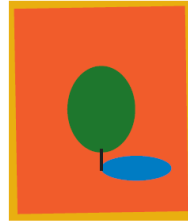


**B O U N D A R Y  
B E N D  
LIMITED**



























# **Determinación del momento óptimo de cosecha Factores agronómicos y económicos**

**ArgOliva 2018  
San Juan, Argentina**



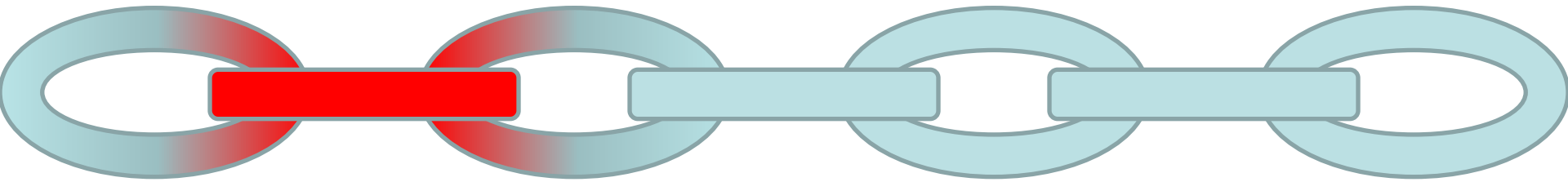


# OUR INTEGRATED BUSINESS

	<p><b>NURSERY</b></p> 	
	<p><b>GROVE OPERATIONS</b></p> 	
	<p><b>HARVESTING TECHNOLOGY</b></p> 	
	<p><b>PROCESSING / STORAGE</b></p> 	
	<p><b>LABORATORY / R&amp;D</b></p> 	
	<p><b>BOTTLING / DISTRIBUTION</b></p> 	
	<p><b>EXTRA VIRGIN OLIVE OILS</b></p> 	
	<p><b>BY-PRODUCT VALUE-ADDING</b></p> 	



# La cosecha es el aspecto mas crítico de la cadena del aceite de oliva



Olivar

**Cosecha**

Procesamiento

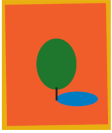
Almacenaje

Blending

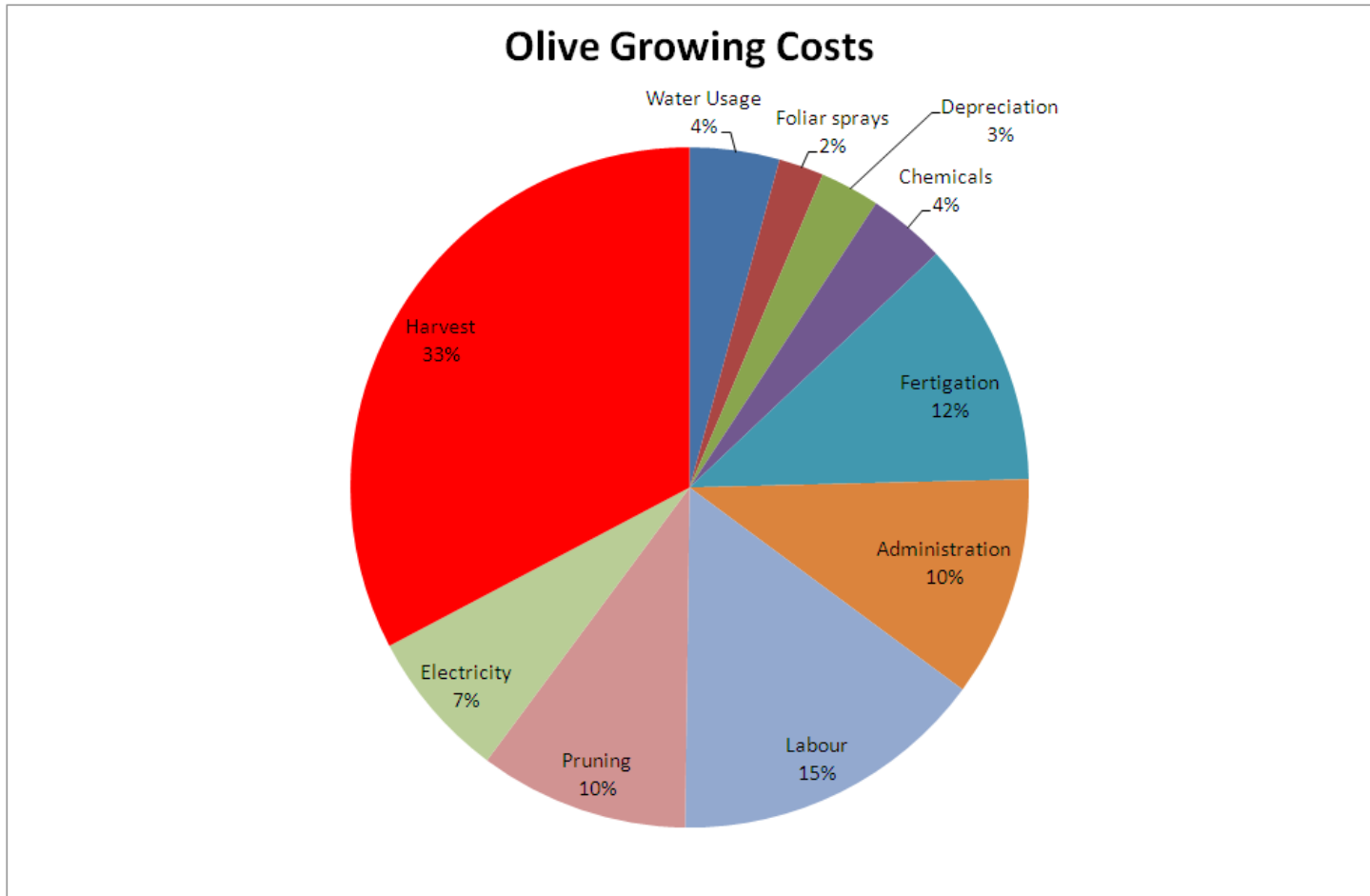
Envasado

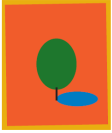
Marketing





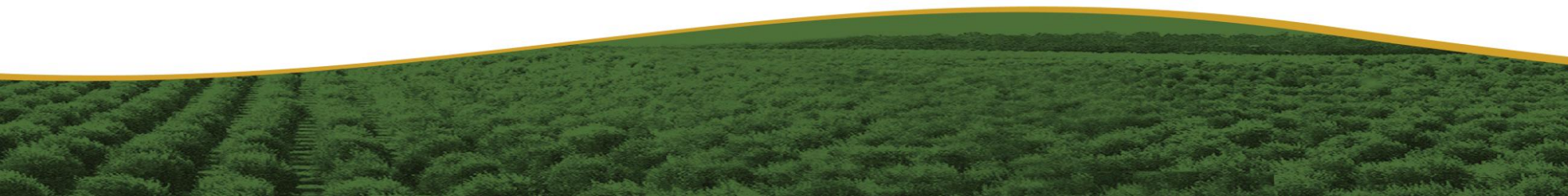
# Y el mas caro...





# Determinación del momento óptimo de cosecha

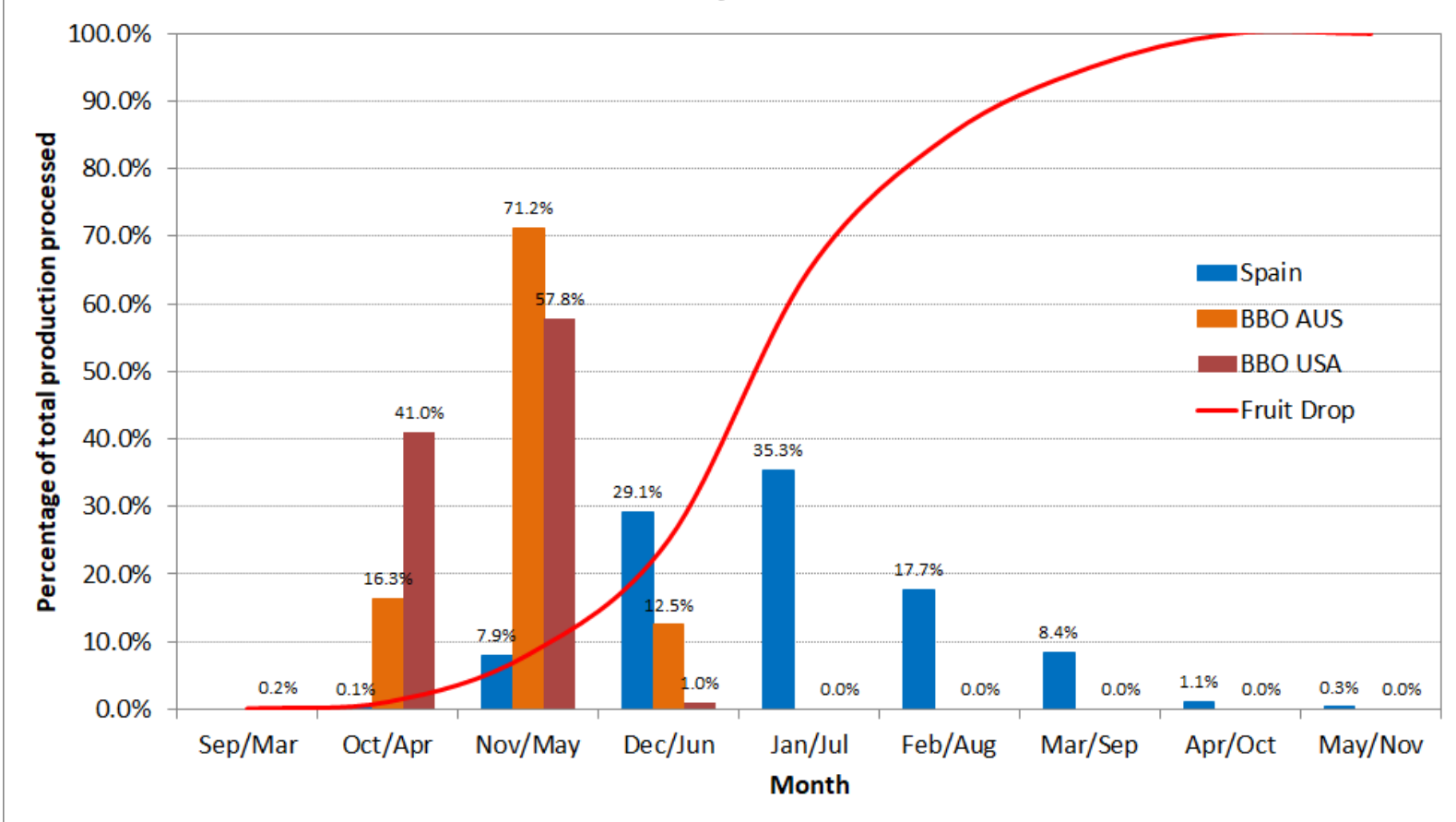
- Máximo rendimiento de aceite.
- Máxima calidad de aceite (al menos el mayor rédito).
- Mínima pérdida de fruta.
- La cosecha del próximo año no debe ser afectada.
- La cosecha debe ser lo más económica posible.





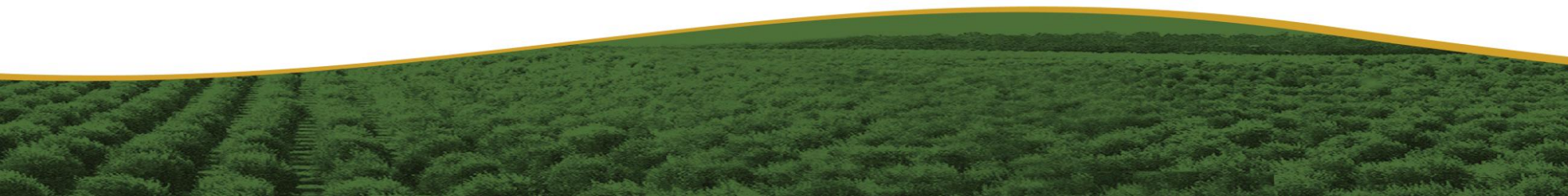
# Momento óptimo de cosecha

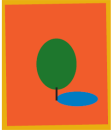
**Comparison between harvest times in Spain and Boundary Bend Ltd**



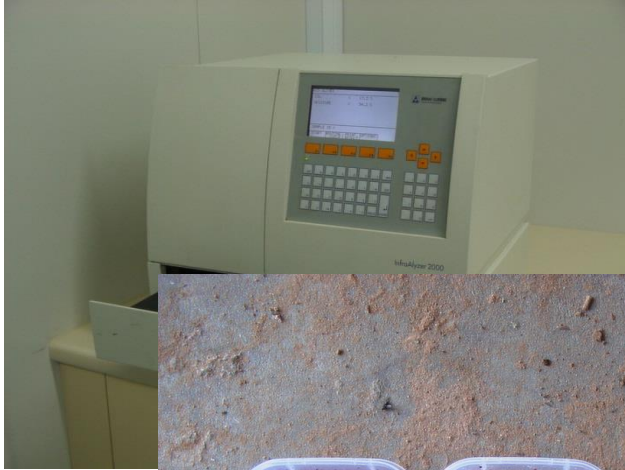


# Maximo rendimiento de aceite

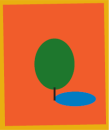




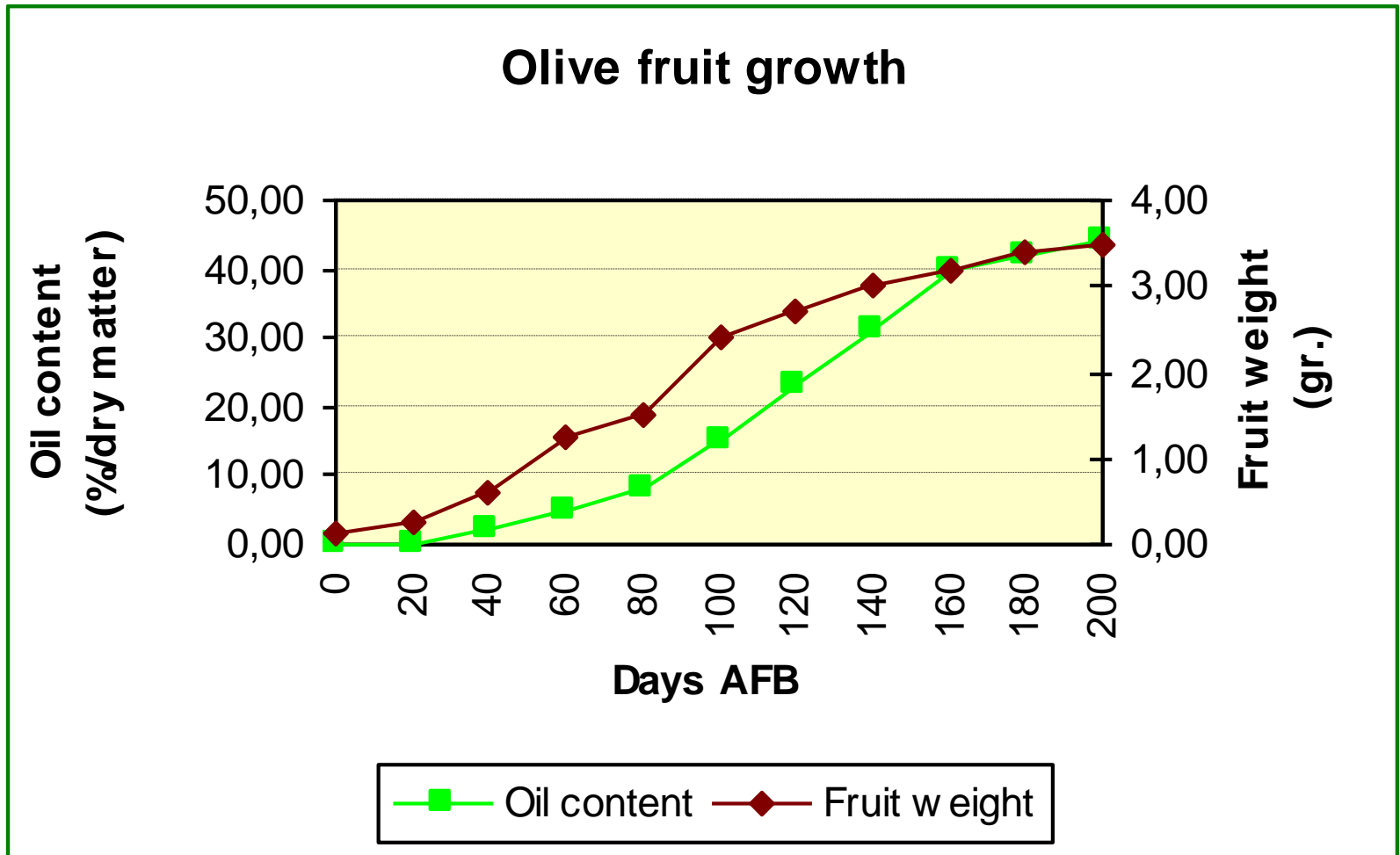
# Rendimientos de aceite







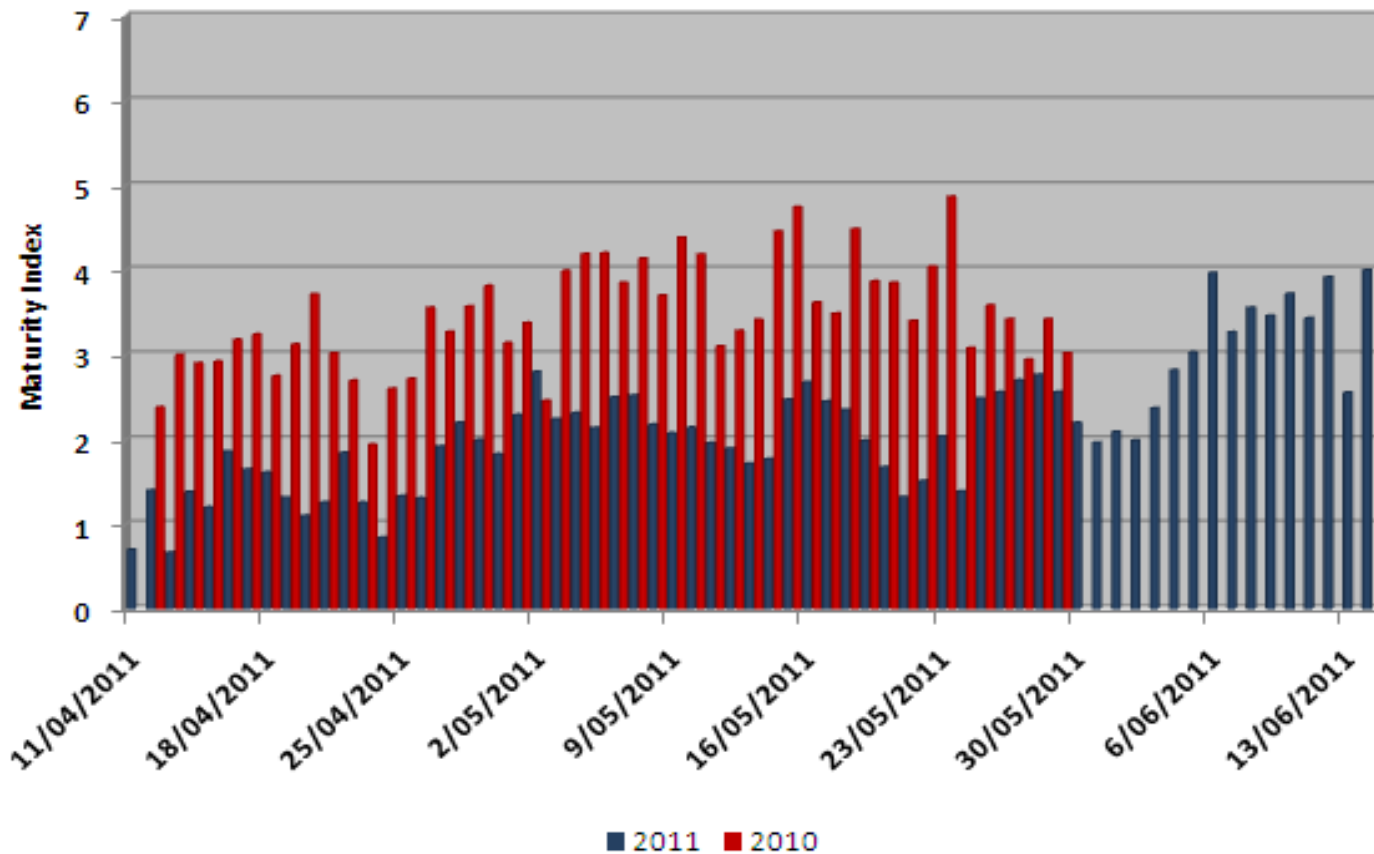
# Rendimientos de aceite





# Rendimientos de aceite

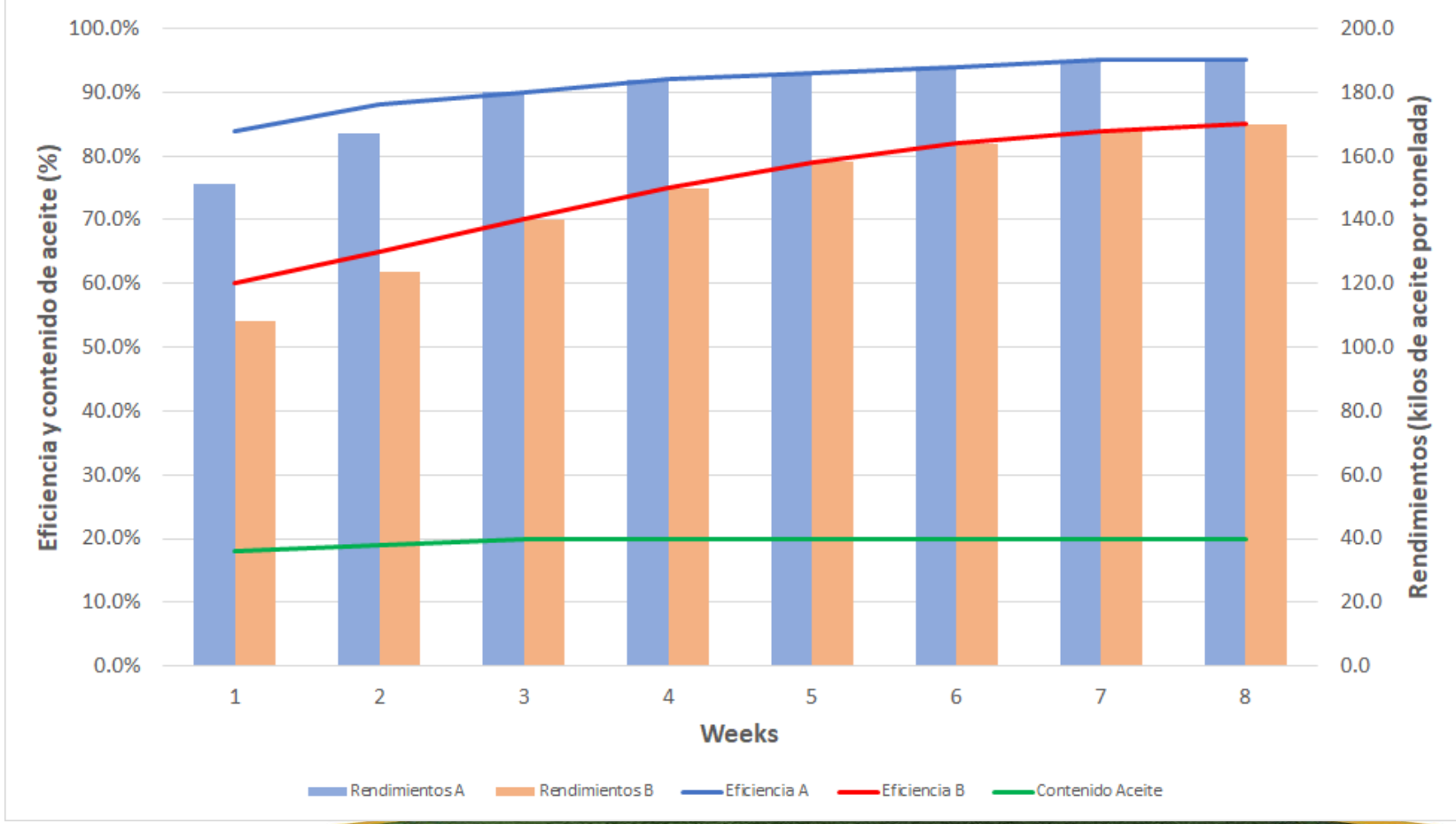
## Maturity Index 2010-2011 (BBE)





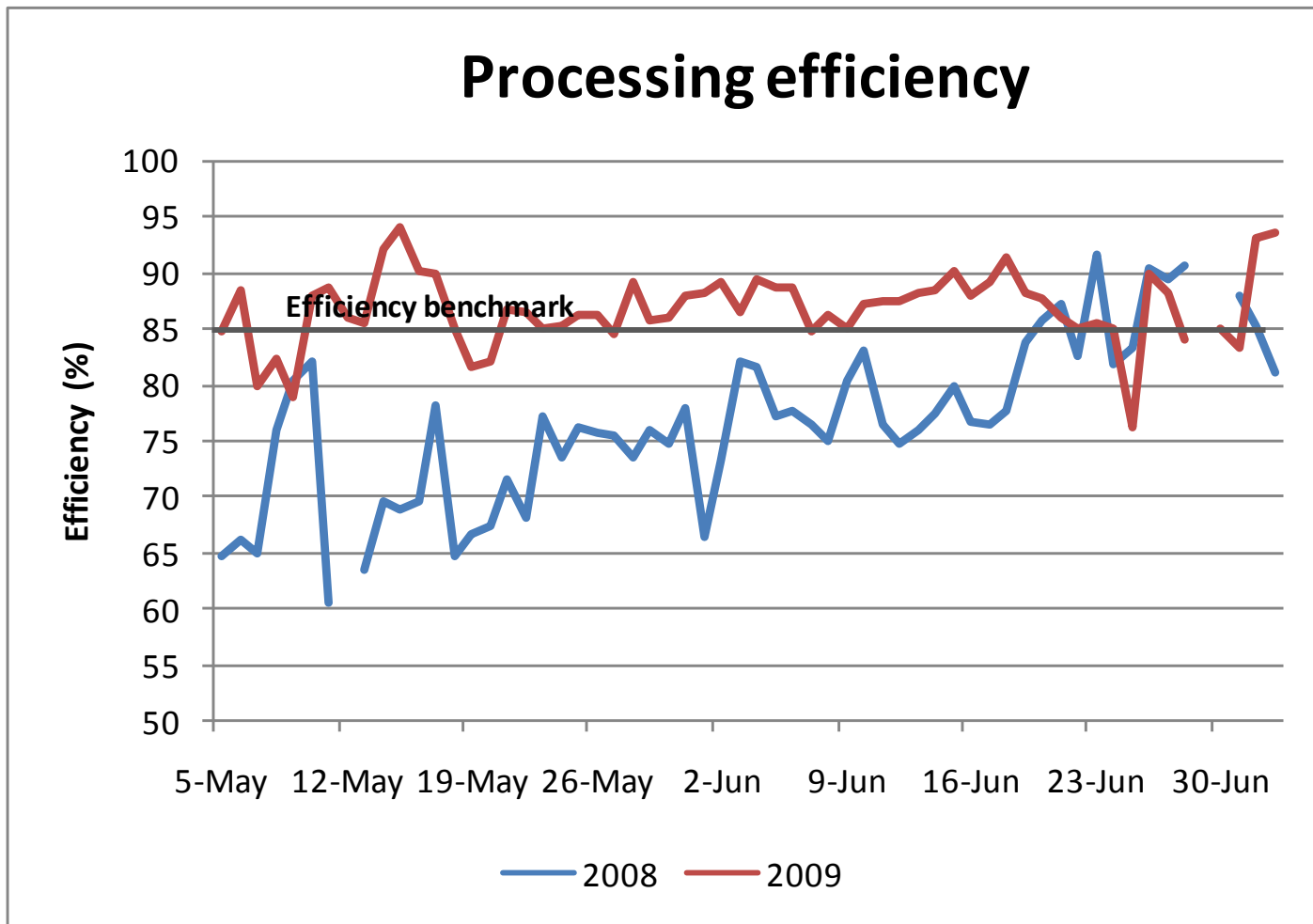
# Rendimientos de aceite

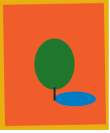
## Evolución de eficiencias de extracción y rendimientos en dos plantas



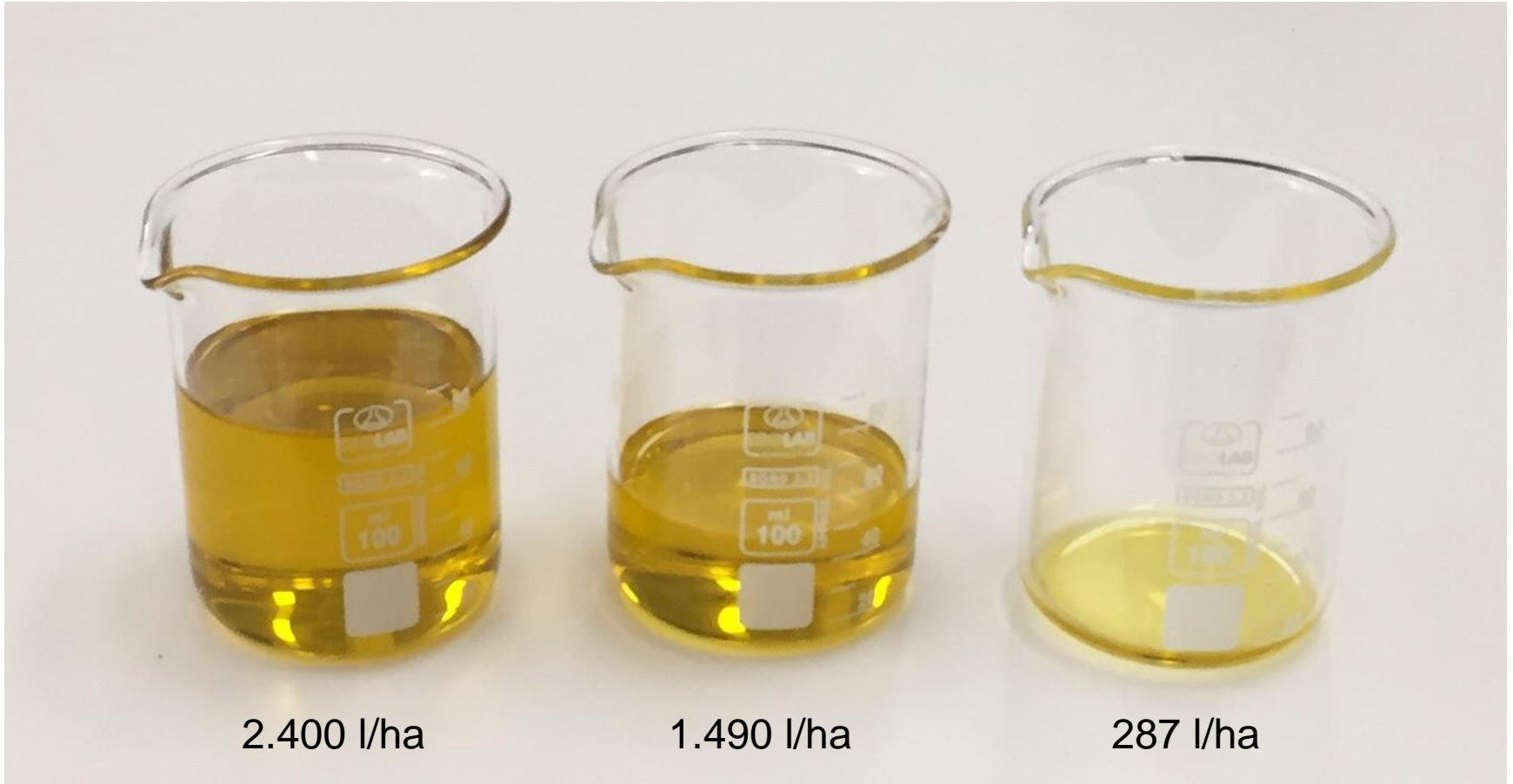


# Rendimientos de aceite





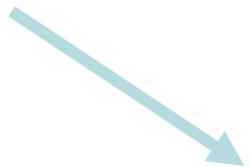
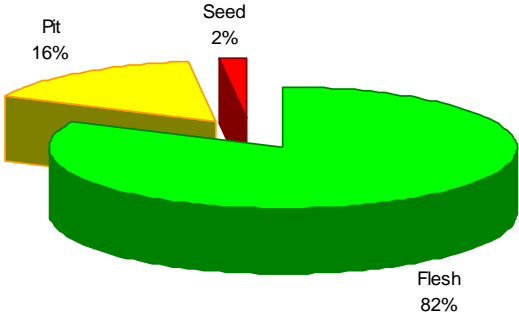
# Rendimiento de aceite



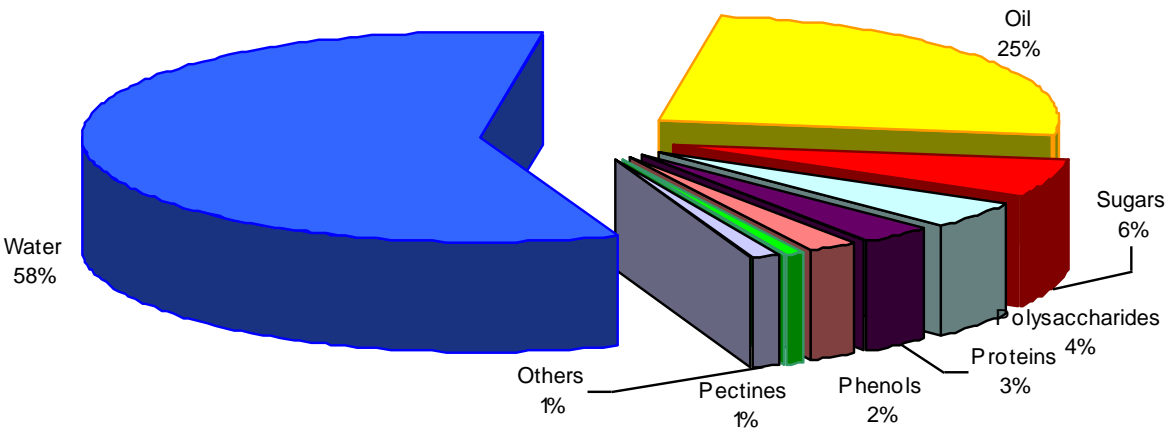


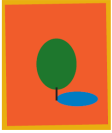
# El rol del riego

**Fruit composition**

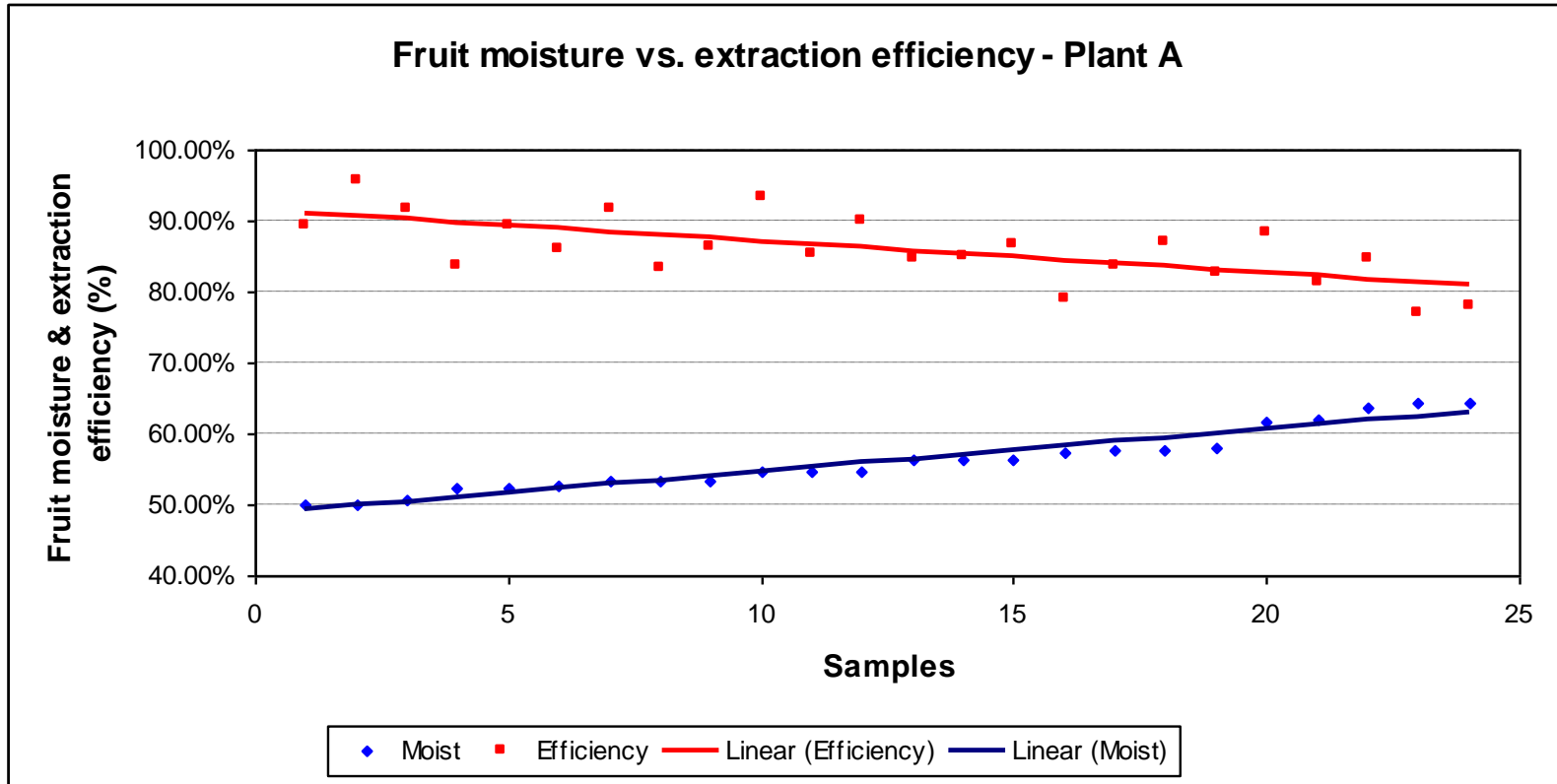


**Flesh composition**



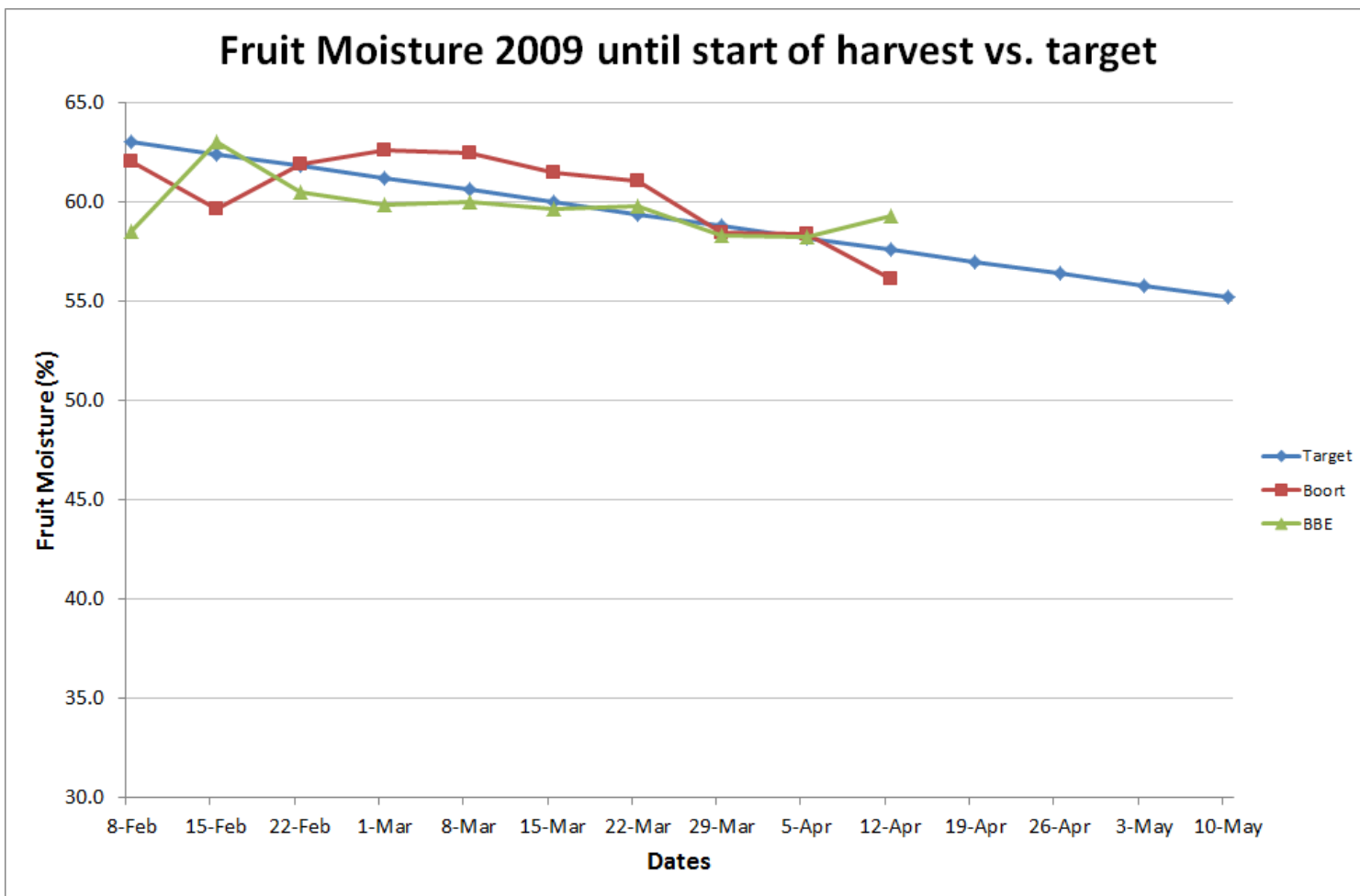


# Eficiencia de proceso





# El rol del riego







# Rendimiento de aceite

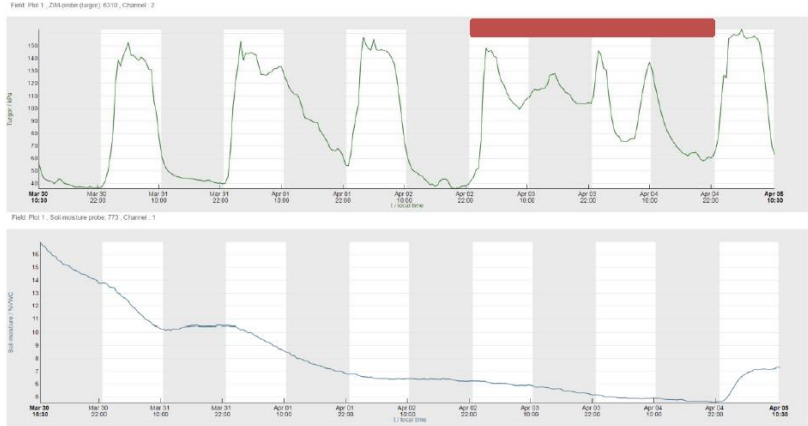
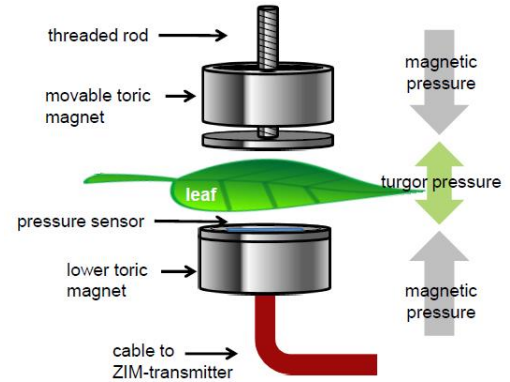
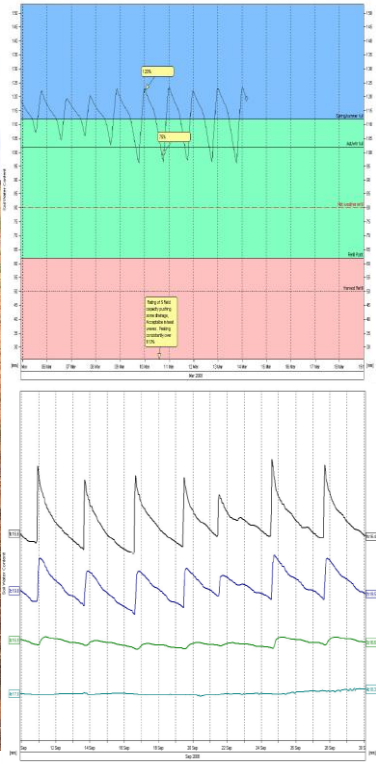


2.0 gr/fruto

1.4 gr/fruto

0.9 gr/fruto

# El rol del riego



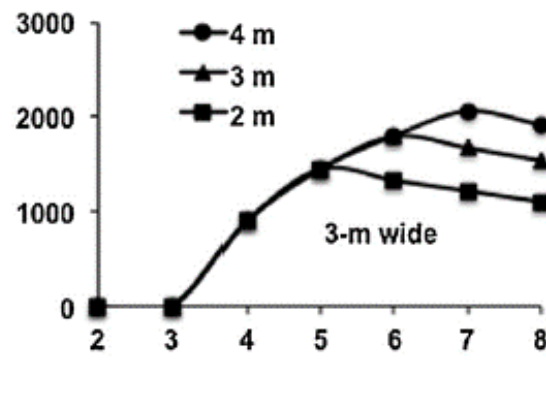
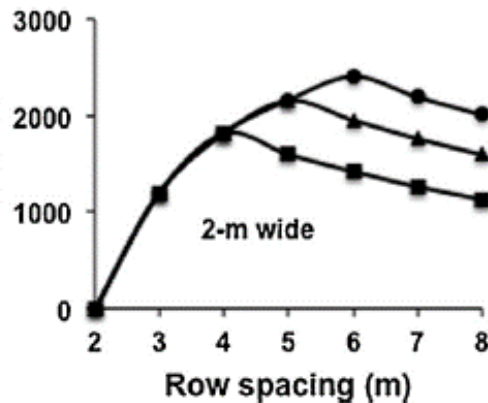
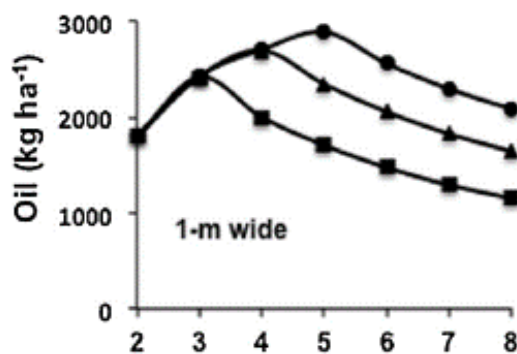
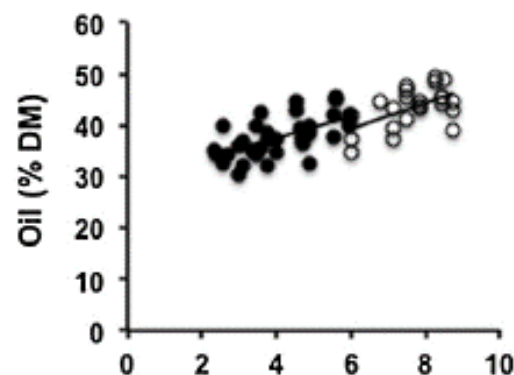
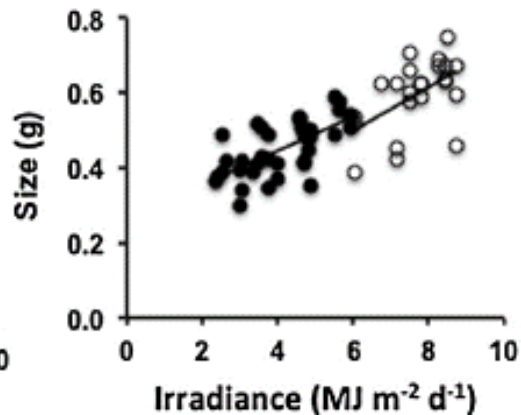
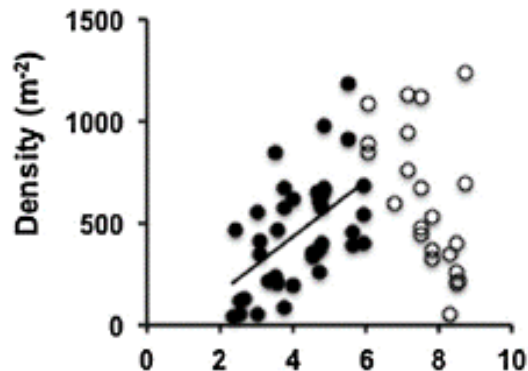


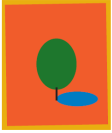
# El rol del riego





# Manejo de la Copa





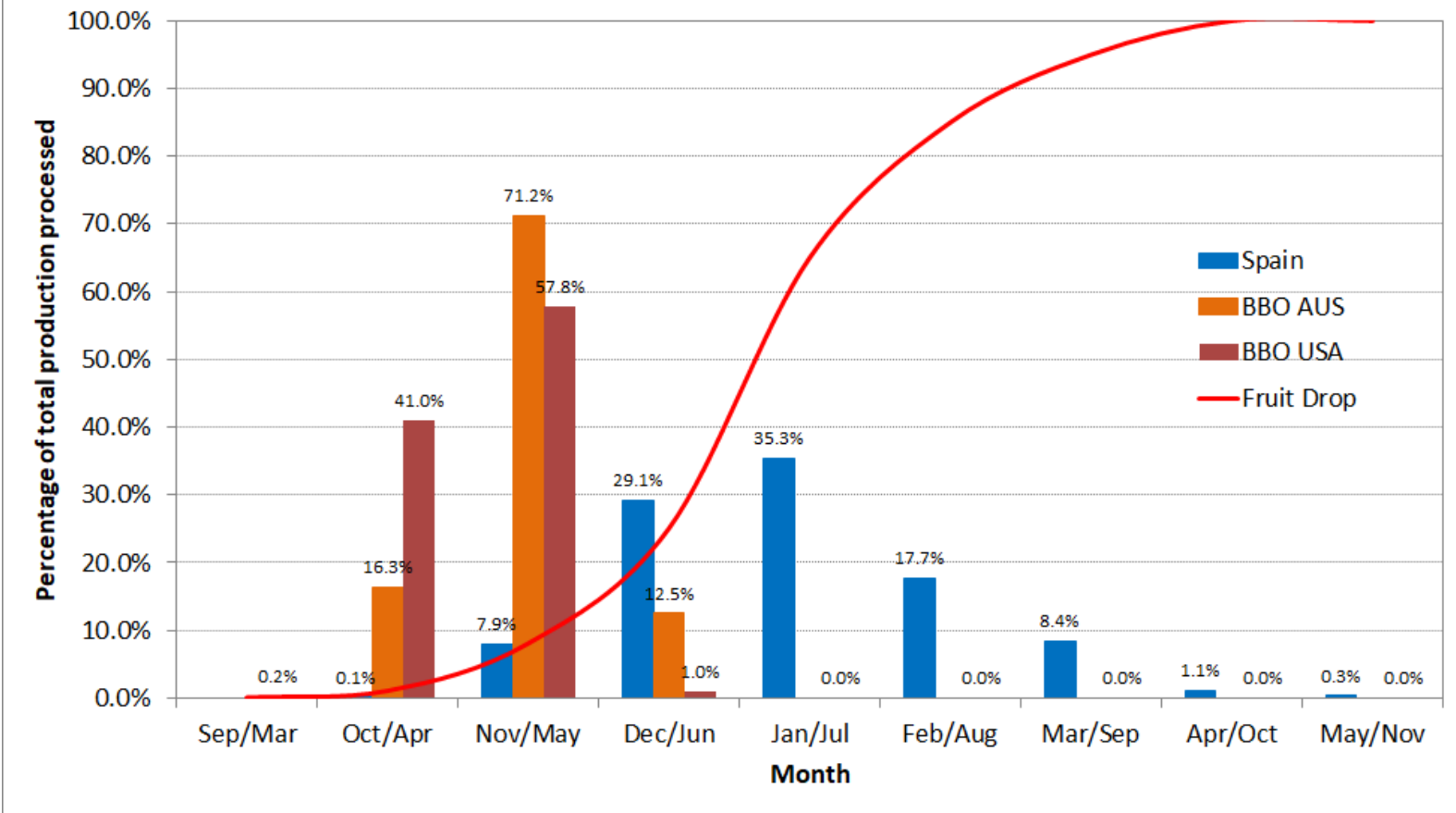
Maxima calidad de aceite (o redito)





# Calidad de aceite

**Comparison between harvest times in Spain and Boundary Bend Ltd**

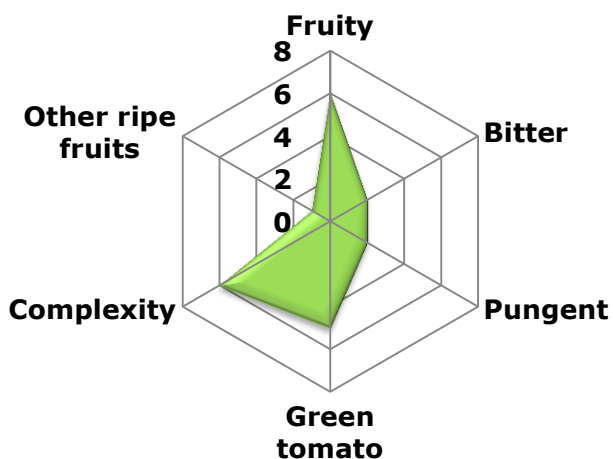




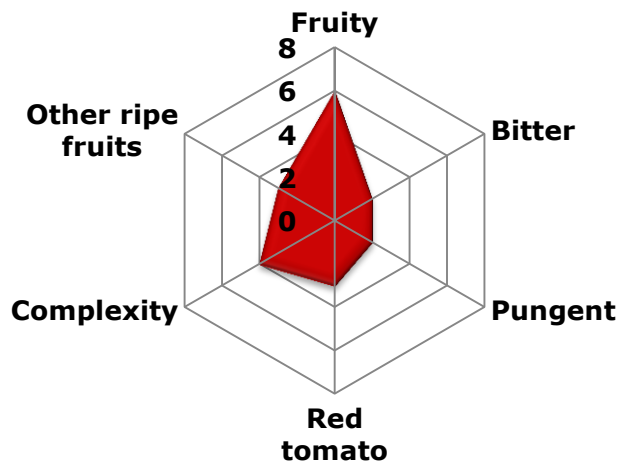
# Calidad de aceite

## Picual

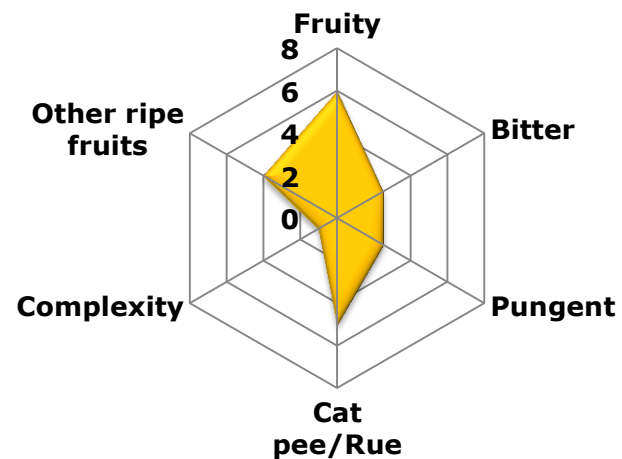
### Cosecha Temprana



### Cosecha Media

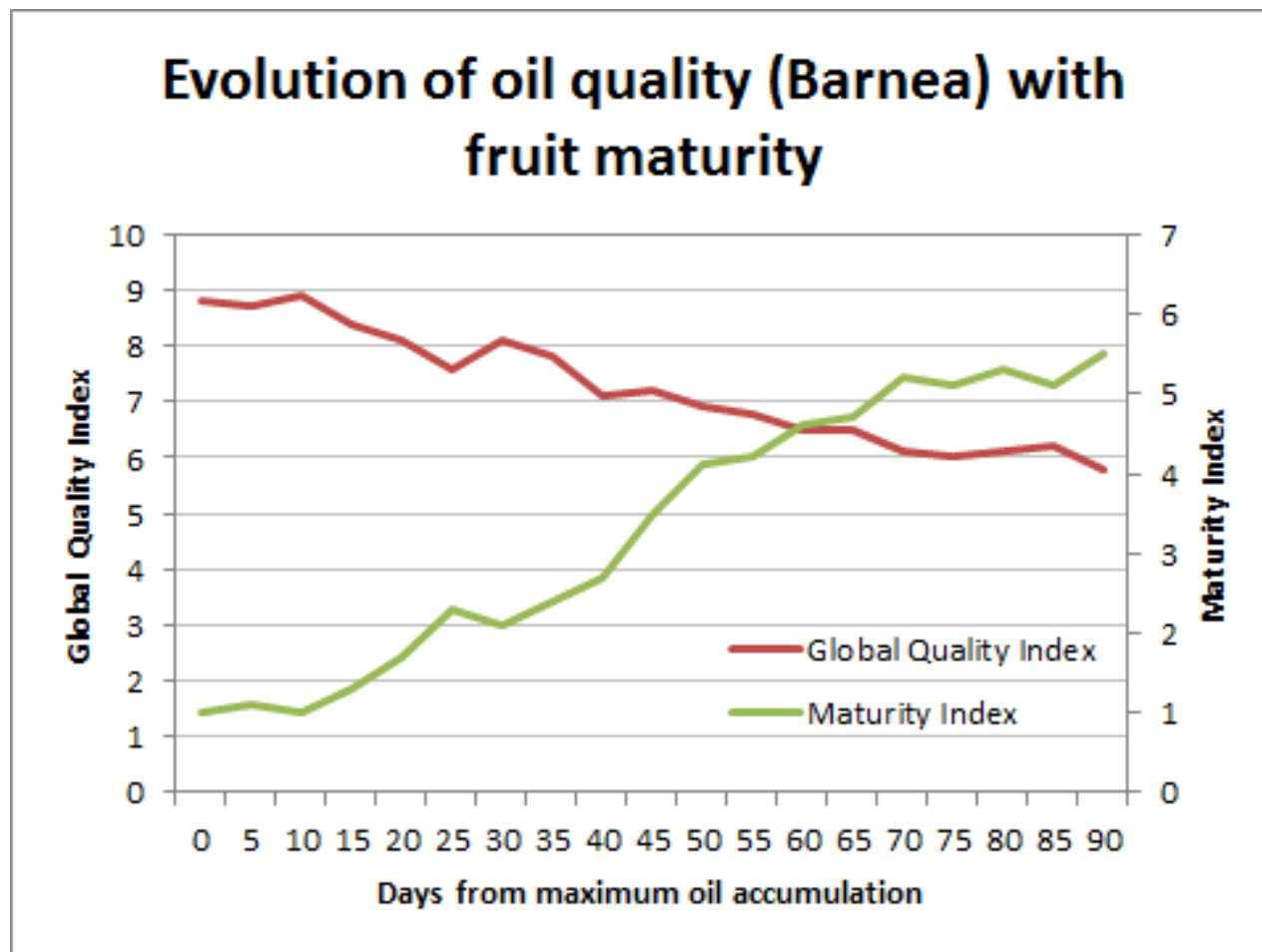


### Cosecha Tardía





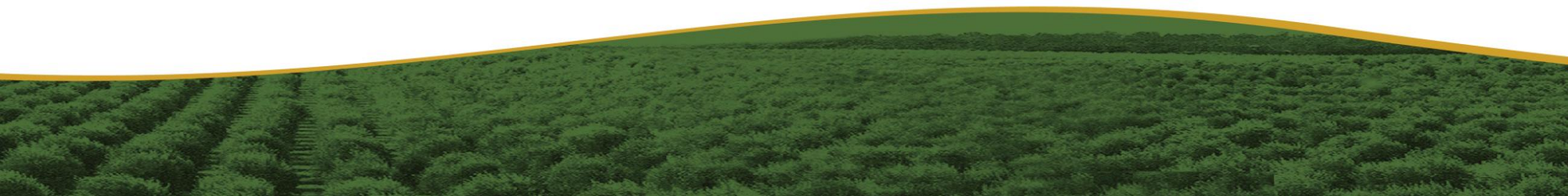
# Calidad de aceite







No afectar la cosecha del año siguiente





# Impacto en la cosecha siguiente

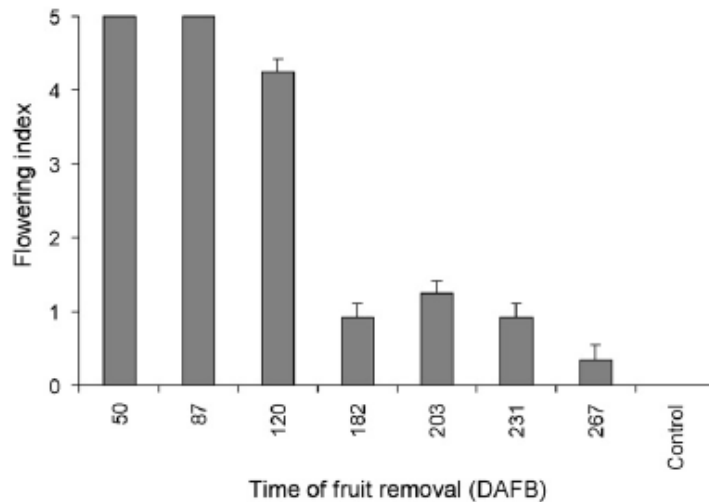
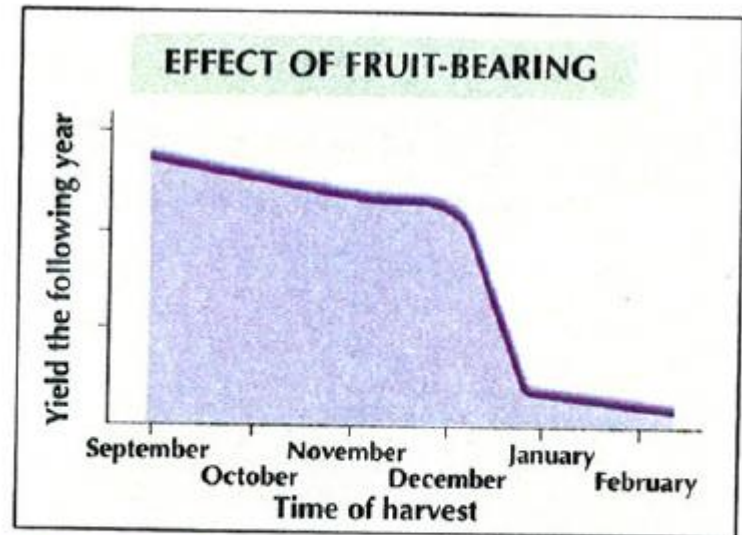


Fig. 3. Effect of manual fruit removal at different times after full bloom in an On-year, starting on June 6, 2006 (50 days after full bloom—DAFB), on the following bloom of olive trees (cv. Coratina), ranked (0—no bloom to 5—heavy bloom) on April 15, 2007. Values are means of six trees  $\pm$  SE.

Dag, A et al; Timing of fruit removal affects concurrent vegetative growth and subsequent return bloom and yield in olive (*Olea europaea* L.); *Scientia Horticulturae*; 2009

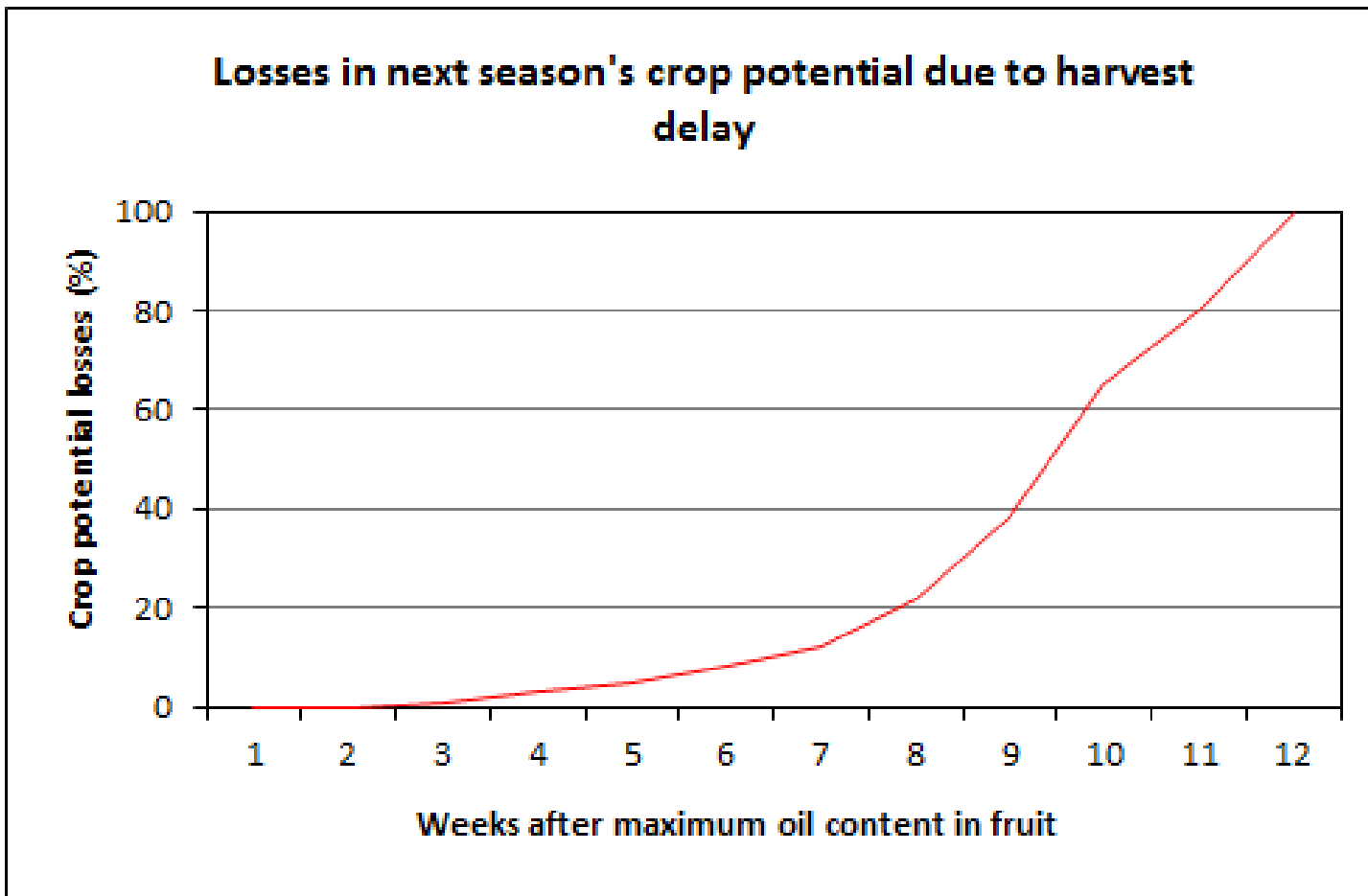


**FIGURE 14.** The relation between harvest time in the current year on the yield of olives in the following season.

Lavee, S et al; *Biology and physiology of the olive*; World Olive Encyclopedia; IOC; 1996



# Impacto en la cosecha siguiente





Cosecha lo mas economica posible





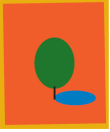
# Tipo de cosechadora





# Eficiencia de cosecha

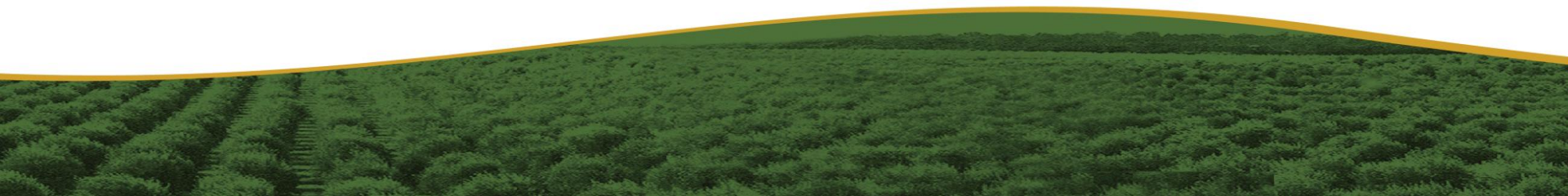




# Eficiencia de cosecha

## Aspectos propios del cultivo

- Fuerza de retención de fruta (influenciado por la variedad, el ambiente, el estado de madurez, el riego, el uso de agentes de abscisión)
- Tamaño de fruta (influenciado por la variedad, el manejo, la carga)
- Largo del pedúnculo (influenciado por la variedad)





Source: Ravetti, L. & Robb, S. Continuous mechanical harvesting in modern Australian olive growing systems. Adv. Hort. Sci. 2010 24(1)

Table 1 - Harvesting Efficiency (in %)

Harvester	Early Harvest				Late Harvest				Average
	Barnea		Frantoio		Barnea		Frantoio		
	Light Crop	Heavy Crop	Light Crop	Heavy Crop	Light Crop	Heavy Crop	Light Crop	Heavy Crop	
Straddle Harvester	91.0% a	88.0% a	89.0% a	86.0% a	96.0% a	93.0% a	93.0% a	91.0% a	90.9%
Side-by-side Shaker	80.0% b	62.0% b	73.0% b	58.0% b	91.0% b	82.0% b	86.0% b	75.0% b	75.9%

Values in the same column followed by the same letter do not significantly differ according to Duncan's test (P 0.05)

Table 2 - Average Speed (in trees/hour of effective operation)

Harvester	Early Harvest				Late Harvest				Average
	Barnea		Frantoio		Barnea		Frantoio		
	Light Crop	Heavy Crop	Light Crop	Heavy Crop	Light Crop	Heavy Crop	Light Crop	Heavy Crop	
Straddle Harvester	105 a	82 a	85 a	64 a	182 a	134 a	125 a	90 a	108
Side-by-side Shaker	140 b	112 b	135 b	90 b	176 a	164 b	154 b	136 b	138

Values in the same column followed by the same letter do not significantly differ according to Duncan's test (P 0.05)

Table 3 - Canopy Damage (in %)

	Early Harvest				Late Harvest				Average
	Barnea		Frantoio		Barnea		Frantoio		
	Light Crop	Heavy Crop	Light Crop	Heavy Crop	Light Crop	Heavy Crop	Light Crop	Heavy Crop	
Straddle Harvester	2.4% a	3.1% a	2.6% a	3.5% a	1.5% a	2.5% a	1.6% a	2.8% a	2.5%
Side-by-side Shaker	0.5% b	1.0% b	0.9% b	1.2% b	0.3% b	0.6% b	0.5% b	0.8% b	0.7%

Values in the same column followed by the same letter do not significantly differ according to Duncan's test (P 0.05)

Table 4 - Trunk Damage (in % of tree with >50% ring bark)

	Early Harvest				Late Harvest				Average
	Barnea		Frantoio		Barnea		Frantoio		
	Light Crop	Heavy Crop	Light Crop	Heavy Crop	Light Crop	Heavy Crop	Light Crop	Heavy Crop	
Straddle Harvester	0.0% a	0.0% a	0.0% a	0.0% a	0.0% a	0.0% a	0.0% a	0.0% a	0.0%
Side-by-side Shaker	0.4% b	0.6% b	0.3% b	0.4% b	0.2% b	0.4% b	0.1% a	0.3% b	0.3%

Values in the same column followed by the same letter do not significantly differ according to Duncan's test (P 0.05)





Source: Ravetti, L. & Robb, S. Continuous mechanical harvesting in modern Australian olive growing systems. Adv. Hort. Sci. 2010 24(1)

Table 1 - Harvesting Efficiency (in %)

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	Light Crop	Heavy Crop	Light Crop	Heavy Crop	Light Crop	Heavy Crop	Light Crop	Heavy Crop	
Straddle Harvester	105 a	82 a	85 a	64 a	182 a	134 a	125 a	90 a	108
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Side-by-side Shaker	0.5% b	1.0% b	0.9% b	1.2% b	0.3% b	0.6% b	0.5% b	0.8% b	0.7%

Values in the same column followed by the same letter do not significantly differ according to Duncan's test (P 0.05)

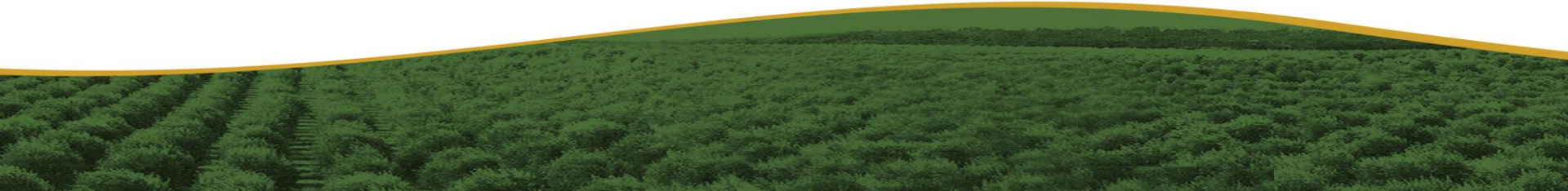
Table 4 - Trunk Damage (in % of tree with >50% ring bark)

	Early Harvest				Late Harvest				Average
	Barnea		Frantoio		Barnea		Frantoio		
	Light Crop	Heavy Crop	Light Crop	Heavy Crop	Light Crop	Heavy Crop	Light Crop	Heavy Crop	
Straddle Harvester	0.0% a	0.0% a	0.0% a	0.0% a	0.0% a	0.0% a	0.0% a	0.0% a	0.0%
Side-by-side Shaker	0.4% b	0.6% b	0.3% b	0.4% b	0.2% b	0.4% b	0.1% a	0.3% b	0.3%

Values in the same column followed by the same letter do not significantly differ according to Duncan's test (P 0.05)

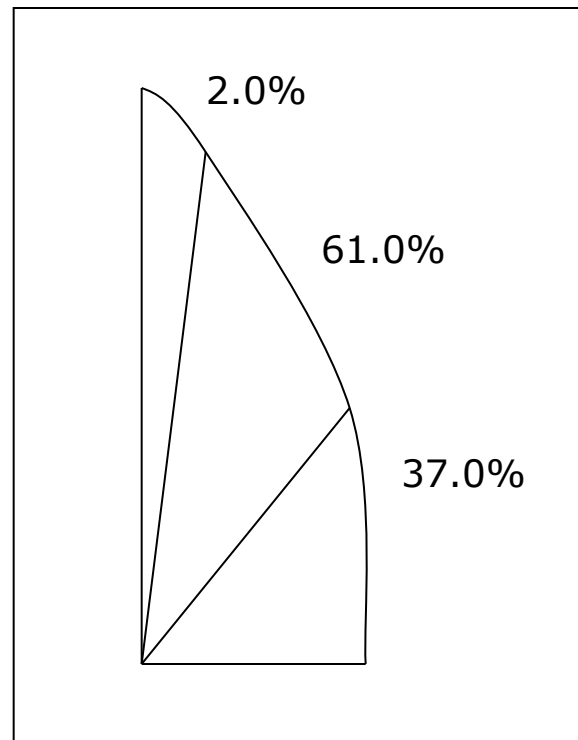
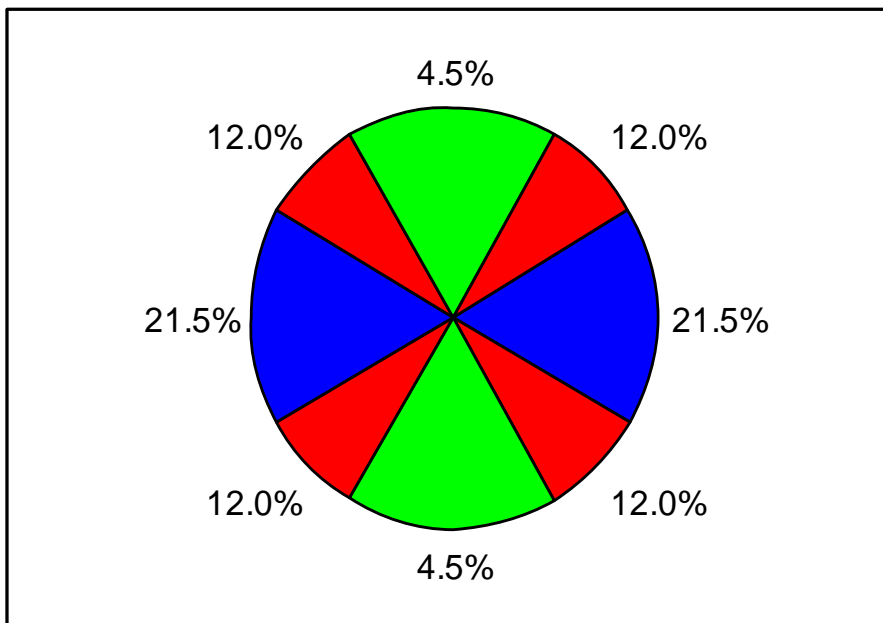


# Eficiencia de cosecha y formación de la planta





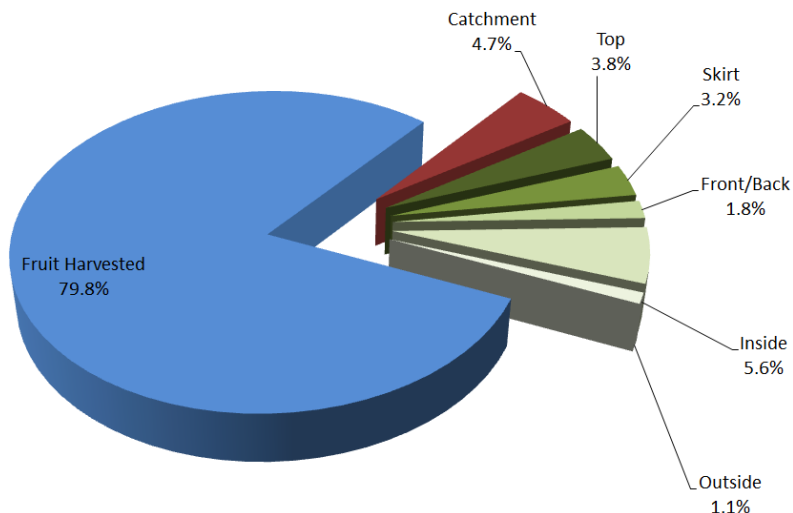
# Eficiencia de cosecha y formación de la planta



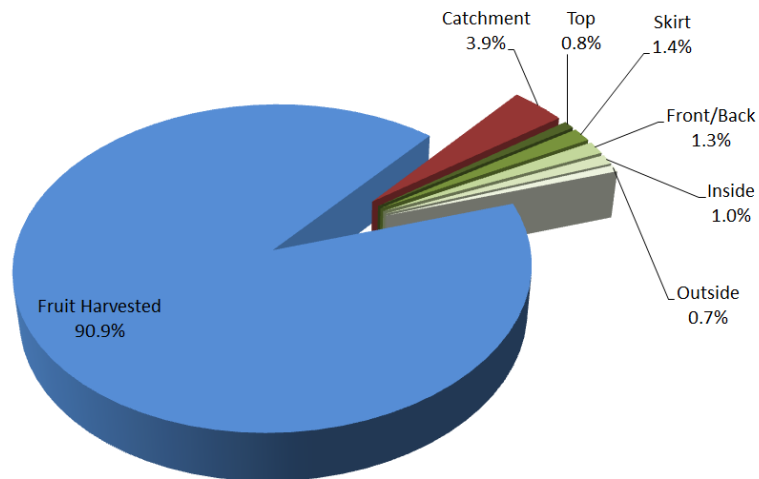


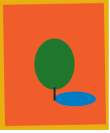
# Eficiencia de cosecha y formación de la planta

Harvest Efficiency Breakdown (Not Well Trained Trees)



Harvest Efficiency Breakdown (Well Trained Trees)





# Eficiencia de cosecha y formación de la planta

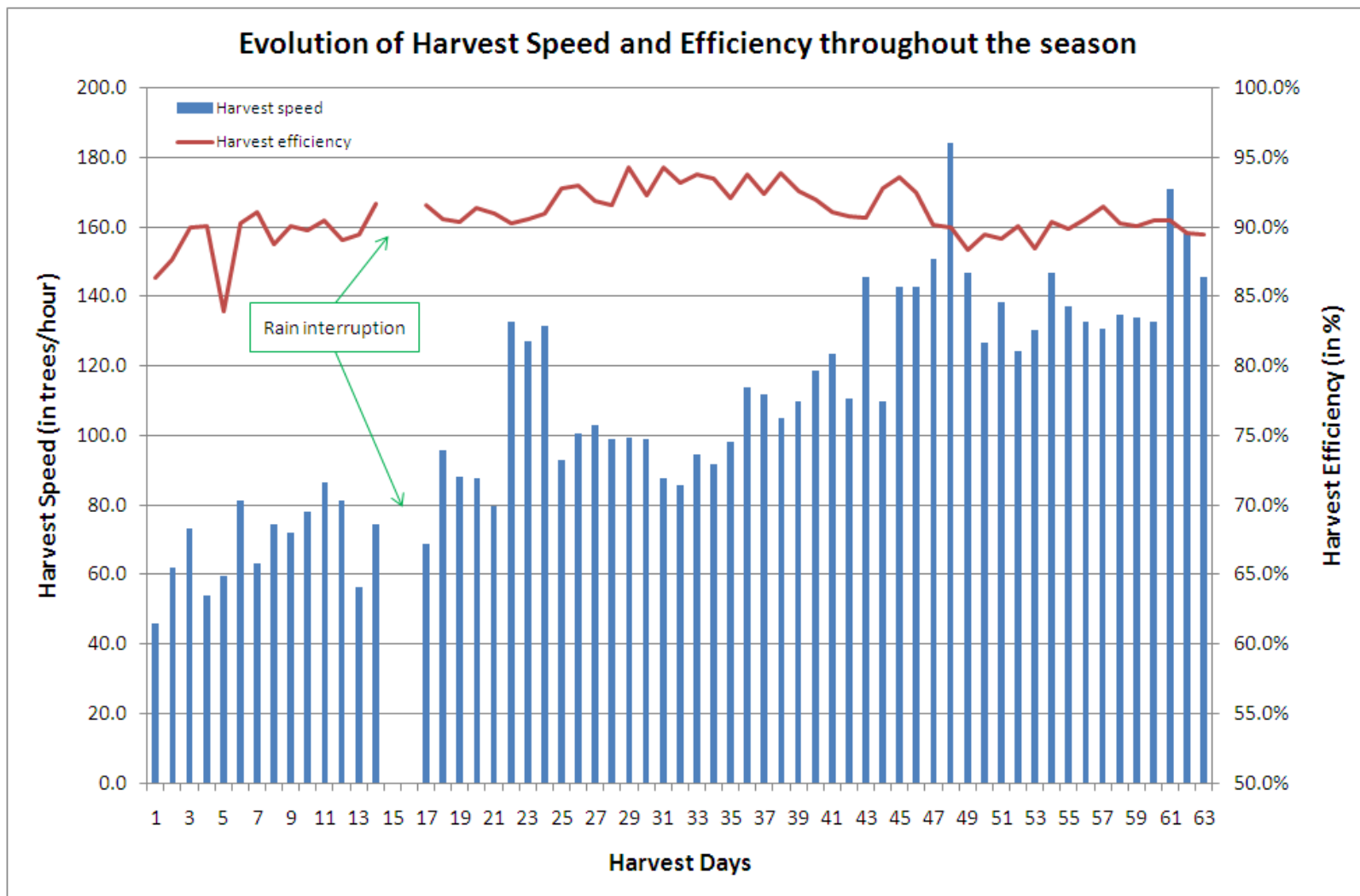
## Harvest Speed and Cost for different tree shapes

Tree Shape	Efficiency	Harvest Speed	US\$/kg
Free Palm/Central Leader	90%	0.72 km/h	0.05
Free Globe/Vase	87%	0.41 km/h	0.09

Trial conducted with Picual trees (8 year-old and 38 kg/tree average @ 6x4m; year 2009)



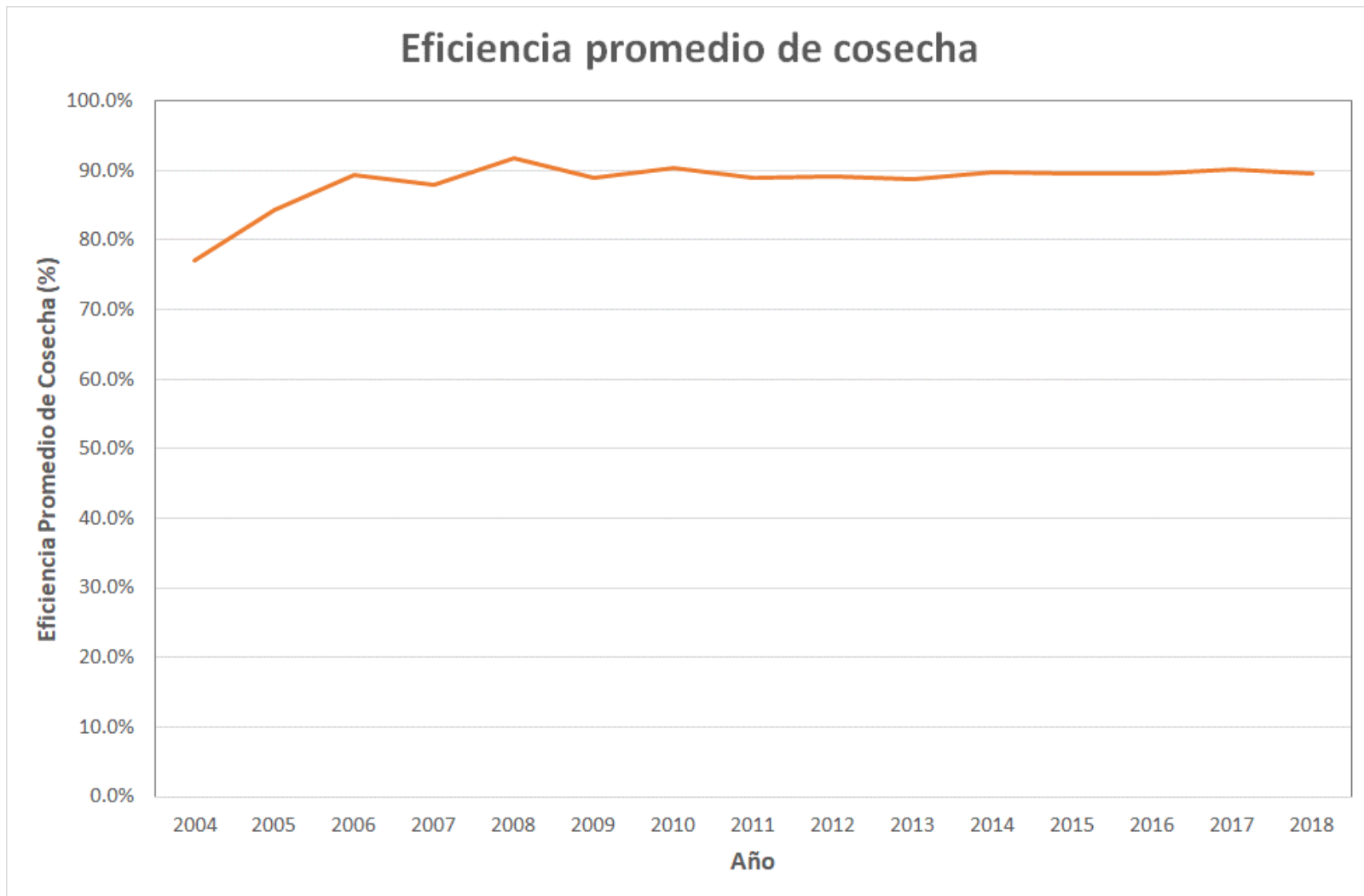
# Velocidad de cosecha vs. eficiencia



Source: Ravetti, L. & Robb, S. Continuous mechanical harvesting in modern Australian olive growing systems. Adv. Hort. Sci. 2010 24(1)



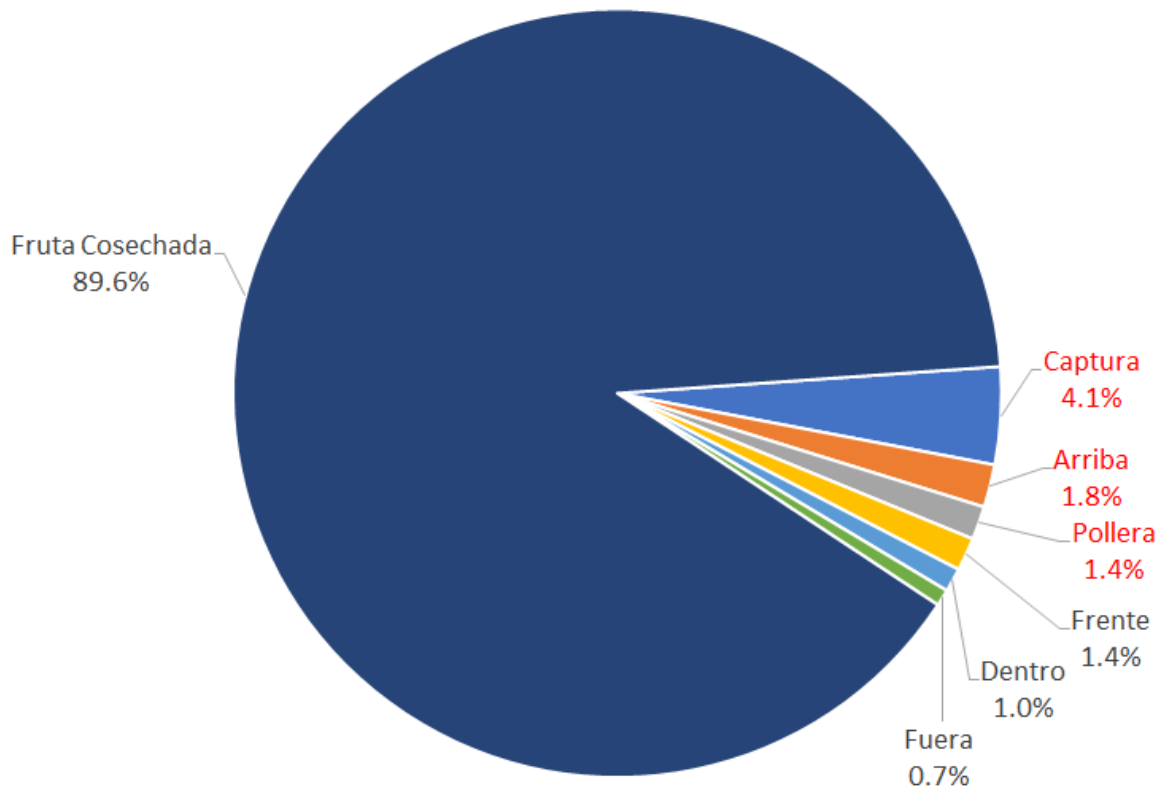
# Control, evaluación y mejora





# Control, evaluación y mejora

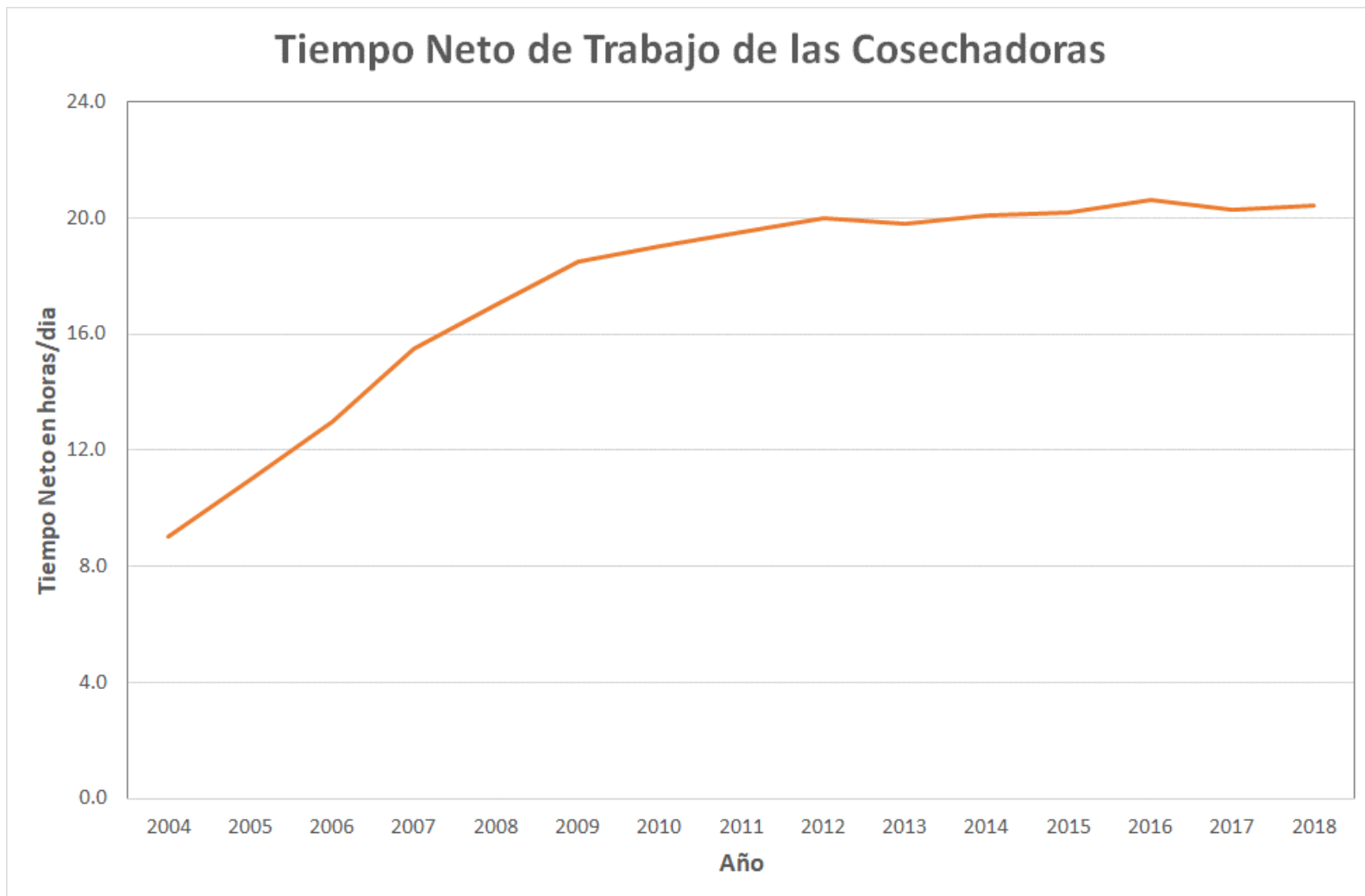
Detalle de Eficiencia de Cosecha (%)







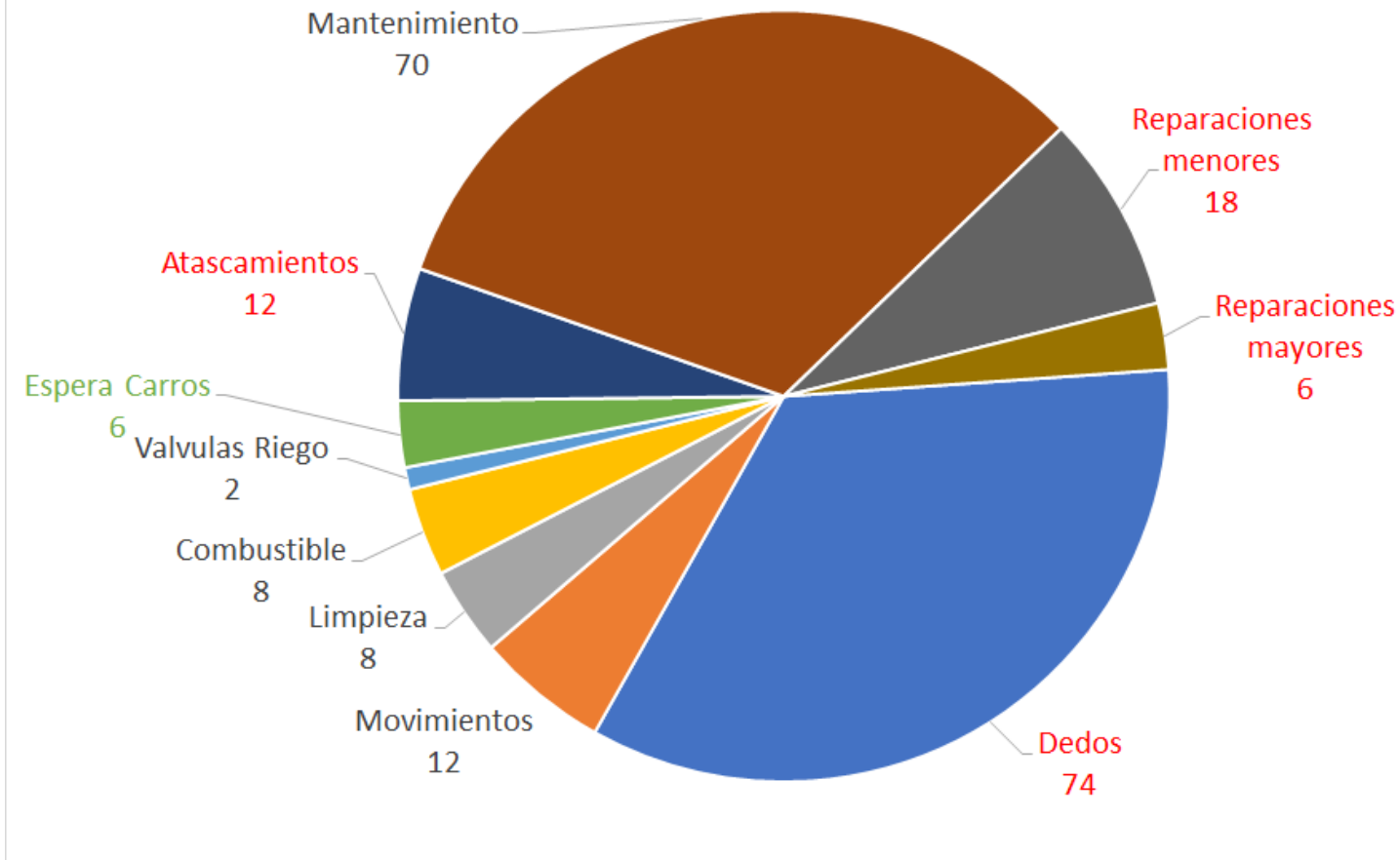
# Tiempos muertos (confiabilidad)





# Tiempos muertos

Detalle de los tiempos muertos (en minutos)





# Control, evaluación y mejora

BOORT 2018

Harvester	Shift	Break down information (in minuts)														Consumables				Fish Plates		
		Finger/HN		New Area	Cleaning	Tree/Wire	Fuel	Valve pas	Washdow	Wait trail	Blockages	Service	Minor rep	Major rep	Other	TOTAL	Finger	sup.	Half Moon	sup.	harv.	sup.
		P	N	C	T	F	V	H	W	B	S	R	M	O		harv.	sup.	harv.	sup.	harv.	sup.	
TC 6	am	2123	275	125	0	248	87	30	40	65	1131	385	80	20	4609	783	300	13	7	15	5	
TC 6	pm	2690	405	260	0	274	245	0	15	315	433	485	240	175	5537	1108	1200	20	19	9	12	
TC 7	am	2800	505	170	0	327	195	35	50	325	475	685	0	195	5762	1230	400	59	5	11	3	
TC 7	pm	3758	420	510	7	290	184	45	55	207	940	615	245	401	7677	985	1100	18	27	9	4	
TC 8	am	3152	385	93	15	377	175	0	0	45	1070	565	75	665	6617	611	225	21	1	2	0	
TC 8	pm	2645	205	201	0	423	345	0	0	135	332	805	180	512	5783	623	625	21	10	12	9	
TC 9	am	3105	530	335	35	376	272	0	5	350	723	1502	605	345	8183	858	650	41	19	2	0	
TC 9	pm	2828	140	517	0	205	190	30	10	455	367	1452	130	245	6569	1616	1075	37	28	4	3	
TC 10	am	2435	375	425	10	372	130	20	0	412	1028	315	355	465	6342	721	425	11	10	0	0	
TC 10	pm	3420	400	475	5	331	280	10	20	355	245	765	520	215	7041	1324	1400	25	16	5	0	
TC 11	am	1525	305	65	15	383	180	0	30	610	1075	270	0	315	4773	660	450	12	0	2	0	
TC 11	pm	2245	480	155	15	272	200	0	0	1095	415	420	80	200	5577	1141	1000	27	34	10	0	
TC 12	am	2590	480	255	25	364	295	20	32	302	774	789	260	580	6766	1026	500	25	9	1	0	
TC 12	pm	2257	275	403	15	346	60	35	5	330	545	731	325	335	5662	1243	1300	21	12	3	0	
TC 13	am	2375	230	90	0	389	195	0	26	1225	585	656	0	240	6011	1198	500	41	8	28	0	
TC 13	pm	2760	586	287	0	241	305	45	10	1326	875	610	90	248	7383	824	1200	50	38	2	0	
TC 15	am	3090	195	197	20	287	128	30	50	875	784	500	40	290	6486	1082	600	39	14	0	0	
TC 15	pm	1635	445	205	0	251	220	0	40	545	497	347	170	155	4510	886	1050	23	17	0	0	
<b>TOTAL</b>		<b>47433.0</b>	<b>6636.0</b>	<b>4768.0</b>	<b>162.0</b>	<b>5756.0</b>	<b>3686.0</b>	<b>300.0</b>	<b>388.0</b>	<b>8972.0</b>	<b>12294.0</b>	<b>11897.0</b>	<b>3395.0</b>	<b>5601.0</b>	<b>111288.0</b>	<b>17919.0</b>		<b>504.0</b>		<b>115.0</b>		
<b>AVERAGE</b>		<b>2635.2</b>	<b>368.7</b>	<b>264.9</b>	<b>9.0</b>	<b>319.8</b>	<b>204.8</b>	<b>16.7</b>	<b>21.6</b>	<b>498.4</b>	<b>683.0</b>	<b>660.9</b>	<b>188.6</b>	<b>311.2</b>	<b>6182.7</b>	<b>995.5</b>		<b>28.0</b>		<b>6.4</b>		
<b>AVG PER DAY PER SH</b>		<b>50.4</b>	<b>7.1</b>	<b>5.1</b>	<b>0.2</b>	<b>6.1</b>	<b>3.9</b>	<b>0.3</b>	<b>0.4</b>	<b>9.5</b>	<b>26.1</b>	<b>12.6</b>	<b>3.6</b>	<b>6.0</b>	<b>118.3</b>	<b>19.1</b>		<b>0.5</b>		<b>0.1</b>		

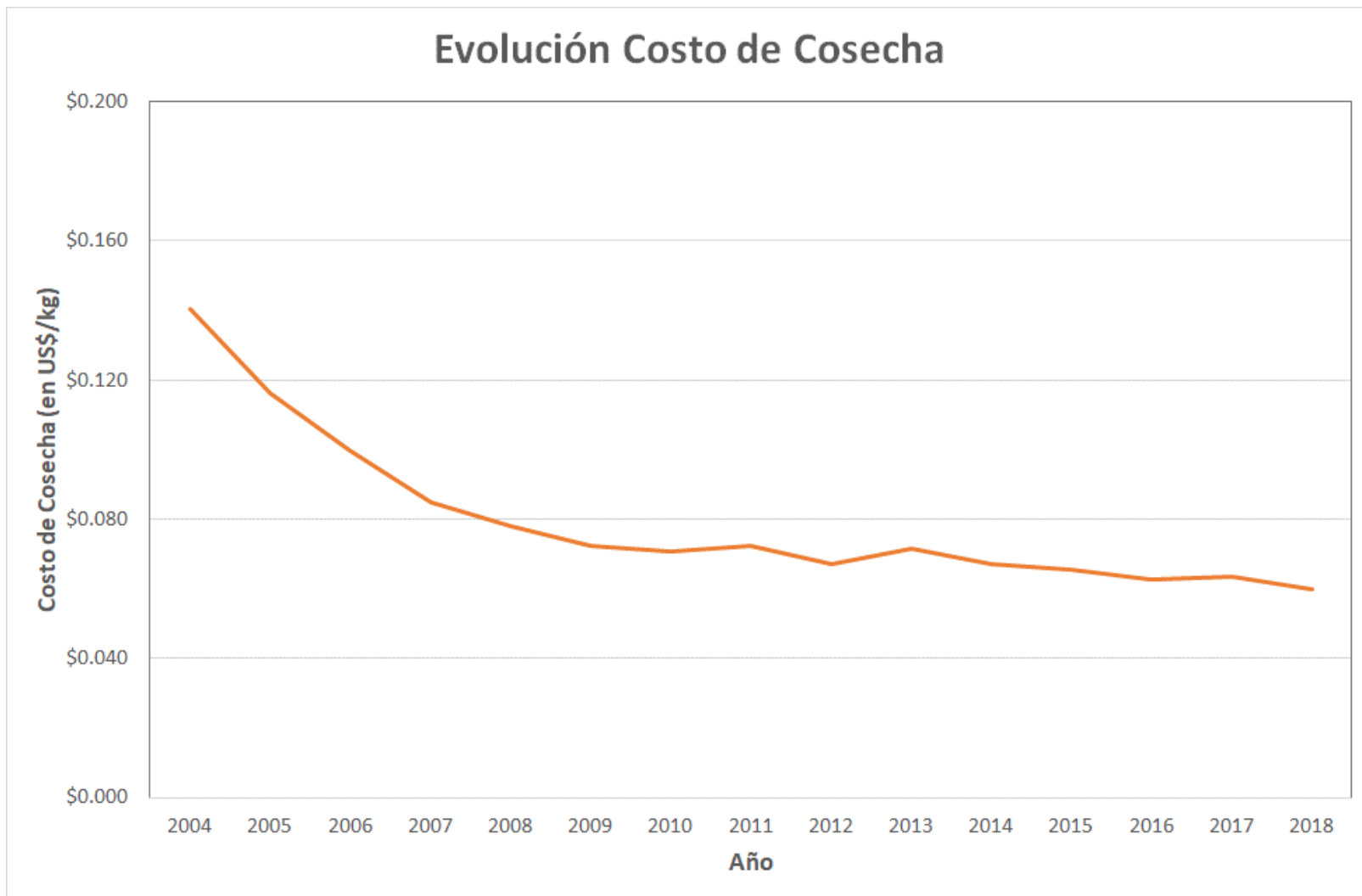


# Control, evaluación y mejora

			Break down information (in minutes)														Consumables				
			Finger/H M	New Area	Cleaning	Tree/Wir e	Fuel	Valve pass	Washdo wn	Wait trailer	Blockage s	Service	Minor repair	Major repair	Other	TOTAL	Finger	Half Moon	Fish Plates		
BOORT	2016	TOTAL	49356	8126	1919	405	7346	3635	1010	1414	3487	15566	14042	3205	8293	117789	19571	741	371		
	2017	TOTAL	56282	7810	2556	440	6205	3167	680	11090	5997	17075	13776	4519	11831	141563	28270	695	226		
	2018	TOTAL	47433	6636	4768	162	5756	3686	300	388	8972	12294	11897	3395	5601	111288	17919	504	115		
	2016	AVG PER DAY PER SH	39.7	6.5	1.5	0.3	5.9	2.9	0.8	1.1	2.8	25.1	11.3	2.6	6.7	94.8	15.8	0.6	0.3		
	2017	AVG PER DAY PER SH	43.4	6.0	2.0	0.3	4.8	2.4	0.5	8.6	4.6	26.4	10.6	3.5	9.1	109.2	21.8	0.5	0.2		
BBE	2016	TOTAL	34449	8563	11042	1030	4004	1340	250	4210	16098	22673	12859	4830	7670	129017	16707	322	398		
	2017	TOTAL	43921	8488	13776	1090	3673	1281	674	9248	3098	21910	8077	2884	12830	130940	21836	257	333		
	2018	TOTAL	35849	8764	14974	1216	4075	1347	743	1057	4355	19964	11037	5021	7361	115763	18682	233	177		
			these data are considering only XL harvester																		
	2016	AVG PER DAY PER SH	30.8	7.6	9.9	0.9	3.6	1.2	0.2	3.8	14.4	40.5	11.5	4.3	6.8	115.2	14.9	0.3	0.4		
WEMEN	2016	TOTAL	8470	2500	230	495	1115	495	275	143	1343	8775	2190	310	1080	27421	6725	126	158		
	2017	TOTAL	15651	2053	370	400	1999	410	965	5081	1409	11466	4944	370	1147	46265	17535	169	76		
	2018	TOTAL	8574	1580	277	237	1132	359	97	35	3497	6222	3375	0	372	25757	8580	123	64		
	2016	AVG PER DAY PER SH	28.8	8.5	0.8	1.7	3.8	1.7	0.9	0.5	4.6	59.7	7.4	1.1	3.7	93.3	22.9	0.4	0.5		
	2017	AVG PER DAY PER SH	36.2	4.8	0.9	0.9	4.6	0.9	2.2	11.8	3.3	53.1	11.4	0.9	2.7	107.1	40.6	0.4	0.2		
2018	AVG PER DAY PER SH	37.6	6.9	1.2	1.0	5.0	1.6	0.4	0.2	15.3	54.6	14.8	0.0	1.6	113.0	37.6	0.5	0.3			



# Control, evaluación y mejora



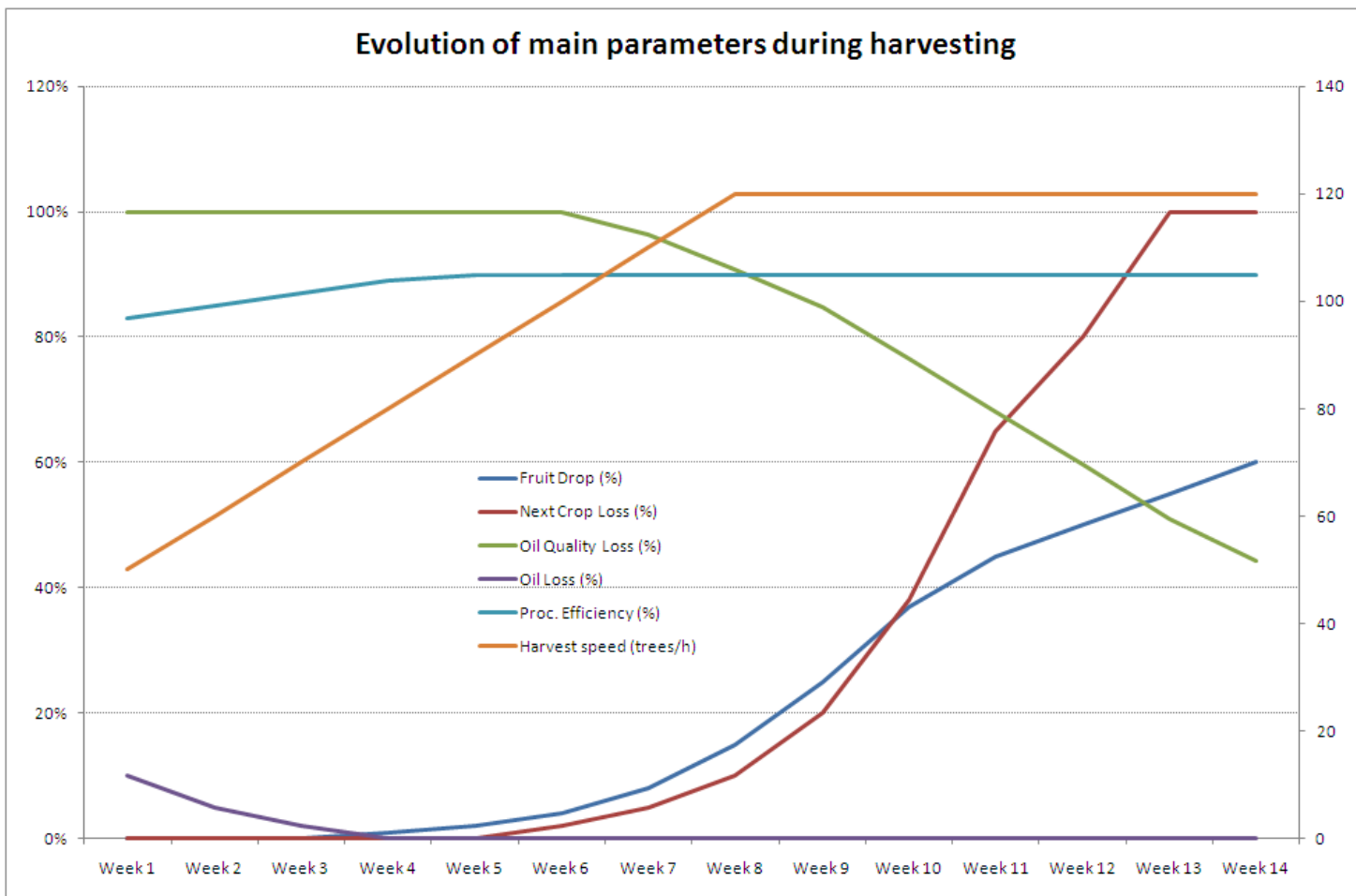


# Conclusiones





# Momento óptimo de cosecha





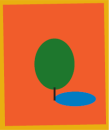
# Momento óptimo de cosecha

Cost effectiveness of harvest length and time

Weeks and time	5 E	5 L	6 E	6 L	7 E	7 L	8 E	8 L	9 E	9 L
Losses for early harvest	-\$140,100	-\$76,757	-\$113,831	-\$62,365	-\$96,319	-\$52,770	-\$78,806	-\$43,176	-\$61,294	-\$33,581
Losses for late harvest	-\$198,262	-\$414,248	-\$449,795	-\$781,796	-\$860,659	-\$1,209,918	-\$1,680,076	-\$2,229,635	-\$3,718,801	-\$4,959,938
Direct harvest costs	-\$1,907,926	-\$1,716,906	-\$1,801,472	-\$1,638,262	-\$1,717,143	-\$1,571,225	-\$1,613,863	-\$1,492,344	-\$1,503,122	-\$1,406,120
Enzyme usage:	-\$510,847	-\$463,814	-\$477,750	-\$434,302	-\$447,534	-\$408,053	-\$414,215	-\$383,141	-\$380,598	-\$351,737
Additional harvest req.	-\$1,080,000	-\$1,080,000	-\$432,000	-\$432,000	\$0	\$0	\$432,000	\$432,000	\$864,000	\$864,000
Additional process. req.	-\$292,500	-\$390,000	-\$292,500	-\$390,000	-\$146,250	-\$195,000	-\$48,750	-\$97,500	\$0	\$0
<b>TOTAL</b>	<b>-\$4,129,635</b>	<b>-\$4,141,725</b>	<b>-\$3,567,348</b>	<b>-\$3,738,724</b>	<b>-\$3,267,905</b>	<b>-\$3,436,967</b>	<b>-\$3,403,712</b>	<b>-\$3,813,795</b>	<b>-\$4,799,815</b>	<b>-\$5,887,376</b>







# Consideraciones finales

- Olivicultura moderna e intensiva.
- Integración vertical.
- Evaluación detallada de todos los componentes agronómicos y económicos que afectan la operación de cosecha.
- Evaluación permanente de la cosecha y de la cosechadora.
- Inversión y apuesta a largo plazo.
- Apertura a los cambios (valor del aceite, tecnología de cosecha y tecnología de proceso).





# Gracias

