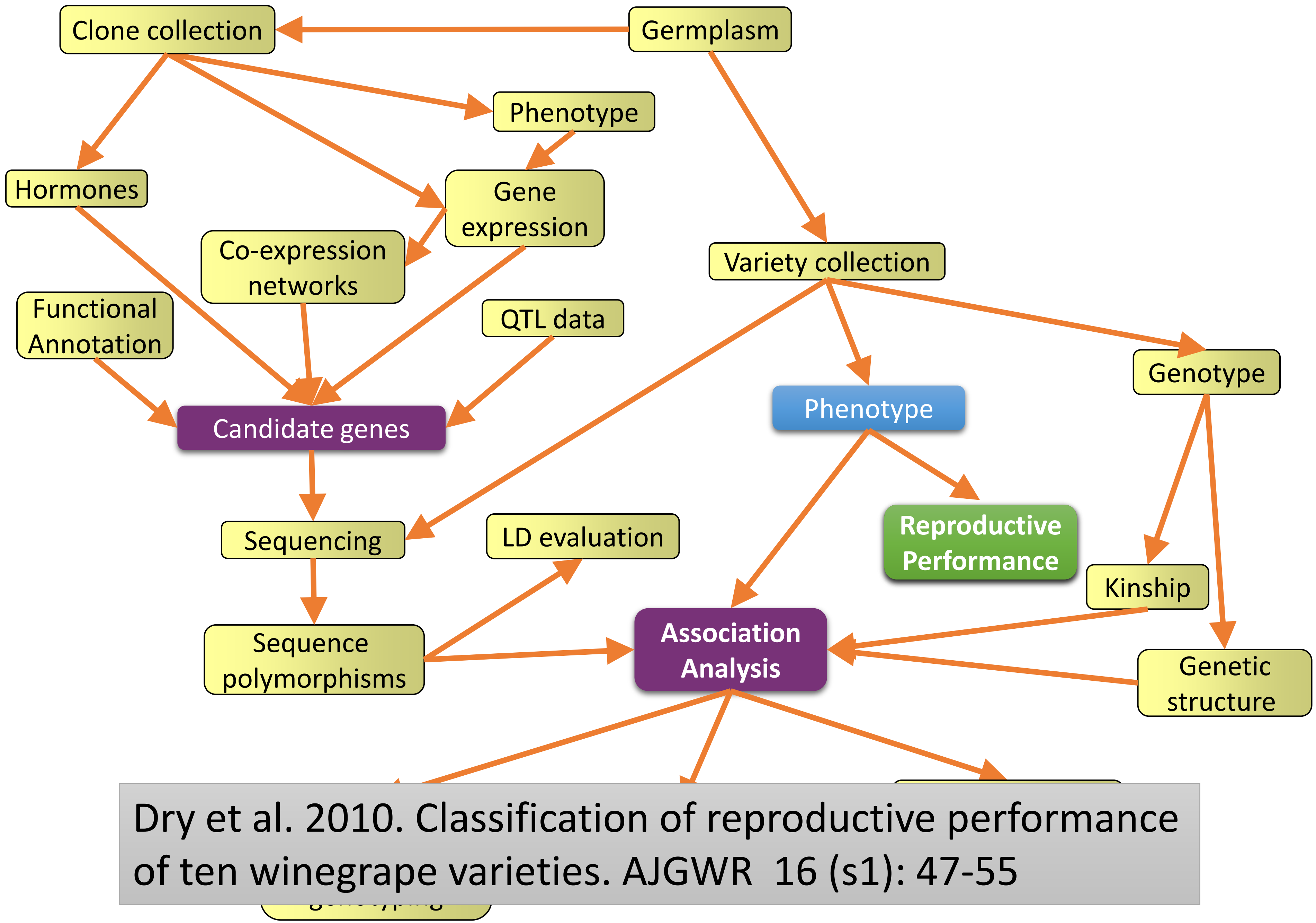
Tello et al. 2015. Multicultivar and multivariate study of the natural variation for grapevine bunch compactness. AJGWR 21:277–289

The **total number of berries per bunch** and the **bunch architecture** arise as the major factors responsible for the trait variation, followed by **berry size**

Total number of berries



Tello et al. 2016. Association analysis of grapevine bunch traits using a comprehensive approach. TAG 119:227-242



Dry et al. 2010. Classification of reproductive performance of ten winegrape varieties. AJGWR 16 (s1): 47-55

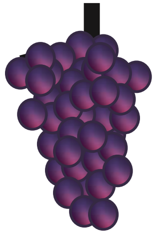
Materials and methods

Plant material

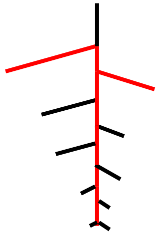
- Finca La Grajera
- 120 cultivars
- Planted 2010
- 2.0 x 1.1 m
- Double cordon pruning North – South

Morpho-agronomic characterization

- 10 bunches/variety
- Bunch variables:



  - Compactness
  - Weight
  - Length
  - Width
- Rachis variables:



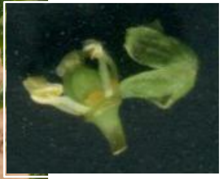
  - Weight
  - Length
  - Length 1 Branch
  - Length 2 Branch

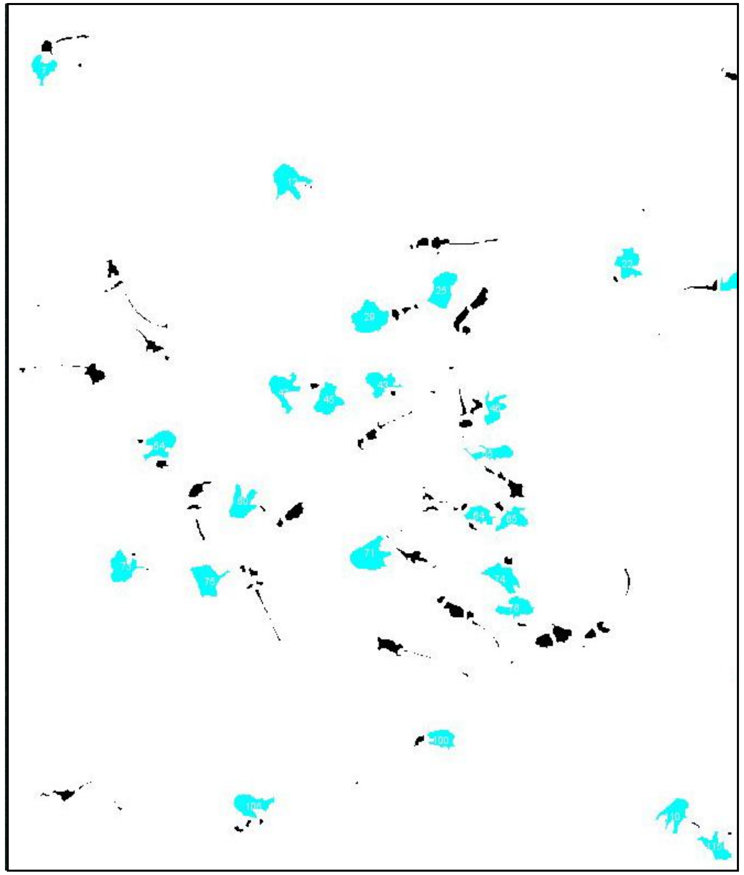
Reproductive performance:

- No. Flowers
- No. Berries
- Fruitset
- Millerandage
- Coulure

2016-2017

Estimating the number of flowers in the inflorescence: counting calyptras





Reproductive performance parameters

Post-flowering organs:

- seeded berries (B_{SD})
- seedless berries (B_{SL})
- live green ovaries (LGO)

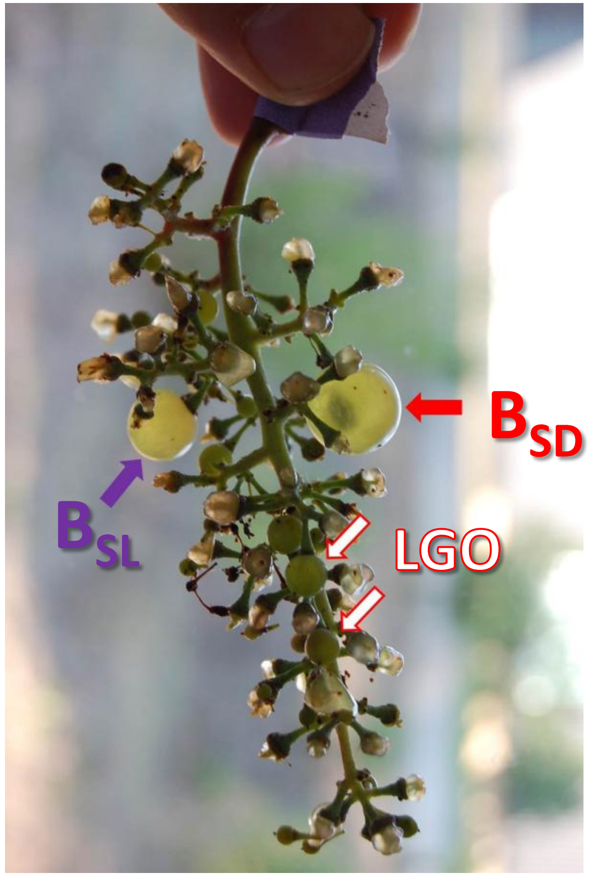
$$Fruitset = \left(\frac{No.\,seeded\ berries + No.\,seedless\ berries}{No.\ Flowers}\right)$$

$$Coulure\ Index = 10 - \left\{\frac{(B_{SD} + B_{SL} + LGO) \times 10}{No.\ Flowers}\right\}$$

Scale: 0 - 10

$$Millerandage\ Index = 10 - \left\{\frac{(B_{SD}) \times 10}{(B_{SD} + B_{SL} + LGO)}\right\}$$

Scale: 0 - 10



Collins, C., & P.R. Dry. 2009. Response of fruitset and other yield components to shoot topping and 2-chlorethyltrimethyl-ammonium chloride application. Aust. J. Grape Wine Res. 15:256-267

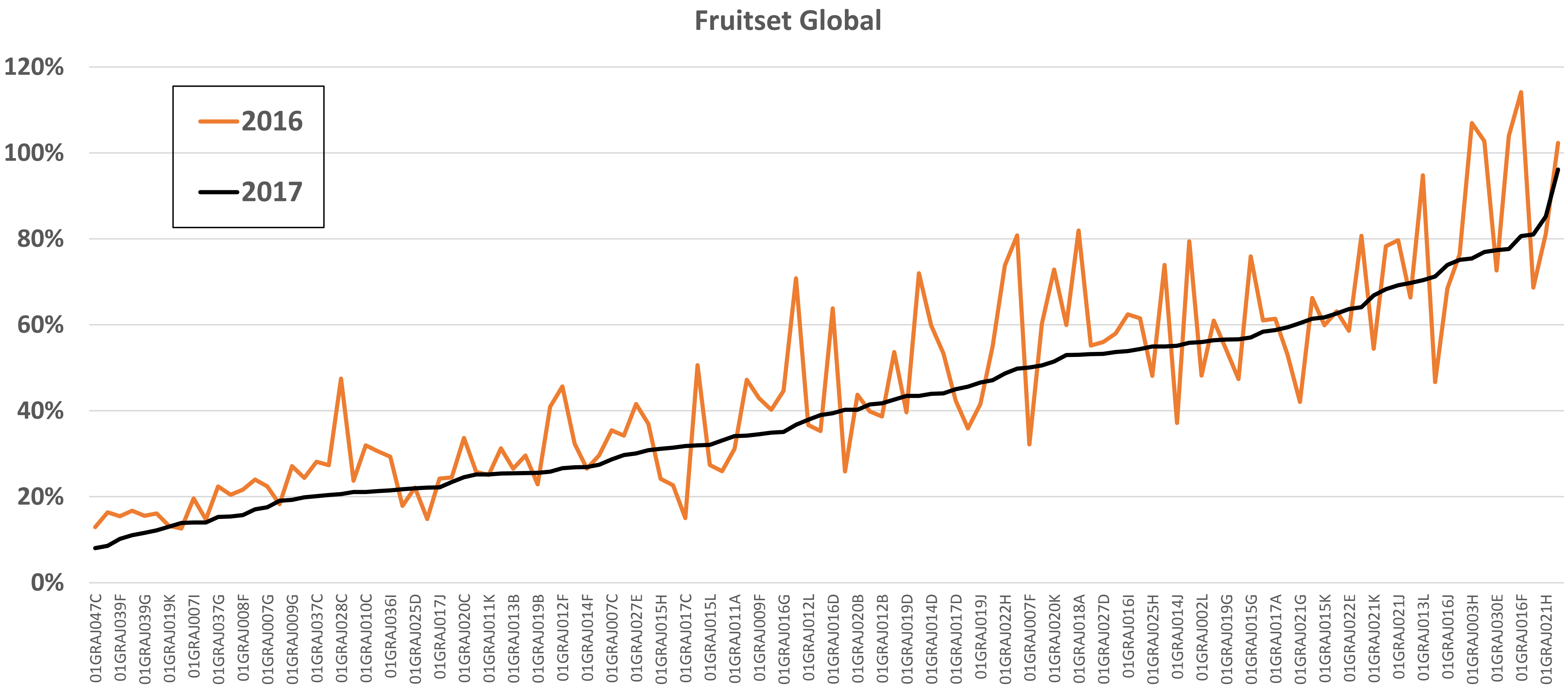
Calculation of Reproductive performance parameters

- **Global (accession-basis)**: all the berries, LGOs and flowers are added up within each accession before calculating its corresponding index
- **Average (bunch-basis)**: indices are calculated for every bunch and then averaged within the accession
- **Average corrected**: after calculating the Average indices, they are re-calculated excluding the individual values out of the mean ± 1 SD for each accession

Summary of Reproductive Performance data from 120 cultivars

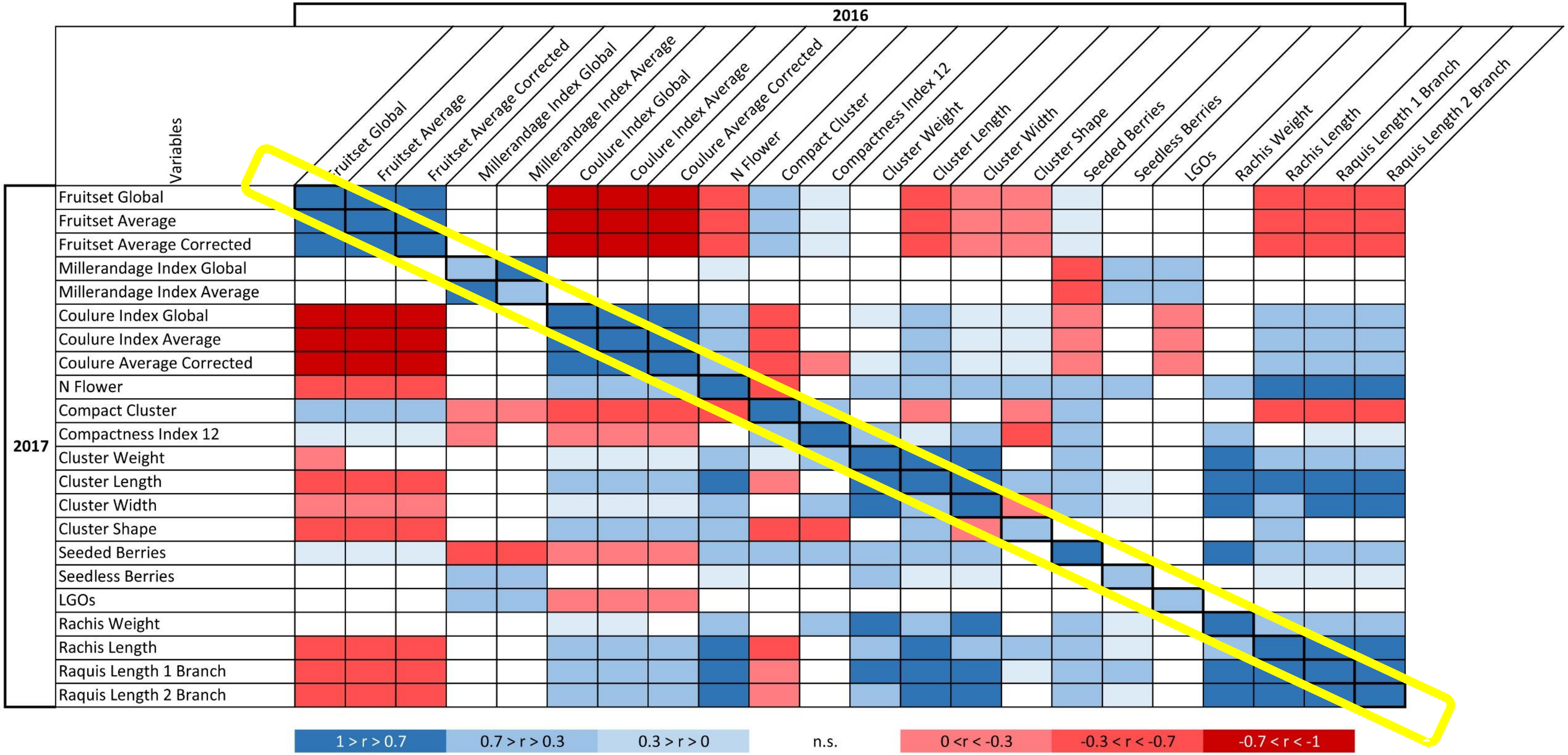
	2016 & 2017				
	N	X̄	Sd	Min	Max
Fruitset Global	240	**43.41%**	22.20%	8.04%	114.16%
Fruitset Avg	240	**45.47%**	22.58%	8.10%	122.00%
Fruitset Avg Corrected	240	**44.81%**	22.73%	7.62%	109.08%
Millerandage Index Global	240	**1.32**	1.27	0.02	10.00
Millerandage Index Avg	240	**1.32**	1.22	0.02	10.00
Coulure Index Global	240	**5.34**	2.43	-2.44	9.19
Coulure Index Avg	240	**5.06**	2.58	-4.23	9.19
Coulure Avg Corrected	240	**5.19**	2.49	-2.42	9.23
N Flower	240	**524.84**	364.69	129.56	3179.20
Seeded Berries	240	**170.68**	80.94	7.60	454.00
Seedless Berries	239	**12.82**	22.13	0.00	214.50
LGOs	240	**11.80**	13.33	0.00	77.70
Compactness	240	**4.80**	1.91	1.00	9.00

Fruitset values for two years



Accessions in increasing order by 2017 data

Correlations between variables and between seasons



Clustering of cultivars according to their reproductive performance

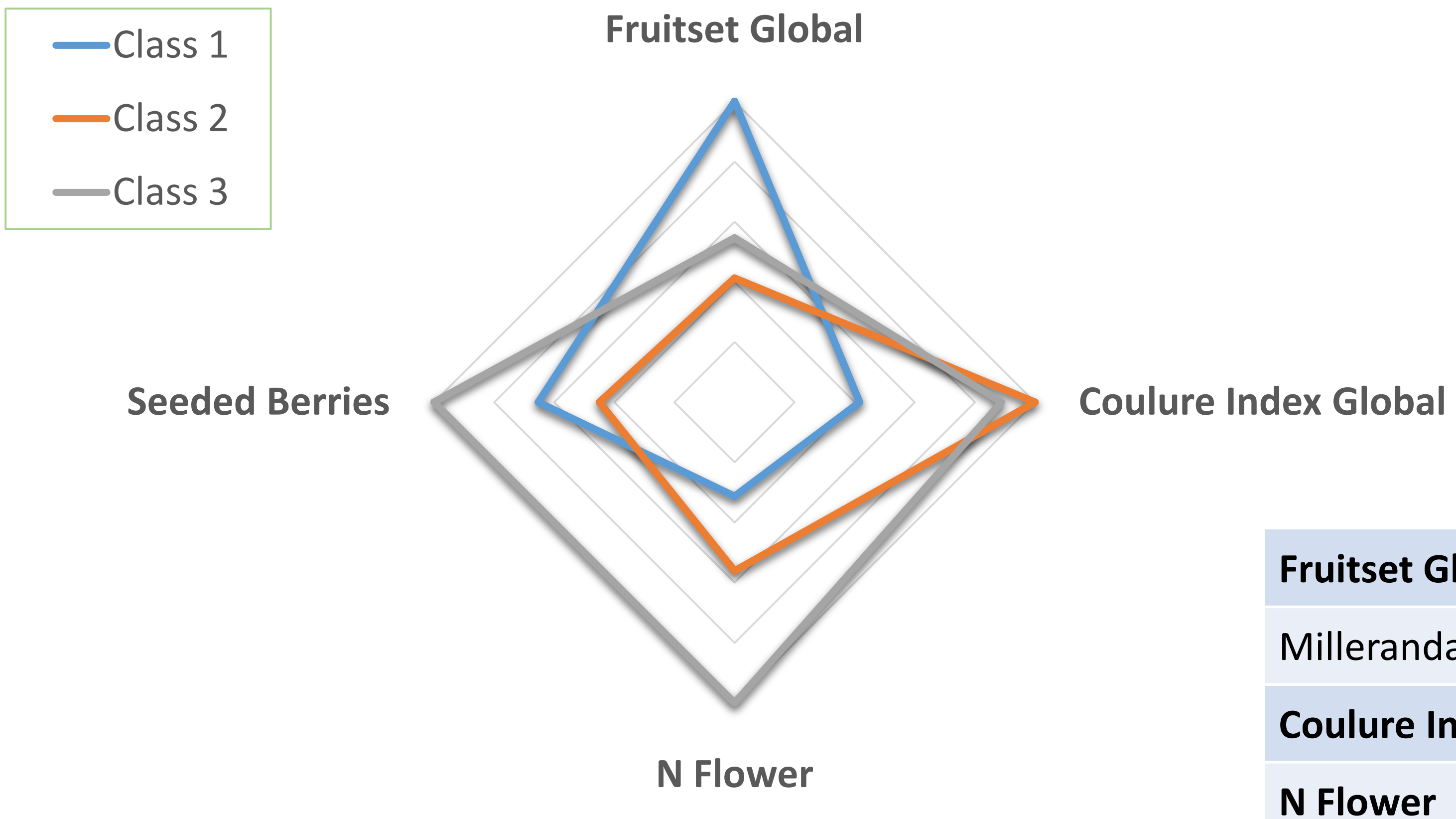
Averages 2016-2017	N	$\bar{x}$	Sd	Min	Max
Fruitset Global	120	43.46%	21.39%	10.48%	99.21%
Millerandage Index Global	120	1.32	1.10	0.05	7.15
Coulure Index Global	120	5.33	2.34	-1.19	8.95
N Flower	120	522.63	343.18	136.68	2476.73
Seeded Berries	120	170.10	74.37	23.40	382.15
Seedless Berries	120	13.09	19.69	0.05	142.54

Agglomerative hierarchical clustering

For each variable (row), different background colors indicate significant differences (α=0,05)

	Classes		
	1	2	3
	47	51	22
Fruitset Global	65.12%	26.91%	35.54%
Millerandage Index Global	1.11	1.58	1.17
Coulure Index Global	2.96	7.10	6.31
N Flower	300.34	538.64	960.43
Seeded Berries	176.32	121.25	270.04
Seedless Berries	8.71	11.51	26.09

Clustering of cultivars according to their reproductive performance (AHC)



	Classes		
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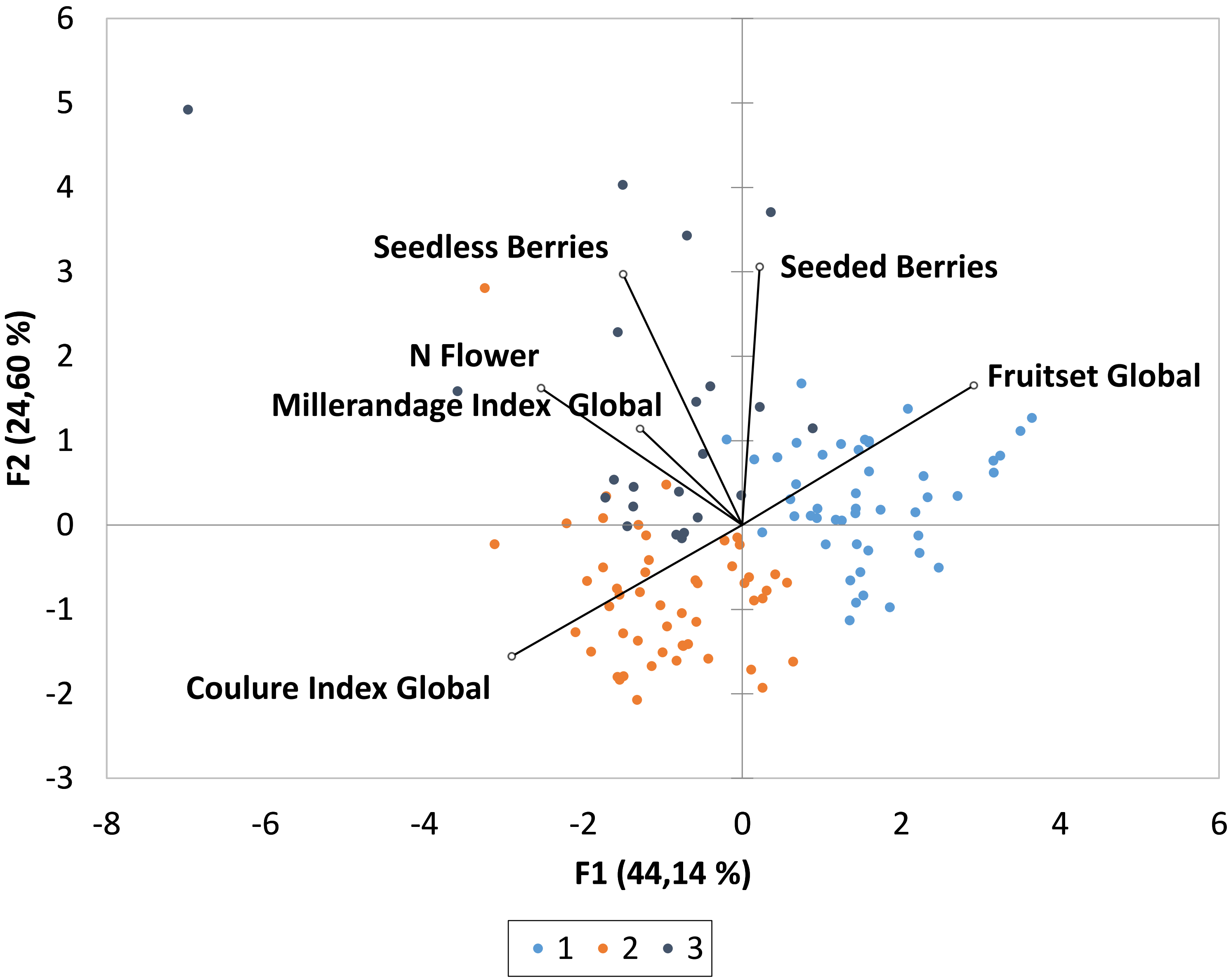
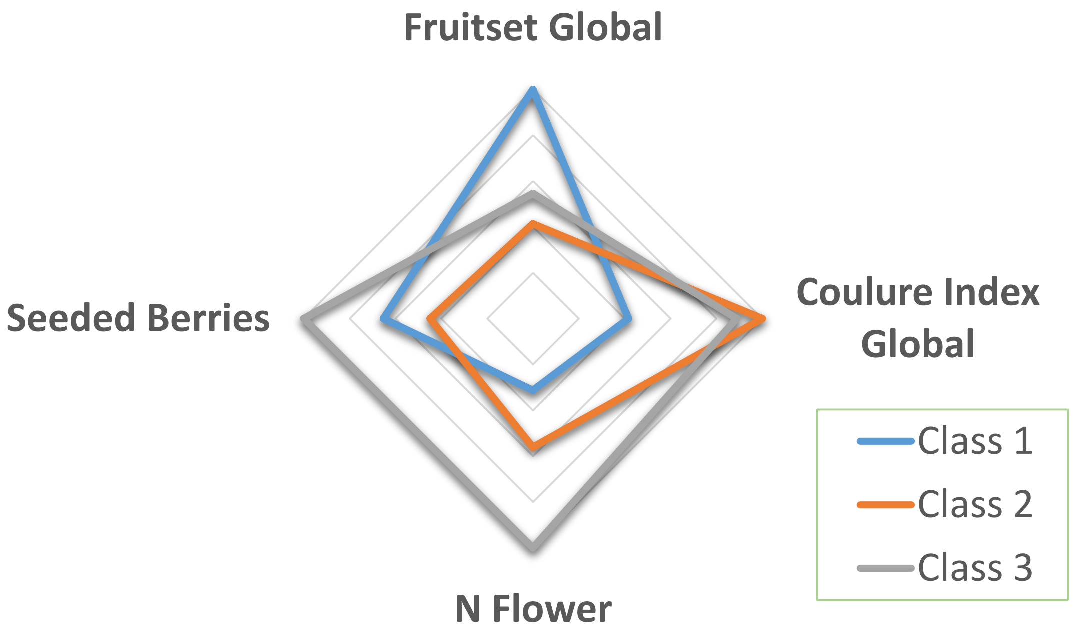
Seeded Berries	176.32	121.25	270.04
Seedless Berries	8.71	11.51	26.09

Clustering of cultivars according to their reproductive performance (PCA-AHC)



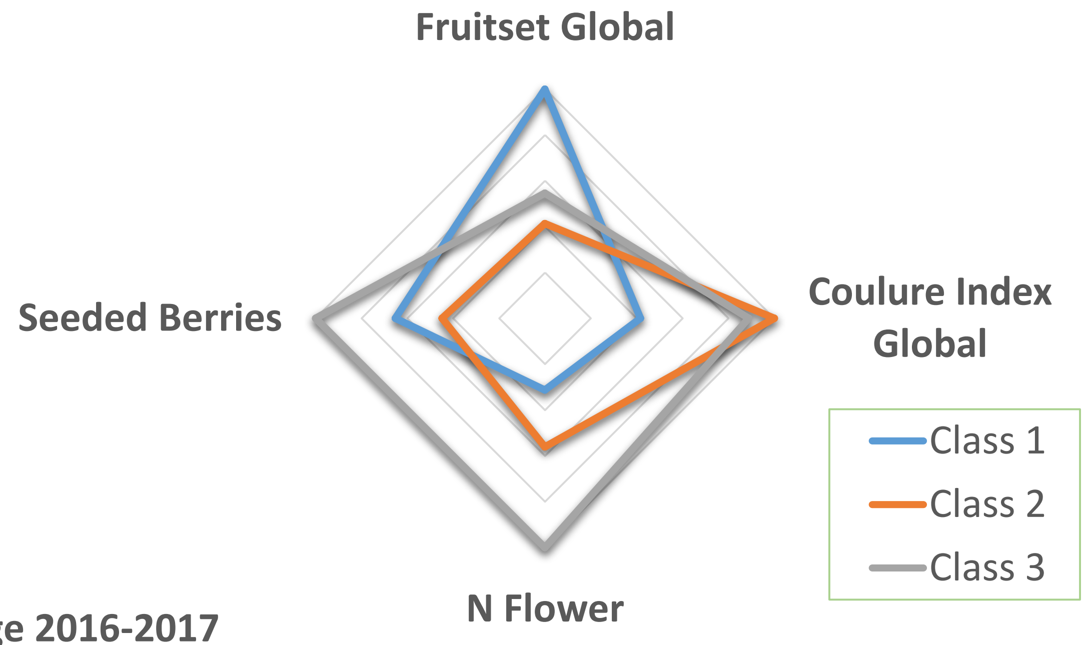
Examples of cultivars classified according to their reproductive performance

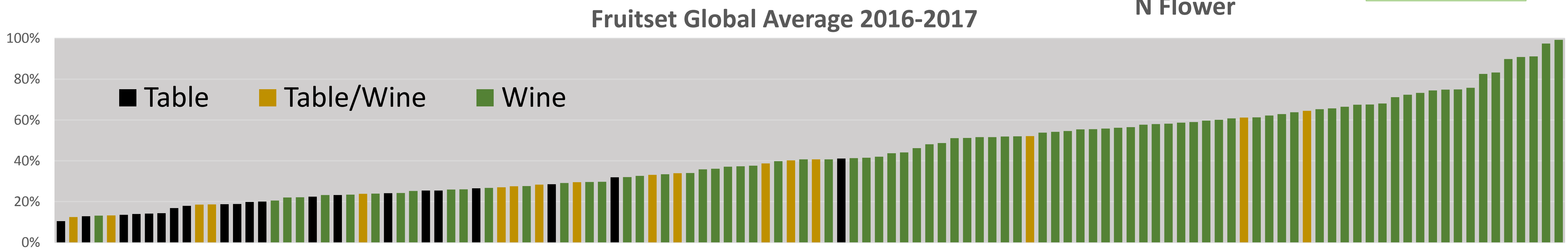
Class 1 (47)	Class 2 (51)	Class 3 (22)
Alfrocheiro	Afus Ali	Airen
Chardonnay	Alphonse Lavallee	Aubun
Gamay Noir	Cabernet Franc	Bobal
Gewuerztraminer	Cabernet Sauvignon	Beba
Monastrell	Cot	Cayetana Blanca
Muscat a Petits Grains	Dabouki	Clairette Blanche
Pinot Noir	Italia	Listan Prieto
Sangiovese	Muscat Hamburg	Nehelescol
Sauvignon Blanc	Riesling Weiss	Pedro Ximenes
Tempranillo	Trebbiano Toscano	Planta Nova



Distribution of cultivars classified according to their reproductive performance and grape use

Use (VIVC)	Class 1	Class 2	Class 3	Total
Wine	44	22	16	82
Table	0	19	2	21
Wine/Table	3	10	4	17
Total	47	51	22	120





The different classes showed differences for all the variables studied, but Millerandage Index

Class	1	2	3
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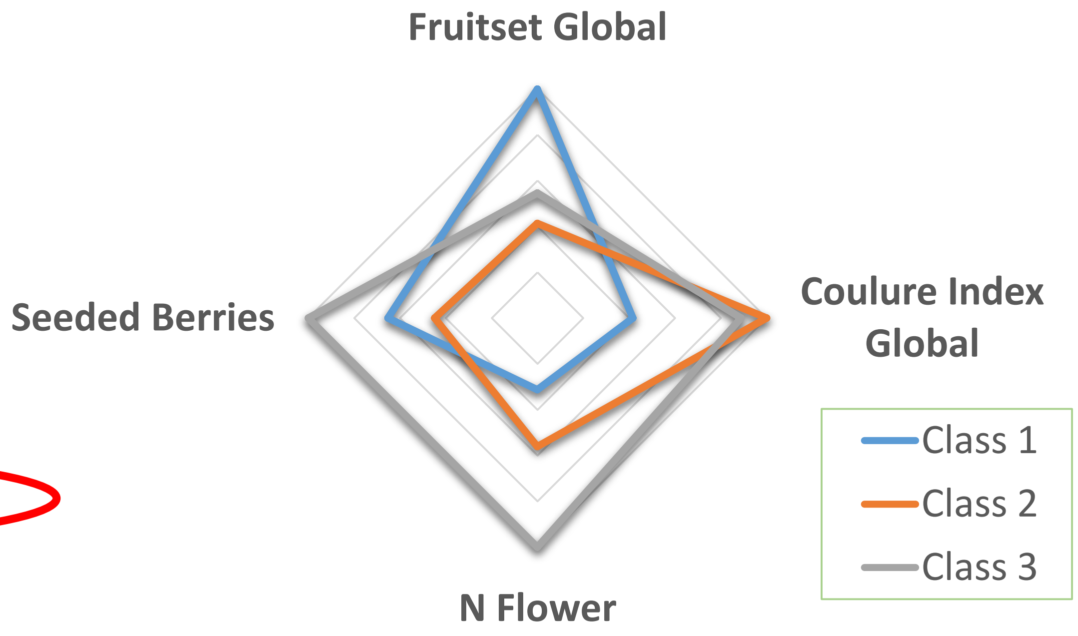
Coulure Index Global	2.96	7.10	6.31
N Flower	300.34	538.64	960.43
Seeded Berries	176.32	121.25	270.04
Seedless Berries	8.71	11.51	26.09
Bunch Compactness	6.1	3.6	4.8
Bunch Weight	315.2	388.3	629.4
Bunch Length	15.7	18.4	22.2
Bunch Width	10.8	11.6	14.4
Rachis Weight	11.9	12.9	25.8
Rachis Length	12.1	15.8	19.4
Rachis Length 1 Branch	46.9	60.6	93.9
Rachis Length 2 Branch	42.5	55.1	84.3



For each variable (row), different background colors indicate significant differences (α=0,05)

Summary and conclusions

- Results of the study of the reproductive performance of 120 cultivars for two seasons, one accession per cultivar in one plot
- A large range of variation was found for different variables related to reproductive performance, including number of flowers, number of berries, fruitset rate and coulure index
- The genetic component had a major impact given the magnitude of the differences and of the correlations found between the two seasons
- A classification according to their reproductive performance grouped cultivars in three classes, partly related to their use
- The classes differ significantly for all the variables studied (but millerandage index), including bunch compactness

Acknowledgements

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International Congress on Grapevine and Wine Sciences

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Thanks for your attention