

*Protea* 'Pink Ice': base temperature and growing degree hours from flower bud stage to harvest stage in the Maule Region, Chile

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## Protea 'Pink Ice' is appreciated in Chile

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- High flower stem yield
- Easy to cultivate
- Rustic
- Flower stem harvest throughout the year

- In Chile, no knowledge about how long the development of the inflorescence bud of *Protea* 'Pink Ice' takes place in every season

The aim of this study was very simple: to determine the **growing degree hours (GDH)** from bud 1 cm in diameter until harvest stage in 4 different seasons in the Maule Region, and to compare bud size between those seasons



1 cm

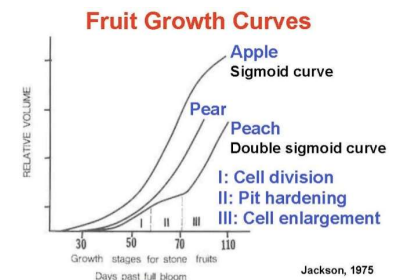
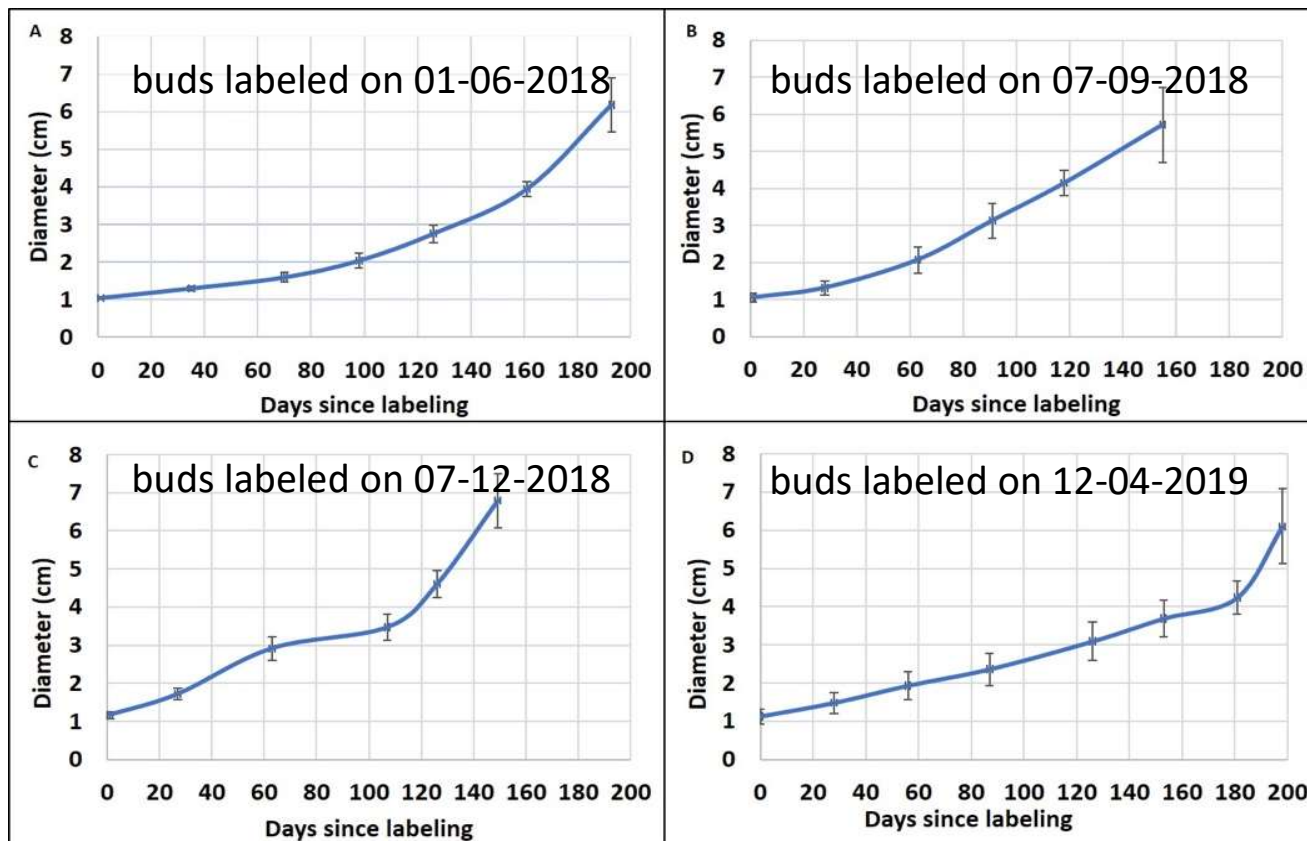
## Bud size

Diameter was measured monthly, and more often closer to harvest stage

Bud length was measured at harvest stage



# Flower bud growth from 1 cm in diameter until harvest stage in different seasons in *Protea* 'Pink Ice'





We attributed  
that pattern to  
the growth of  
lateral buds



Both final bud diameter and length were higher in the September buds than in April buds

Labeling time	Final bud length (cm)	Final bud diameter (cm)
01-06-2018	10.29 ± 0.79 bc	6.18 ± 0.72 ab
07-09-2018	11.06 ± 0.52 a	6.99 ± 0.71 a
07-12-2018	10.86 ± 0.56 ab	6.80 ± 0.56 ab
12-04-2019	10.22 ± 0.37 c	6.27 ± 0.75 b
Statistical significance	**	**



Values in each column followed by the same letter do not differ statistically. HSD Test ( $p \leq 0.05$ ).

- Thermal sum to complete bud development, expressed as GDH
- $GDH = \text{measured temperature} - \text{base temperature}$
- To calculate the growing degree hours (GDH), we needed the **base temperature** for flower bud growth

\*Temperature was measured every 15 minutes





# Base temperature

Definition: is that temperature below which plant growth is zero

Literature:

*Protea* 'Carnival': 1°C (Hoffman and Jacobs, 2010) Sprouting to harvest

*Protea* 'Pink Ice': 9°C (Louw et al., 2018) Visible bud to harvest

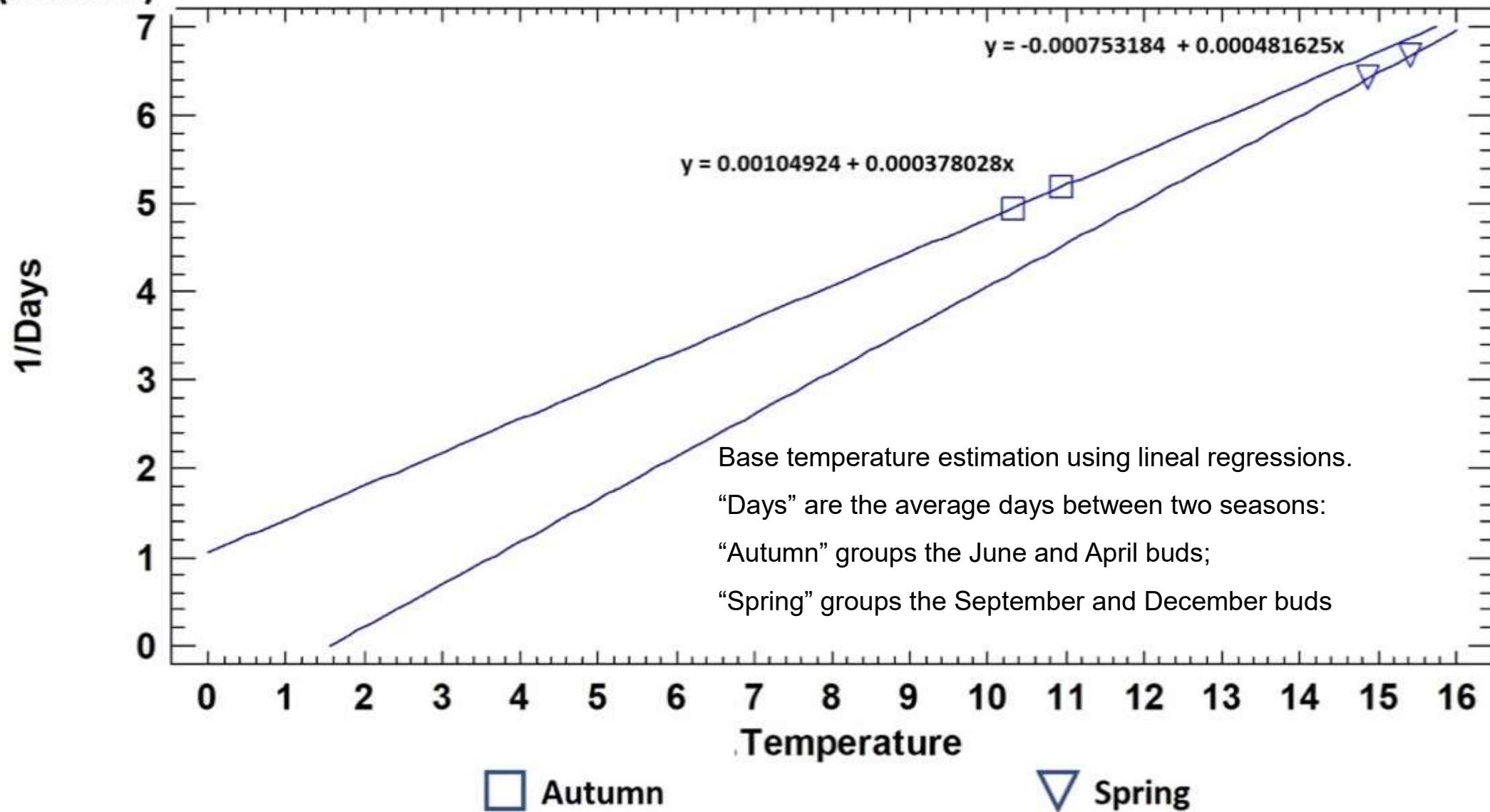
# Growing degree days for *Protea* 'Pink Ice' from the time the flower bud was 1 cm in diameter in different seasons, until flower stem harvest, based on different base temperatures

Labeling time	Days from labeling to harvest	Base temperature										
		0°C	1°C	2°C	3°C	4°C	5°C	6°C	7°C	8°C	9°C	10°C
01-06-2018	193 ± 5	50,746	46,192	41,716	37,367	33,167	29,140	25,285	21,667	18,328	15,288	12,561
07-09-2018	156 ± 11	56,073	49,745	46,600	43,484	40,410	37,378	34,407	31,535	28,798	26,225	23,870
07-12-2018	150 ± 7	55,657	52,016	48,421	44,810	41,218	37,655	34,144	30,698	27,353	24,132	21,072
12-04-2019	202 ± 13	50,597	46,655	41,866	37,636	33,590	29,776	26,195	22,850	19,754	16,932	14,451
Average		53,268	48,652	44,651	40,824	37,096	33,487	30,008	26,688	23,558	20,644	17,989
SD		3,004	2,742	3,386	3,876	4,309	4,661	4,943	5,148	5,281	5,347	5,356
%CV		5.639%	5.636%	7.582%	9.495%	11.616%	13.920%	16.474%	19.291%	22.419%	25.902%	29.777%



Lowest Variation Coefficient

(X 0.001)



GDH comparison for flower buds of 1 cm in diameter labeled at different times of the year, using 1°C as base temperature

Labeling time	Growing degree hours to harvest time (GDH)
01-06-2018	46,192 b
07-09-2018	49,745 ab
07-12-2018	52,016 a
12-04-2019	46,655 b
Significance	**
Values in each column followed by the same letter do not differ statistically. HSD Test ( $p \leq 0.05$ ).	



Date of bud 1 cm diameter	Estimated harvest date $\pm$ days
01 January	18 June $\pm$ 7
15 January	16 July $\pm$ 7
01 February	24 July $\pm$ 7
15 February	17 September $\pm$ 7
01 March	17 September $\pm$ 13
15 March	07 October $\pm$ 13
01 April	25 October $\pm$ 13
15 April	18 November $\pm$ 13
01 May	20 November $\pm$ 13
15 May	01 December $\pm$ 5
01 June	10 December $\pm$ 5
15 June	16 December $\pm$ 5
01 July	23 December $\pm$ 5
15 July	31 December $\pm$ 5
01 August	16 January $\pm$ 11
15 August	22 January $\pm$ 11
01 September	01 February $\pm$ 11
15 September	09 February $\pm$ 11
01 October	19 February $\pm$ 11
15 October	28 February $\pm$ 11
01 November	22 March $\pm$ 7
15 November	06 April $\pm$ 11
01 December	26 April $\pm$ 11
15 December	16 May $\pm$ 11





# Conclusions

The growth in diameter of the flower buds in the different seasons showed double sigmoid curves, attributed to the growth of lateral buds. This fact emphasizes the importance of their early removal. The final flower bud diameter and length depended on the date the buds were labeled, the diameter varying from 6.2 cm (June) and 7 cm (September), and the length varied from 10.2 cm (April) to 11.1 cm (September).

The estimated base temperature for the period from bud 1 cm in diameter to harvest stage in Huapi was around 1°C.

Based on that base temperature, the calculated GDH were from 46,192 GDH (June buds) to 52,016 (December buds)

The days to harvest stage also depended on the season, being from 150 to 202 days for buds labeled in December and April, respectively.

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