WORKSHOP ON
"OLIVE CULTIVAR ADAPTATION AND CLIMATIC CHANGE"
UNIA. BAEZA (JAÉN) SPAIN
2-3 NOVEMBER 2017

CHILLING REQUIREMENTS OF OLIVE CULTIVARS: FIRST RESULTS.

D. Cabello
Universidad de Córdoba
Spain

C. Muñoz-Díez
Universidad de Córdoba
Spain

L Rallo
Universidad de Córdoba
Spain

Universidad de Córdoba

CHILLING REQUIREMENTS OF OLIVE CULTIVARS: FIRST RESULTS.

1. INTRODUCTION

2. BUD DORMANCY

3. DORMANCY RELEASE :THE EXPLANT METHOD

4. CULTIVARS VARIABILITY

   - THE EXPLANT METHOD
   - MEASURING CHILLING
   - RELEASE FROM DORMANCY
   - FIELD REPRODUCTIVE BUDBURST
   - CHILLING REQUIREMENTS

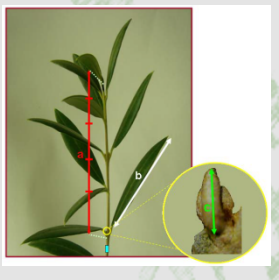
5. CONCLUSIONS

1. INTRODUCTION

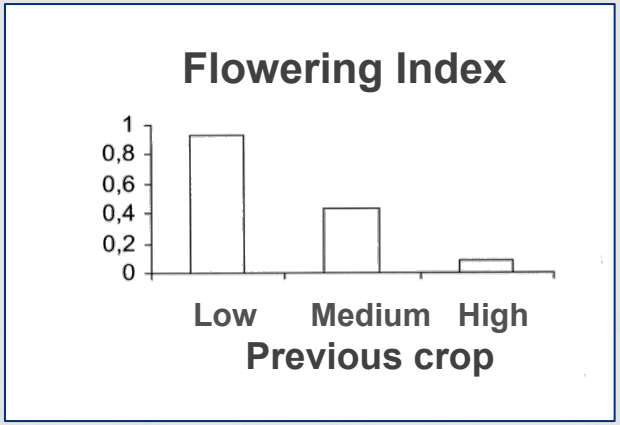
- Chilling requirements is a major factor for cultivar adaptation in North and South America olive growing areas.
- Insufficient chilling is evidenced by the absence or irregular and asynchronous flowering
- Current prediction of global warming in the Mediterranean Basin may modify the adaptation of their autochthonous olive cultivars by insufficient chilling
- Low chilling cultivars may overcome this drawback in such climatic scenarios.

2. BUD DORMANCY

BIENNIAL BEARING



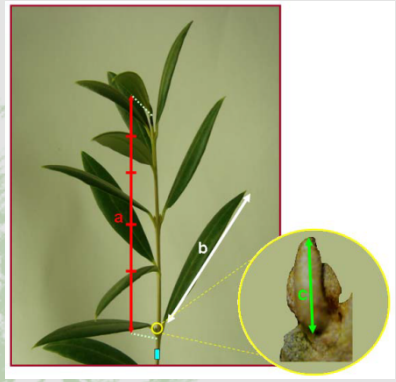
- Olive fruiting occurs in axillary buds of the previous year's growth
- Developing fruit reduces vegetative growth
- Developing fruit inhibits return bloom
- Winter rest is characterized by generalized bud dormancy

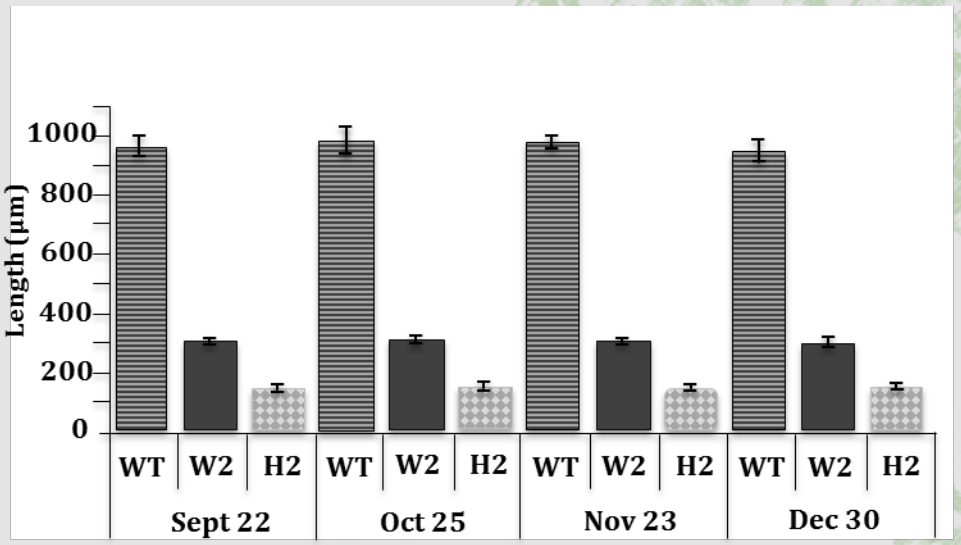


2. BUD DORMANCY

DORMANCY BUD DEVELOPMENT TIMING

GROWTH | ONSET | MAINTENANCE | W. REST

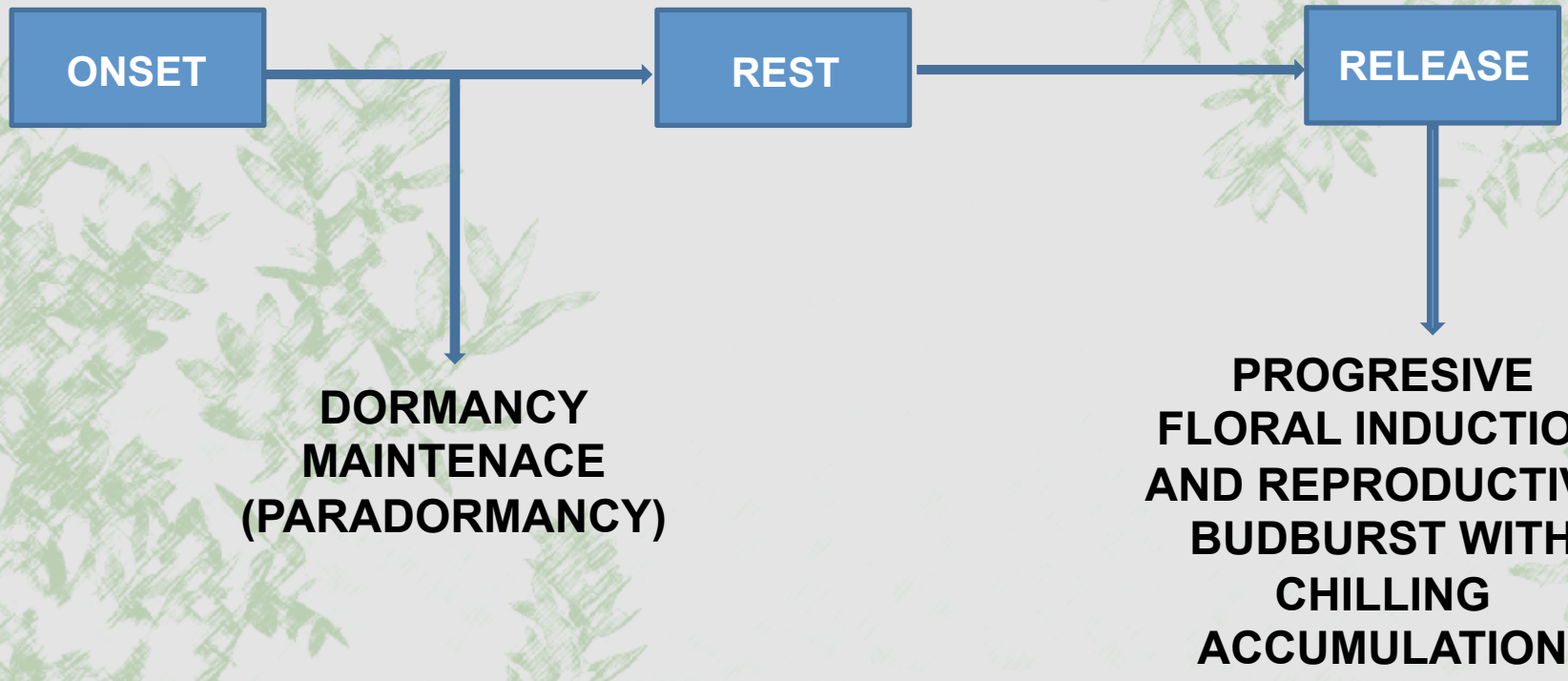




1. Leaves and buds reached their final size at LAD+ 4-6 weeks
2. From that time to winter rest no changes in bud size or structure
3. Bud dormancy onset proceeds acropetally
4. Massive bloom return in OFF trees

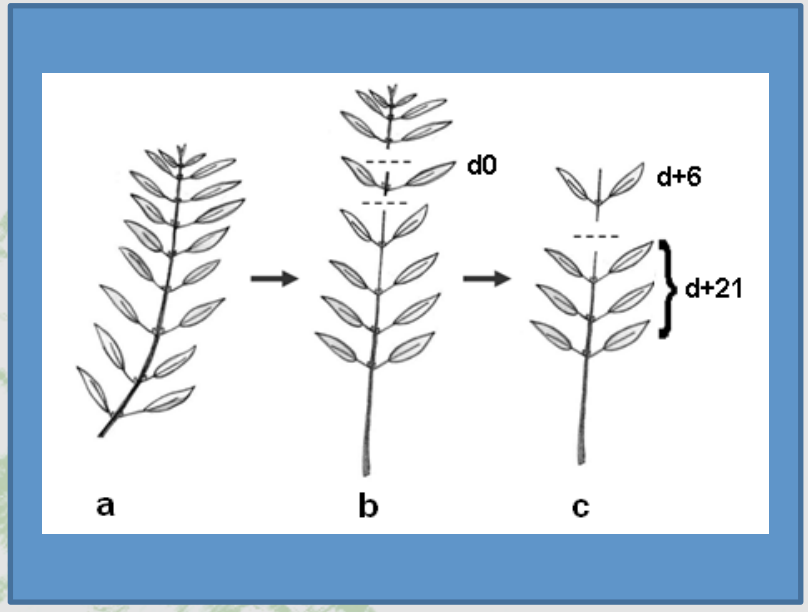
BUD DORMANCY

THE ROLE OF LEAVES



3. DORMANCY RELEASE: THE EXPLANT SYSTEM

TREE SAMPLING WINTER REST



Growth Chamber
12.5º C, 20ºC and 30ºC
>80% RH, 200 µmol

STUDIED FACTORS

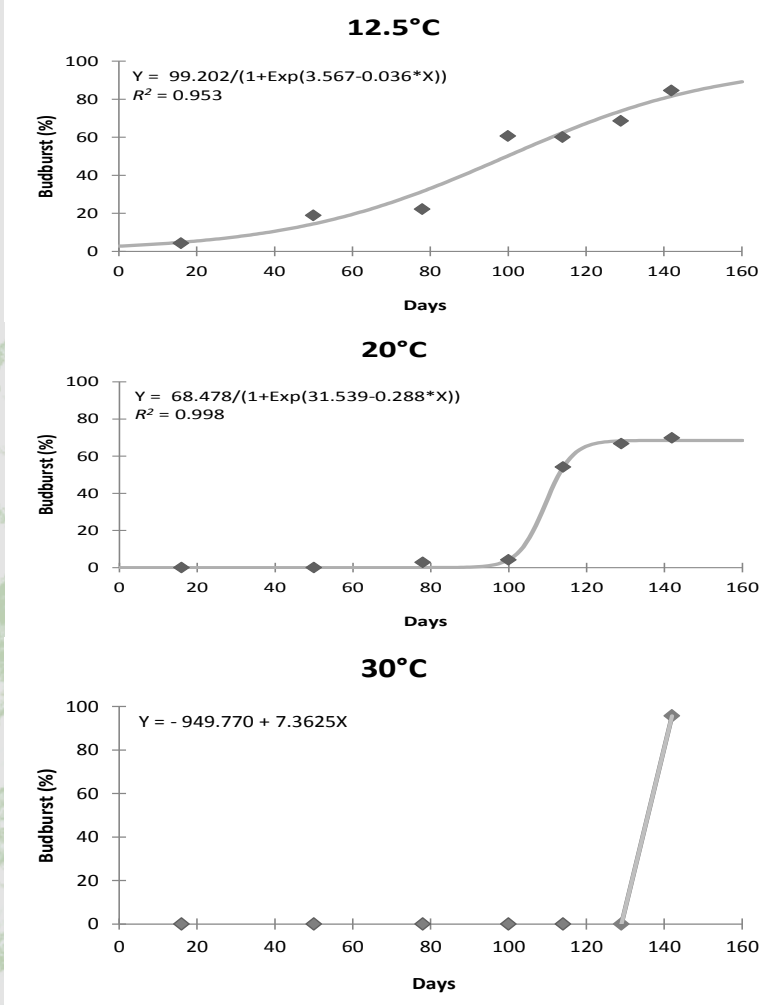
- **ON and OFF sampled trees**
- **Shoot apex and leaf removal**
- **G. CH. temperature**
- Morphogenesis

3. DORMANCY RELEASE: THE EXPLANT SYSTEM

12.5º C

20º C

30º C



RESULTS

- Budburst % increased and ensued faster with chilling accumulation
- 12.5º C was an efficient temperature for chilling accumulation and also allowed slow budburst once enough chilling was accumulated
- 20ºC was an adequate temperature for comparative studies
- 30ºC annulled natural chilling accumulation so budburst didn't occur, except for the samples taken very late after sufficient chilling had accumulated.

3. DORMANCY RELEASE: THE EXPLANT METHOD VALIDATION

G CH 10-12ºC
8 W and 12 W

EXPLANTS

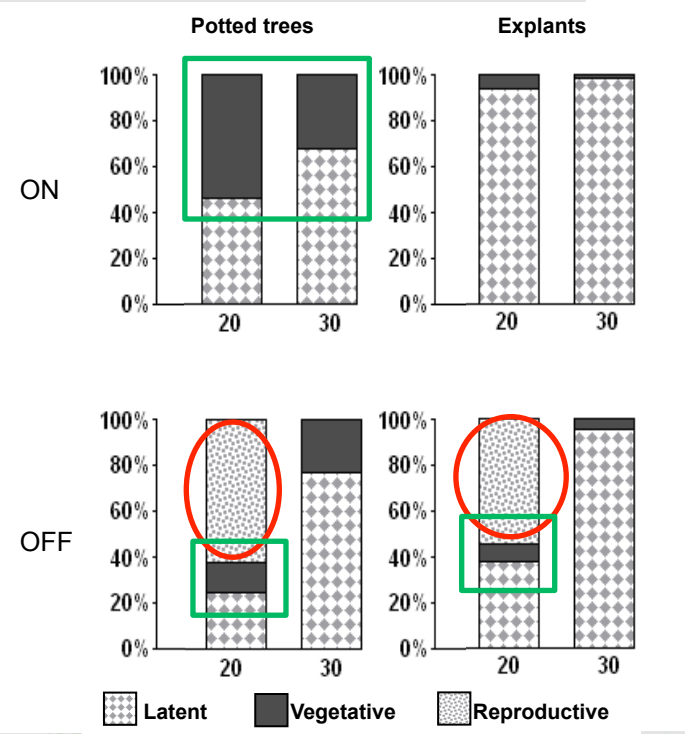
TREE SHOOTS

G CH
20ºC and 30ºC
>80% RH, 200 µmol

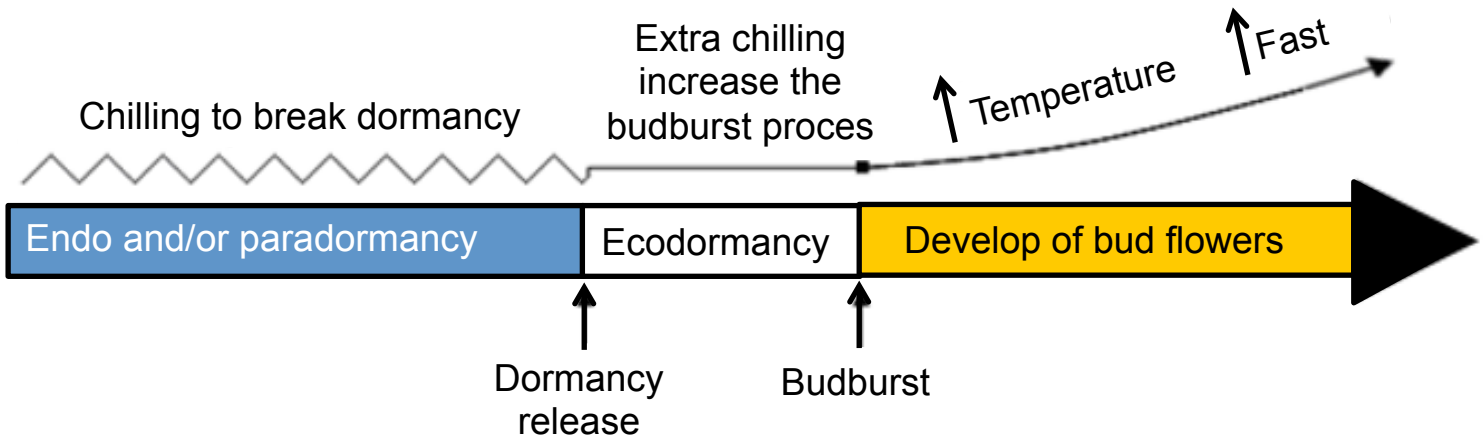
3. DORMANCY RELEASE: THE EXPLANT METHOD VALIDATION

CHILLING 12 WEEKS 10º-12ºC → BUDBURST AT 20ºC and 30ºC

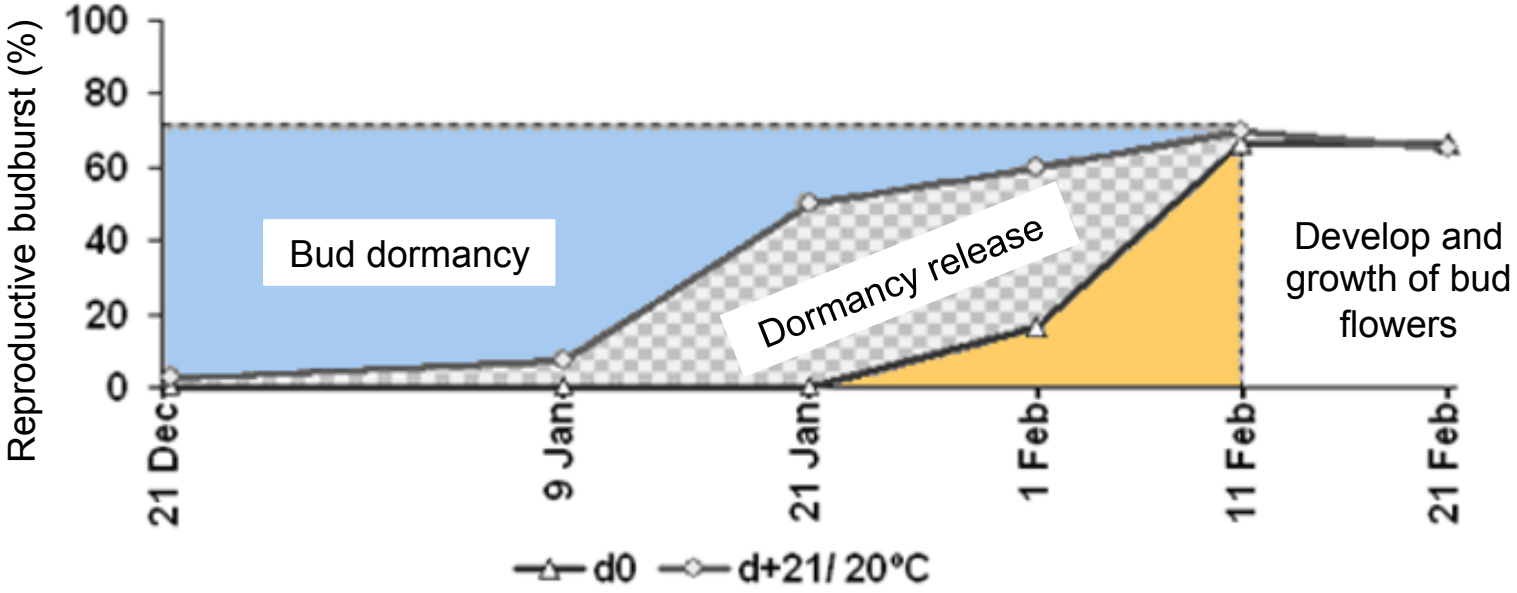
POTTED TREES vs EXPLANTS



A) Dormancy Release of Reproductive Budburst



B) Dormancy Release Period



3. DORMANCY RELEASE: THE EXPLANT METHOD PROPOSAL

1. OFF TREE SHOOTS

2. LEAFFY 4-6 NODES EXPLANTS

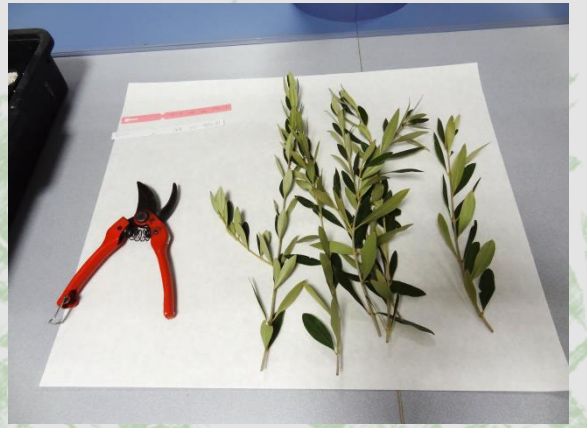
3. GROWTH CHAMBER (GH)
    1. 20ºC
    2. HR >90%
    3. PAR 200 µmol m^{-2} s^{-1}

4. WEEKLY RECORDS BUDBURST

5.PERMANENT CONTROL GH

4. CULTIVARS VARIABILITY

THE EXPLANT METHOD



4. CULTIVARS VARIABILITY

THE EXPLANT METHOD

4. CULTIVARS VARIABILITY

THE EXPLANT METHOD

Frantoio 2/9/16 (+21 days)

4. CULTIVARS VARIABILITY

THE EXPLANT METHOD

Verdial de Vélez-Málaga 2/9/16 (+21 days)

4. CULTIVARS VARIABILITY

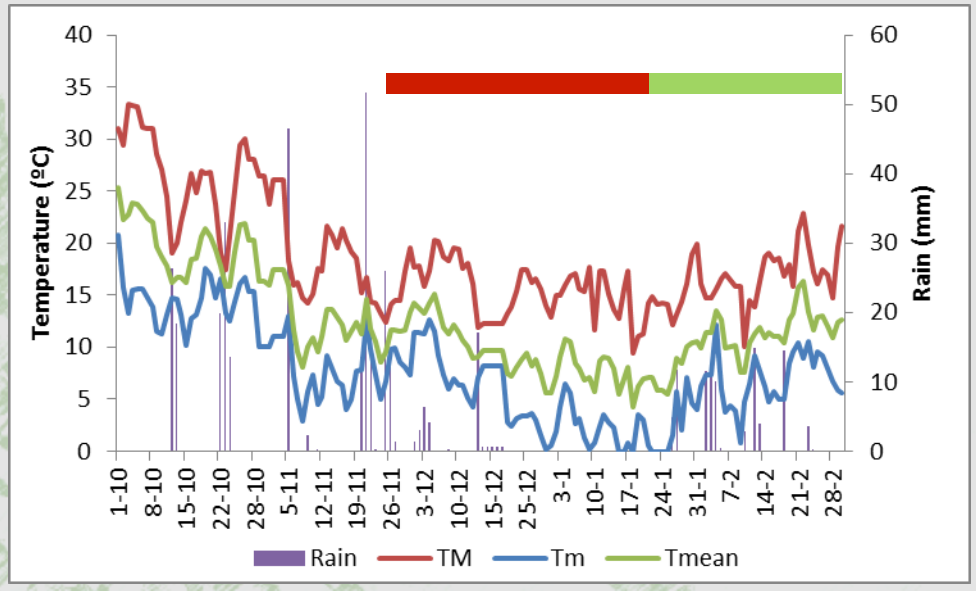
THE EXPLANT METHOD

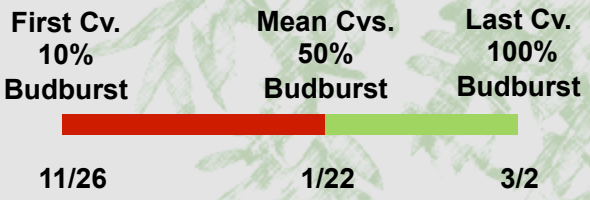
Chemlal de Kabyle 2/9/16 (+21 days)

4. CULTIVARS VARIABILITY

RELEASE FROM DORMANCY

TEMPERATURE AND RAINFALL

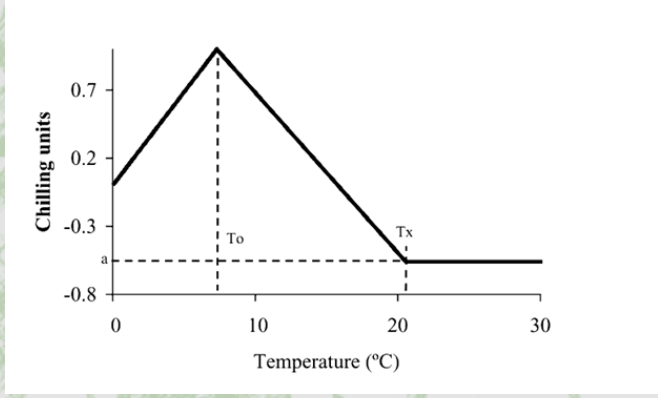


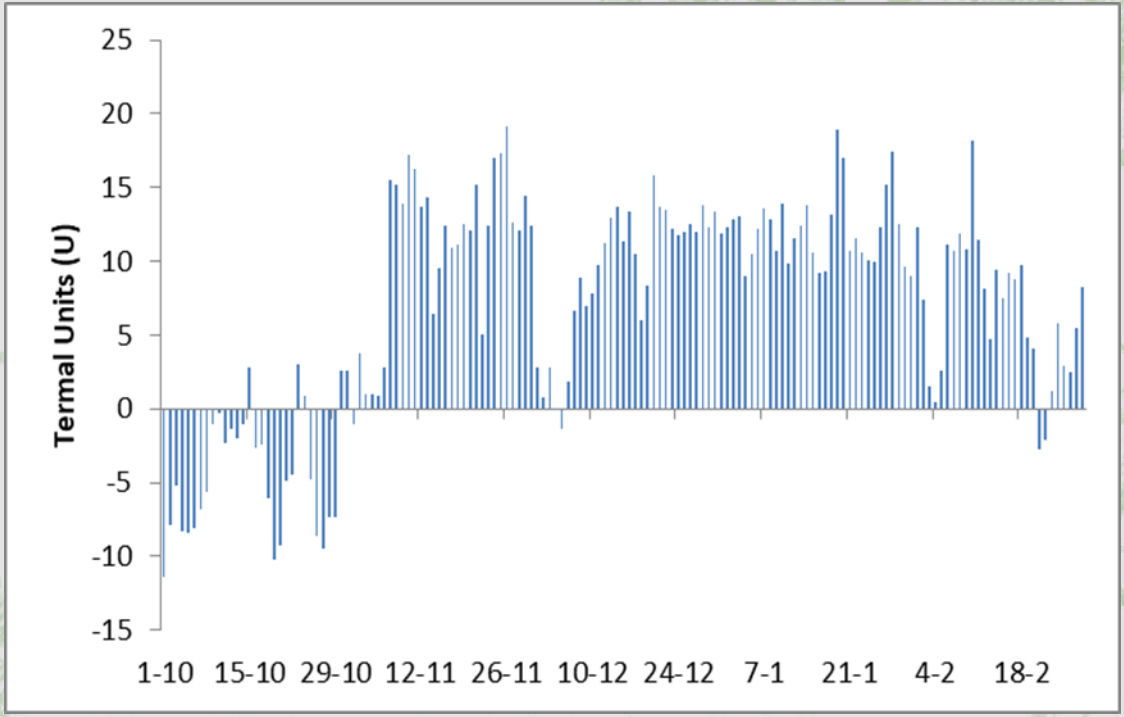


	Periods		
Mean	**10/1-11/26**	**11/26-1/22**	**1/22-3/2**
T mean (ºC)	16.4	9.4	10.7
T max (ºC)	22.8	15.5	16.6
T min (ºC)	11.3	5.2	6.3

4. CULTIVARS VARIABILITY

THE THERMAL UNITS (TU) SINCE 30 OCT (DE MELO-ABREU et al. 2004)



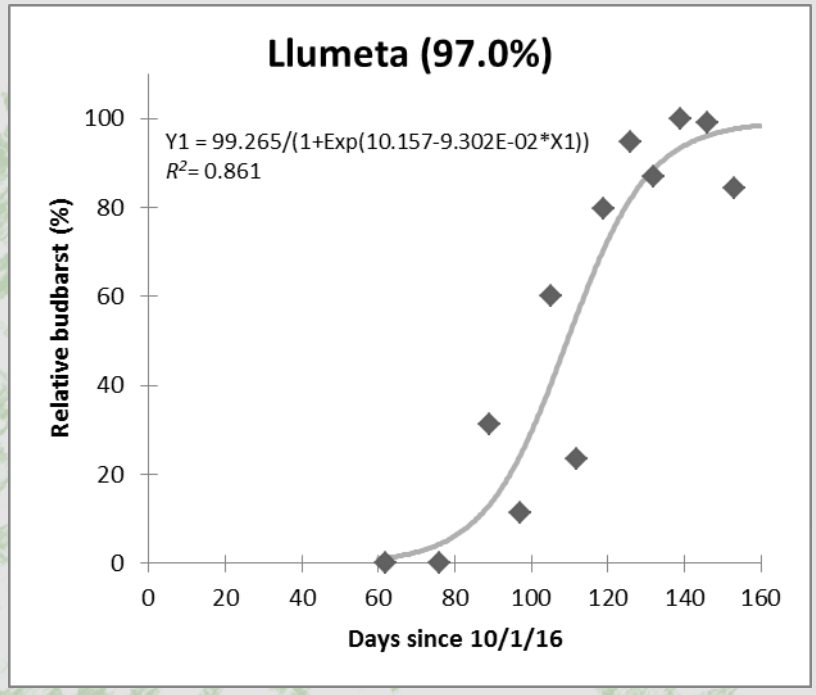


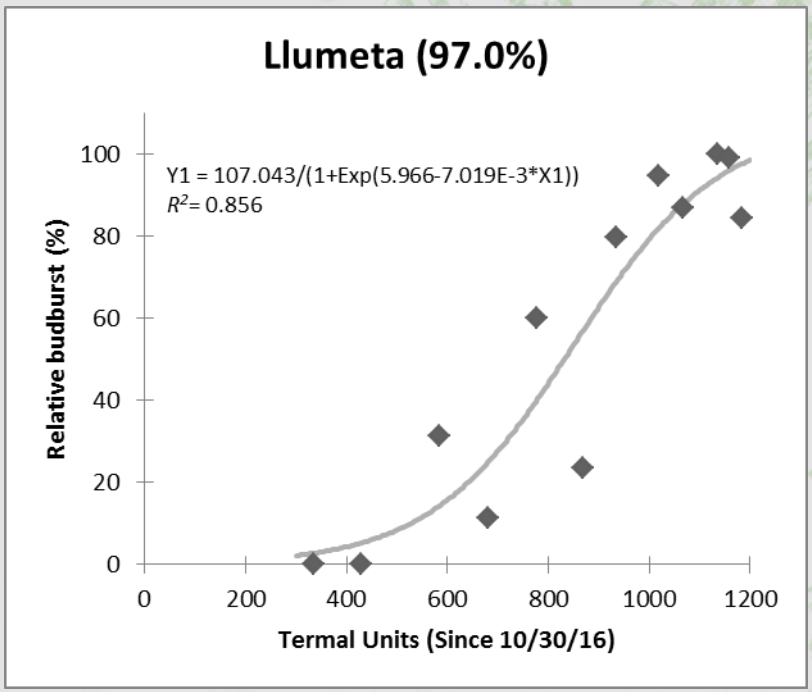
4. CULTIVARS VARIABILITY

RELEASE FROM DORMANCY

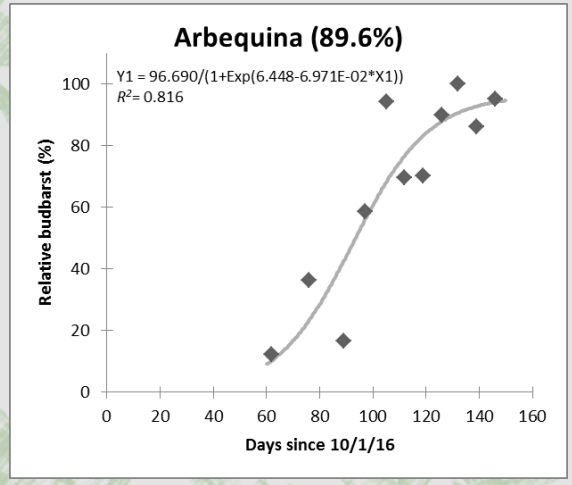
DAYS AFTER 1 OCT

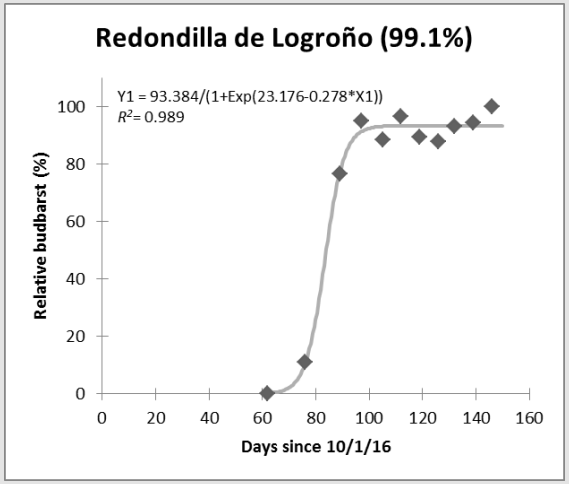
THE THERMAL UNITS (TU) SINCE 30 OCT (DE MELO-ABREU et al. 2004)

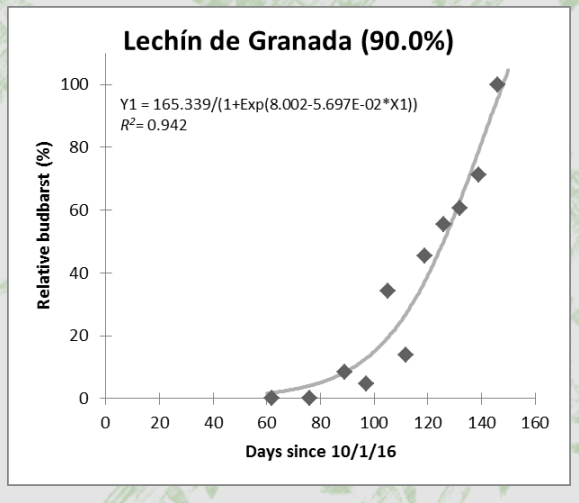


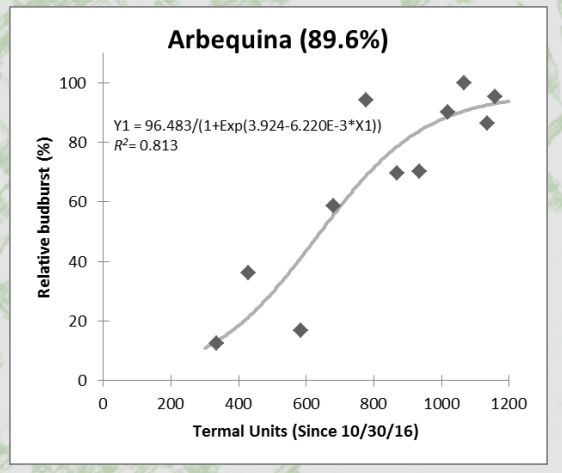


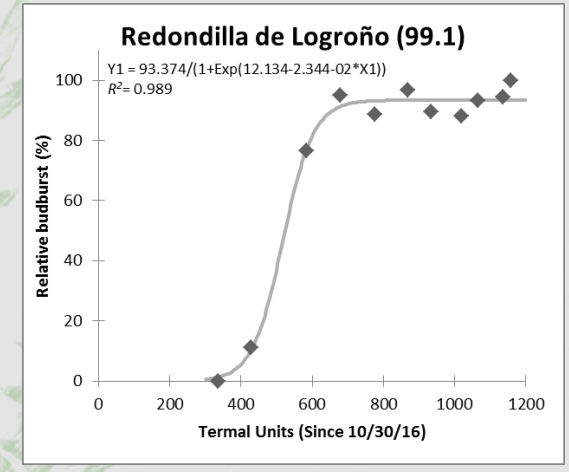
4. CULTIVARS VARIABILITY

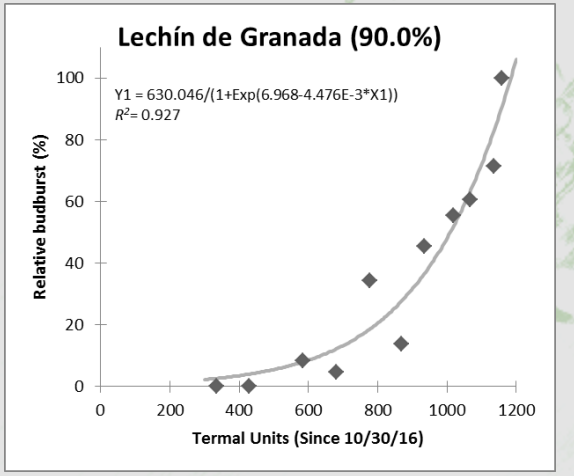




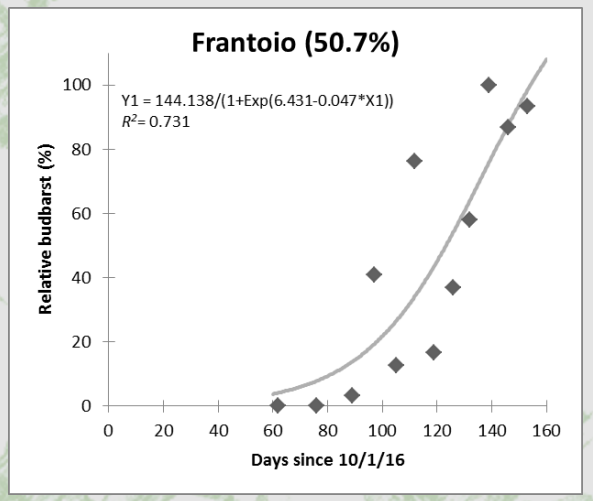


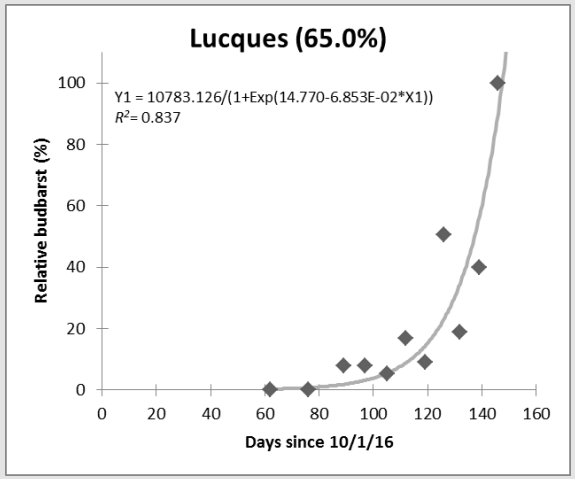


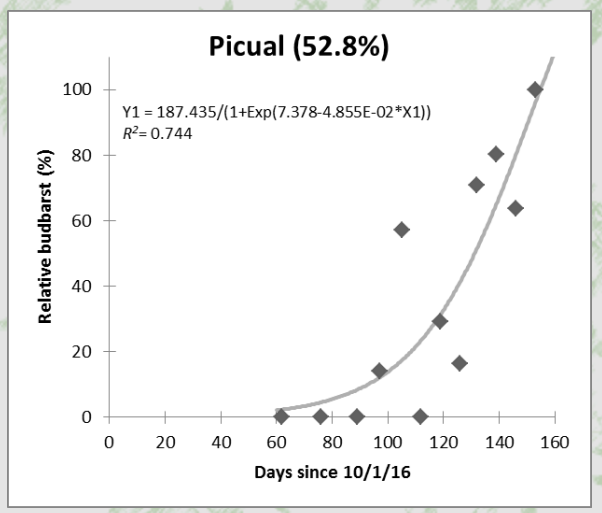


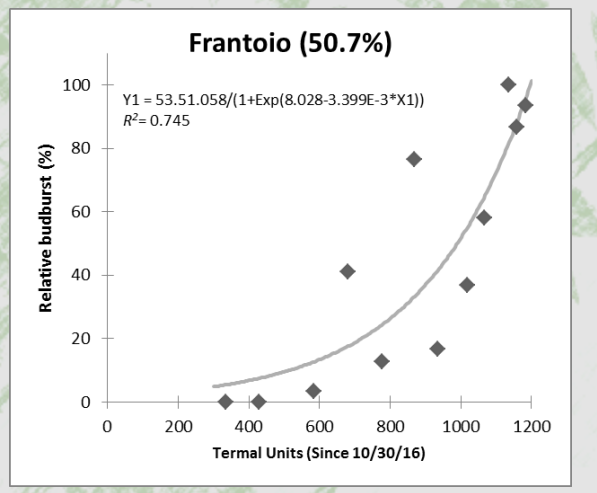


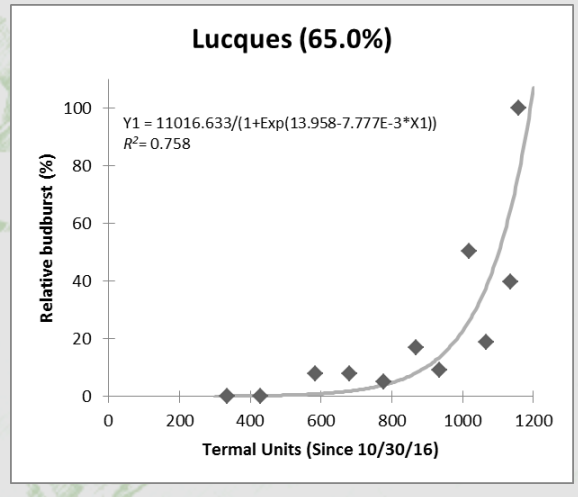
4. CULTIVARS VARIABILITY

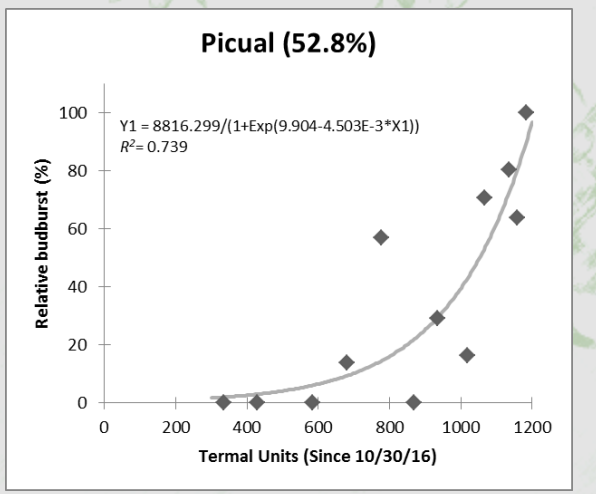




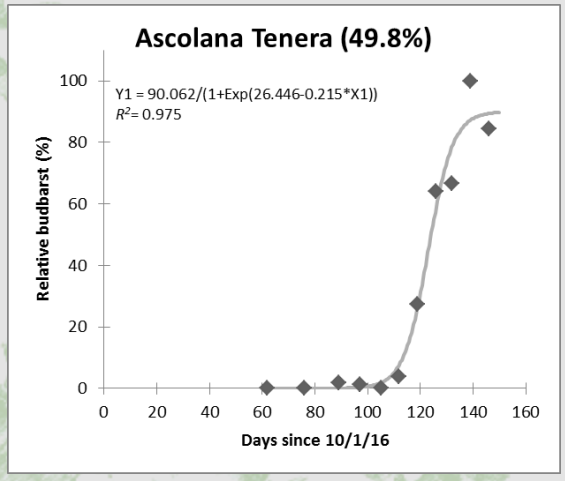


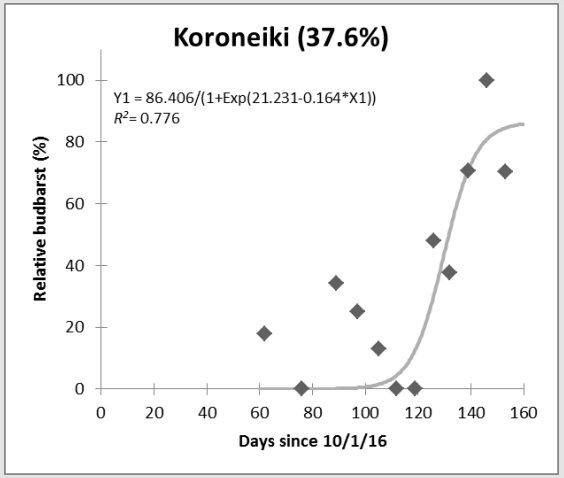


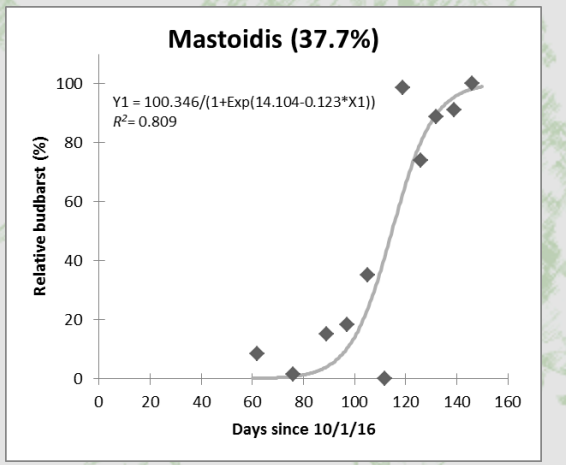


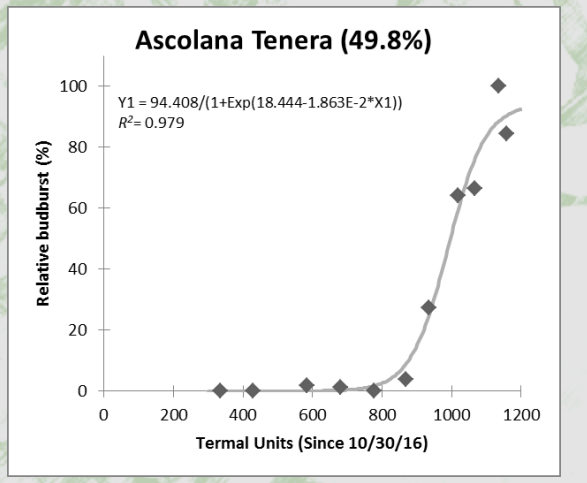


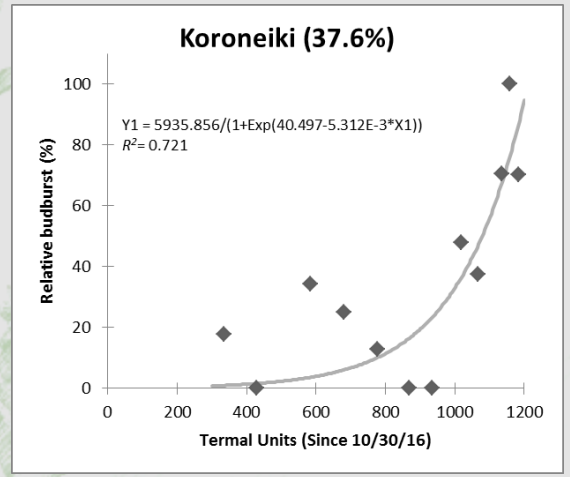
4. CULTIVARS VARIABILITY

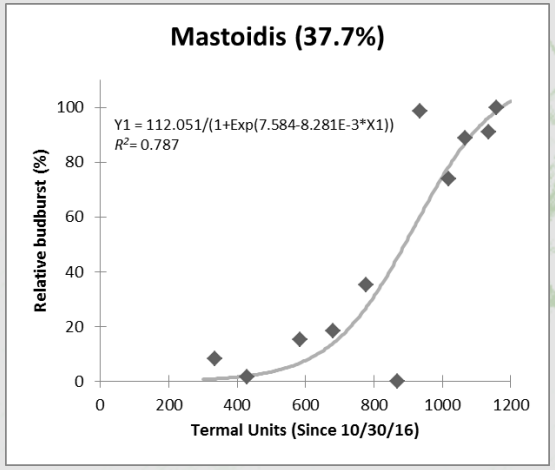




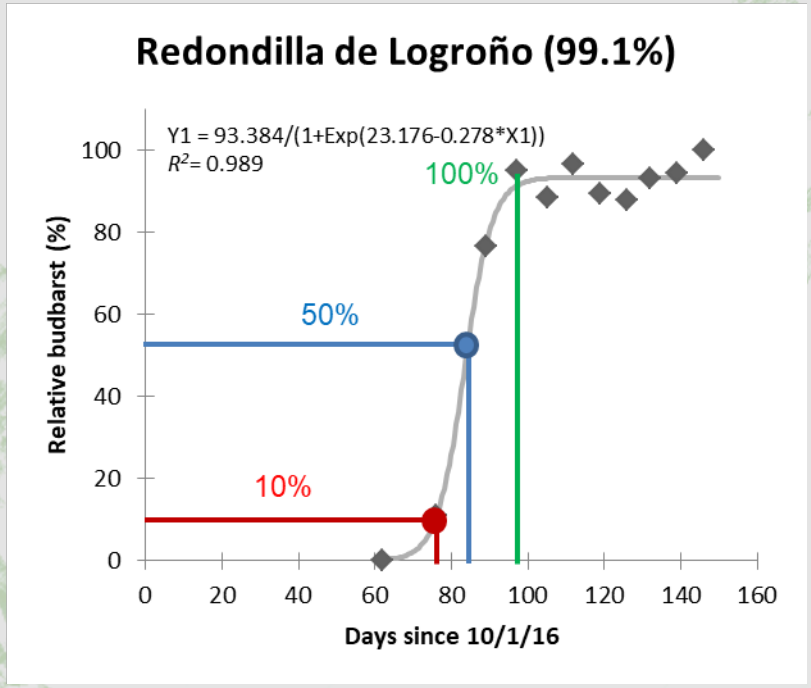






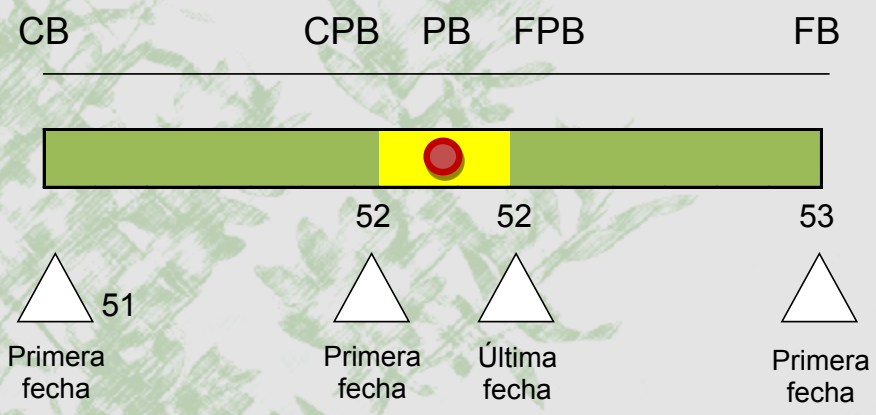


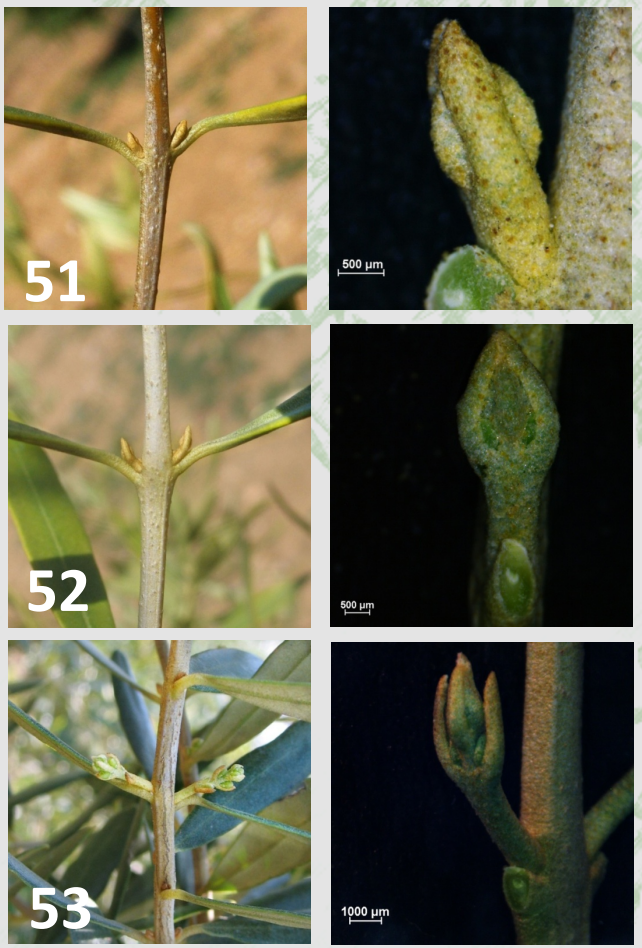
4. CULTIVARS VARIABILITY



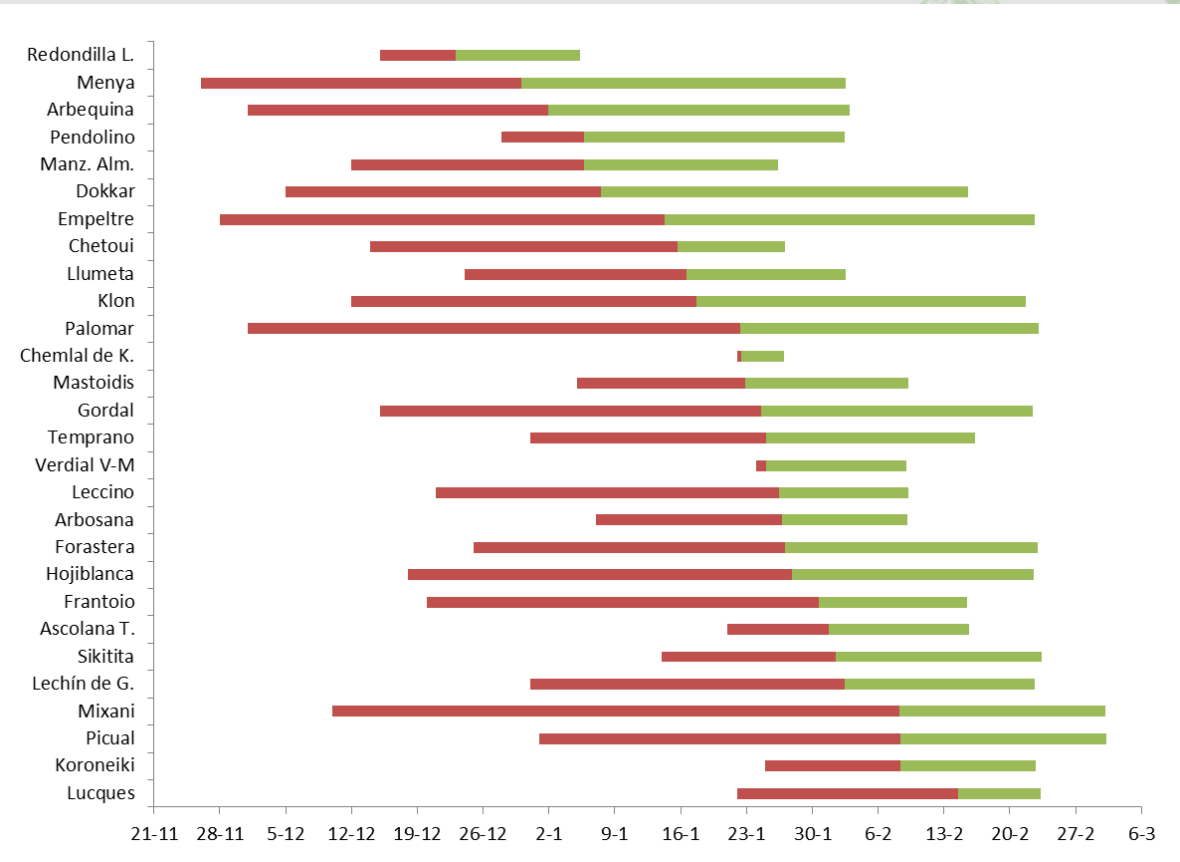
4. CULTIVARS VARIABILITY

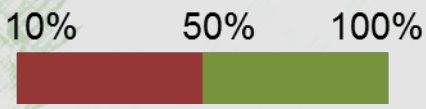
Escala BBCH



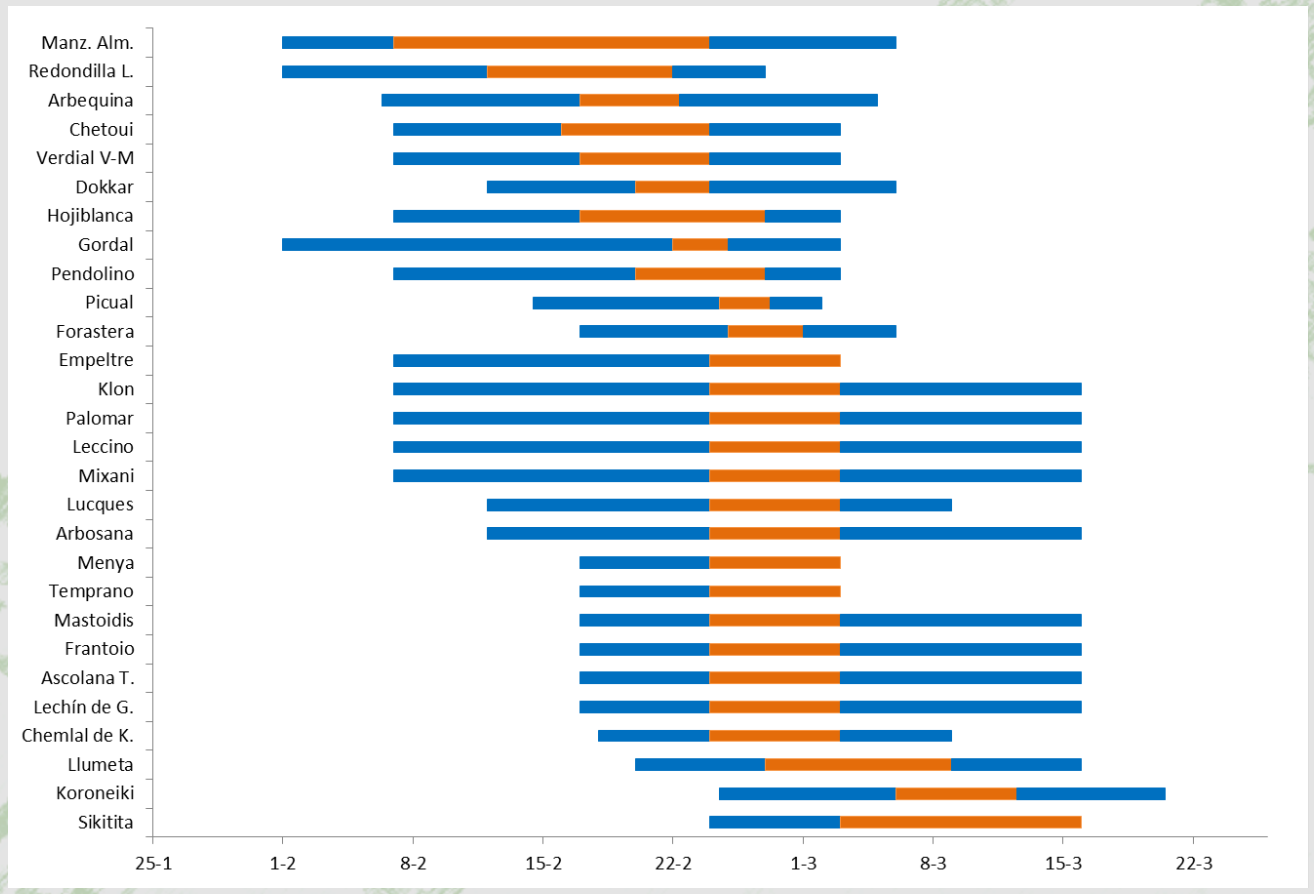


4. CULTIVARS VARIABILITY DORMANCY RELEASE PERIOD

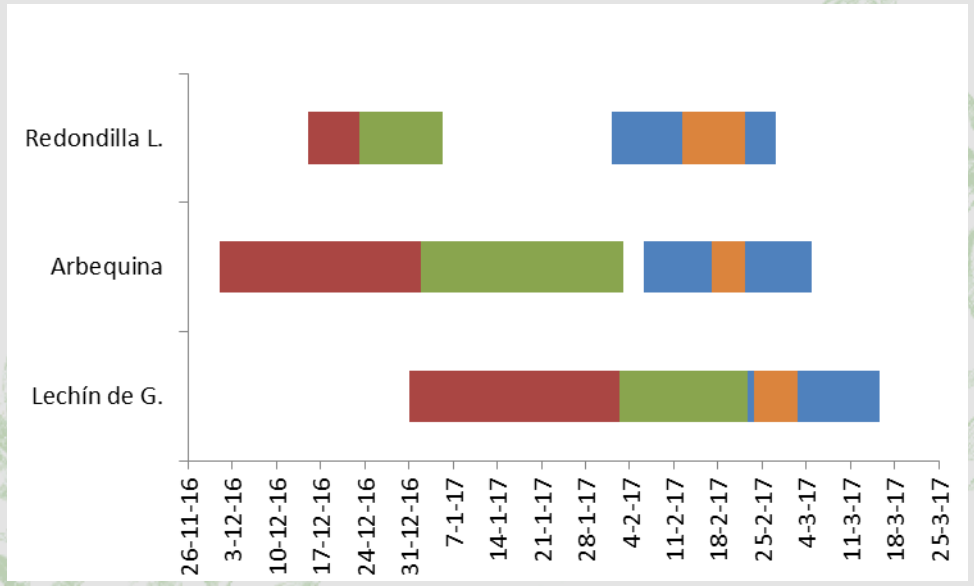




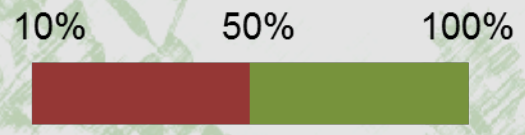
4. CULTIVARS VARIABILITY
BUDBURST PERIOD



4. CULTIVARS VARIABILITY



Release From Dormancy



Natural Reproductive Budburst

4. CULTIVARS VARIABILITY

CHILLING REQUIREMENTS

Cultivar	Release from dormancy						Natural Reproductive Budnurst					
	Date			Last Time[1] (Days)			Date			Last Time[2] (Days)		
	10% (TU)[2]	50% (TU)[2]	100% (TU)[2]	10%.	50%	100%	Start (TT)[3]	Full (TT)[3]	End (TT)[3]	Start	Full	End
Redondilla de Logroño	15/12 (429)	23/12 (522)	5/1 (680)	76	84	97	1/2 (4.4)	17/2 (31.0)	27/2 (71.4)	124	140	150
Arbequina	1/12 (335)	2/1 (1044)	3/2 (1019)	62	94	126	6/2 (17.8)	19/2 (35.9)	5/3 (80.1)	129	142	156
Lechín de Granada	21/12 (497)	3/2 (1416)	23/2 (1556)	92	126	146	17/2 (31.0)	27/2 (71.4)	16/3 (145)	140	150	167

1 : Since 10/1/16
2 : Thermal Units (TU) since 10/30/16
3 : Melo-Abreu TT(To= 9.1ºC)

5. CONCLUSIONS

Standard protocol to evaluate:

- Chilling requirements for cultivars
- Interaction genotype x environment
- Range of optimum temperatures for release of dormancy and bud burst development
- Validation of models
- Enlarge our knowledge about olive floral induction, dormancy and floral initiation and development

Acknowledgements

The development of the explant method has been developed by:

- Diego Cabello
- George Martin
- Luis Rallo
- Antonio Ramos
- Hava Rapoport
- Guillermo Rubio

This work is included in Diego Cabello's PhD program

Open questions???