Pollen collection by honey bees as an indicator of inter-cultivar visitation in almonds

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Australian packages imported

- ca. 5000 in 2005
- ca. 30,000 in 2006
- ca. $115 per 4-lb package

Why import Australian packages?

- Colony loss due to varroa
- High almond rental fees
- Strengthen weak colonies
- Varroa-free bees

Colony types tested:

- AUS 4lb (Dec 05)*
- AUS 3lb (Jan 06)*
- AUS 4lb (Jan 06)
- US 6-frame
- US 8-frame

n = 12 for all groups of trapped colonies; an additional 15 each for 8-frame and 4-lb package colonies were free-flying.


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1600


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Colony comparison plan

- Trap pollen for 20 days
- Count foragers every 2 hours in free flying colonies
- Determine if pollen traps affect behavior

Beginning colony strength

Colony	Strength
AUS 4lb (Dec 05)	1.5 a
AUS 3lb (Jan 06)	2.4 b
AUS 4lb (Jan 06)	3.8 c
US 6-frame	3.1 c
US 8-frame	5.9 d

*Means followed by the same letter are not sign. diff. (Divide by 0.7 to calculate California almond pollination count)

Ending colony strength

Colony	Strength
AUS 4lb (Dec)	1.2 a
AUS 3lb (Jan)	2.1 ab
AUS 4lb (Jan)	3.1 b
US 6-frame	4.7 c
US 8-frame	8.4 d

(Divide by 0.7 to calculate California almond pollination count)

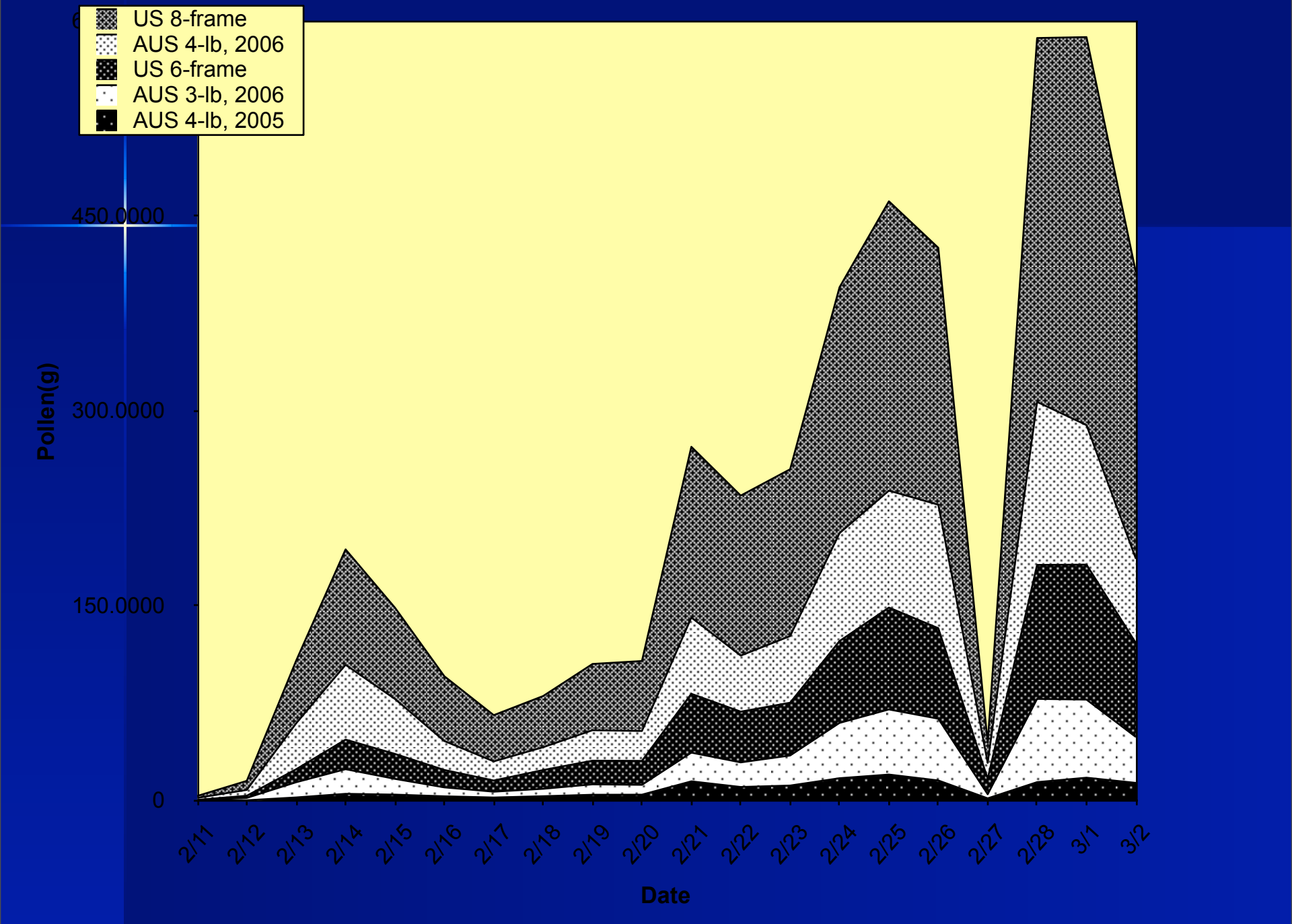
Percent strength change

Colony	% change
AUS 4lb (Dec 05)	77.1 a
AUS 3lb (Jan 06)	84.5 a
AUS 4lb (Jan 06)	83.7 a
US 6-frame	154.9 b
US 8-frame	145.2 b

Percent brood change

Colony	% change
AUS 4lb (Dec 05)	136.0 ab
AUS 3lb (Jan 06)	143.1 ab
AUS 4lb (Jan 06)	176.5 b
US 6-frame	124.6 ab
US 8-frame	101.7 a

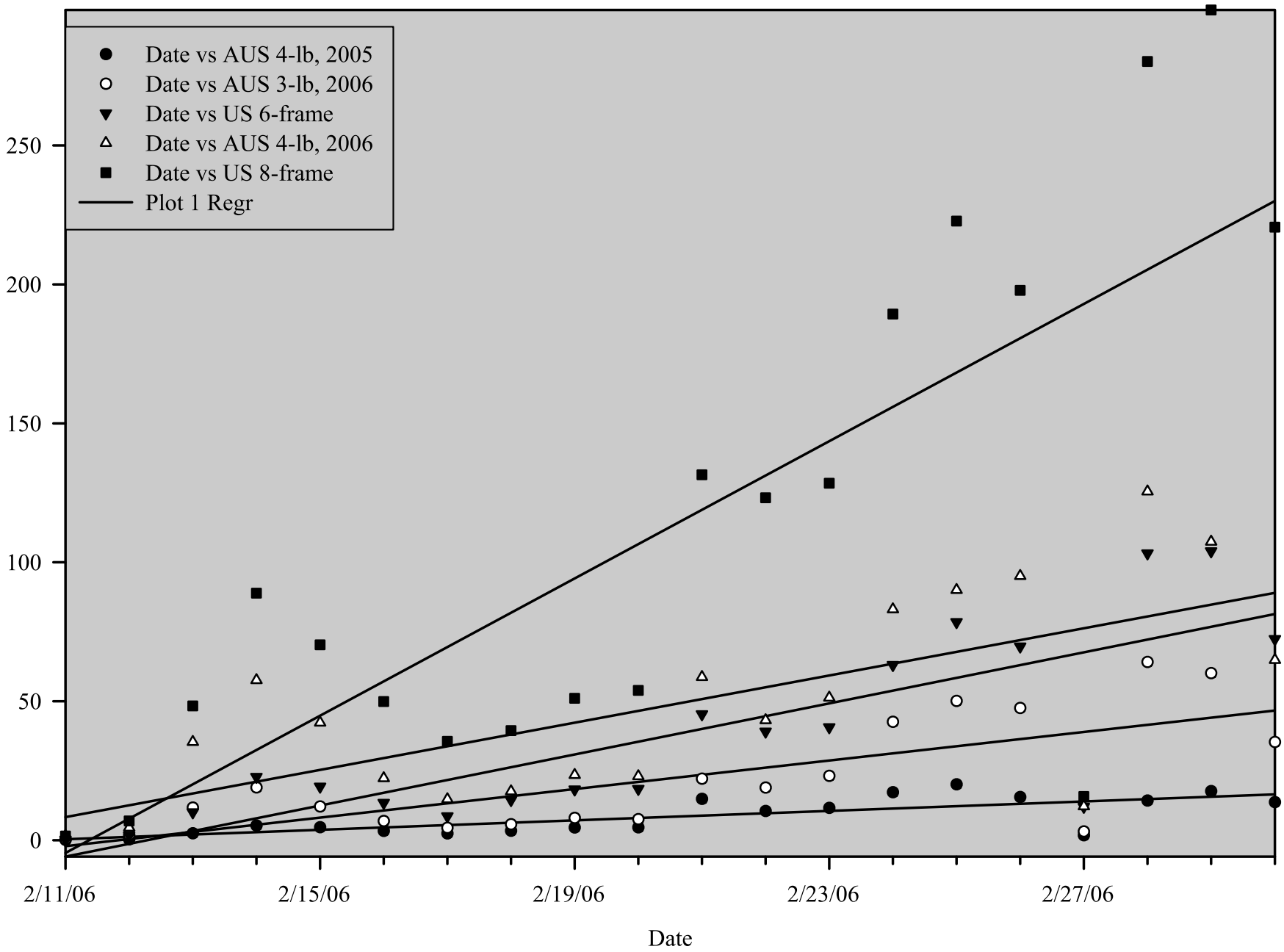
Fig. 1 Comparison of daily pollen collection by five different types of colonies



Average daily pollen collected

Colony	pollen (g)
AUS 4lb (Dec)	8.4 a
AUS 3lb (Jan)	22.2 b
AUS 4lb (Jan)	48.7 c
US 6-frame	37.8 c
US 8-frame	112.7 d

Comparision of daily pollen(g) collection by five different types of colonies



Pollen foraging rate*

(based on beginning strength)

Colony	grams/frame
AUS 4lb (Dec)	5.2 a
AUS 3lb (Jan)	9.2 b
AUS 4lb (Jan)	12.7 c
US 6-frame	11.5 bc
US 8-frame	19.6 d

*Grams of pollen per frame of bees

Pollen foraging rate*

(based on ending strength)

Colony	grams/frame
AUS 4lb (Dec)	5.8 a
AUS 3lb (Jan)	10.0 b
AUS 4lb (Jan)	14.5 c
US 6-frame	7.2 a
US 8-frame	12.8 c

*Grams of pollen per frame of bees

Pollen pellet weight during the trial*

Date	AUS 4-lb	US 8-frame
10 – 14 Feb	5.0 a	5.5 a
15 – 19 Feb	6.4 b	6.6 b
20 – 24 Feb	7.6 c	7.6 c
25 Feb – 1 Mar	10.5 d	10.2 d

*Five collection days for 12 colonies each.
*All pellets were almond

Pollen pellet weight during the day*

Hours	AUS 4-lb	US 8-frame
8 - 10hrs	6.5 b	6.7 b
10 - 12	7.4 a	7.5 a
12 - 14	7.1 ab	7.1 ab
14 - 16	5.5 c	5.5 c

* Five collection days for 12 colonies each

Correlation with collected pollen

Measure	r
Begin CA bees	0.62**
Begin bees	0.65***
Begin brood	0.68***
Begin bees&brood	0.70***
End CA bees	0.76***
End bees	0.76***
End brood	0.68***
End bees&brood	0.77***

Time of nut set plan

- Bag blossoms across orchard (n = 120)
- Expose blossoms for 2.5hrs starting at 800hrs
- Calculate nut set for specific time
- Compare colony pollen foraging with nut set


Eschen

Percent nut set by time of day for two cultivars

Hours	Fritz (early)	Butte (late)
800 – 1030hrs	38.6 ab	11.9 a
1030 – 1300	46.4 a	24.8 c
1300 - 1530	39.7 ab	20.0 bc
1530 – 1800	32.3 b	18.7 b
“Control”	70.7	44.3

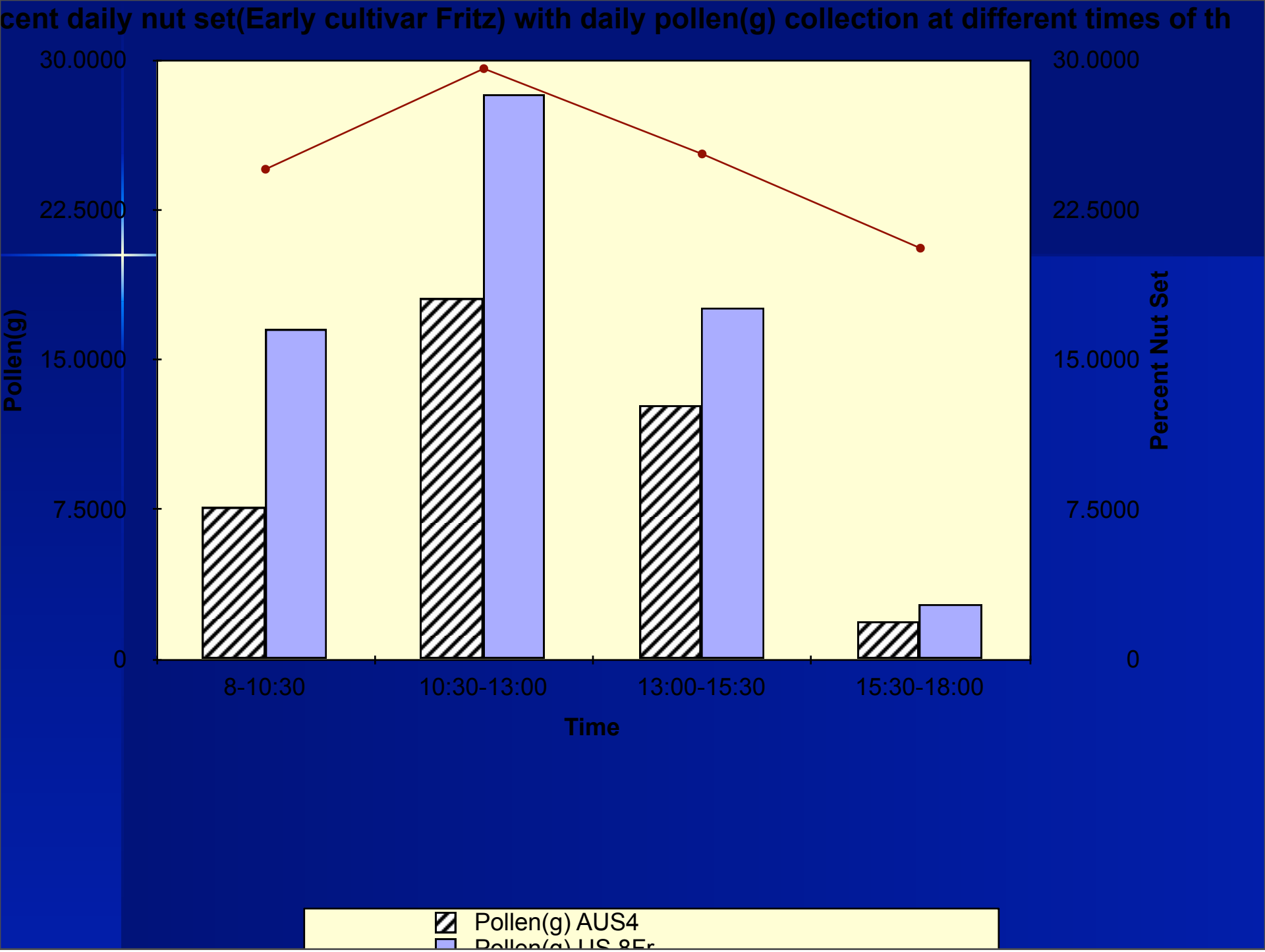
Grams of pollen collected during the day*

Hours	AUS 4-lb	US 8-frame
8 - 10hrs	6.1 b	18.4 b
10 - 12	19.1 a	42.5 a
12 - 14	16.4 a	35.7 a
14 - 16	8.3 b	18.9 b
16 - 17	1.5 c	4.1 c

* Five collection days for 12 colonies each

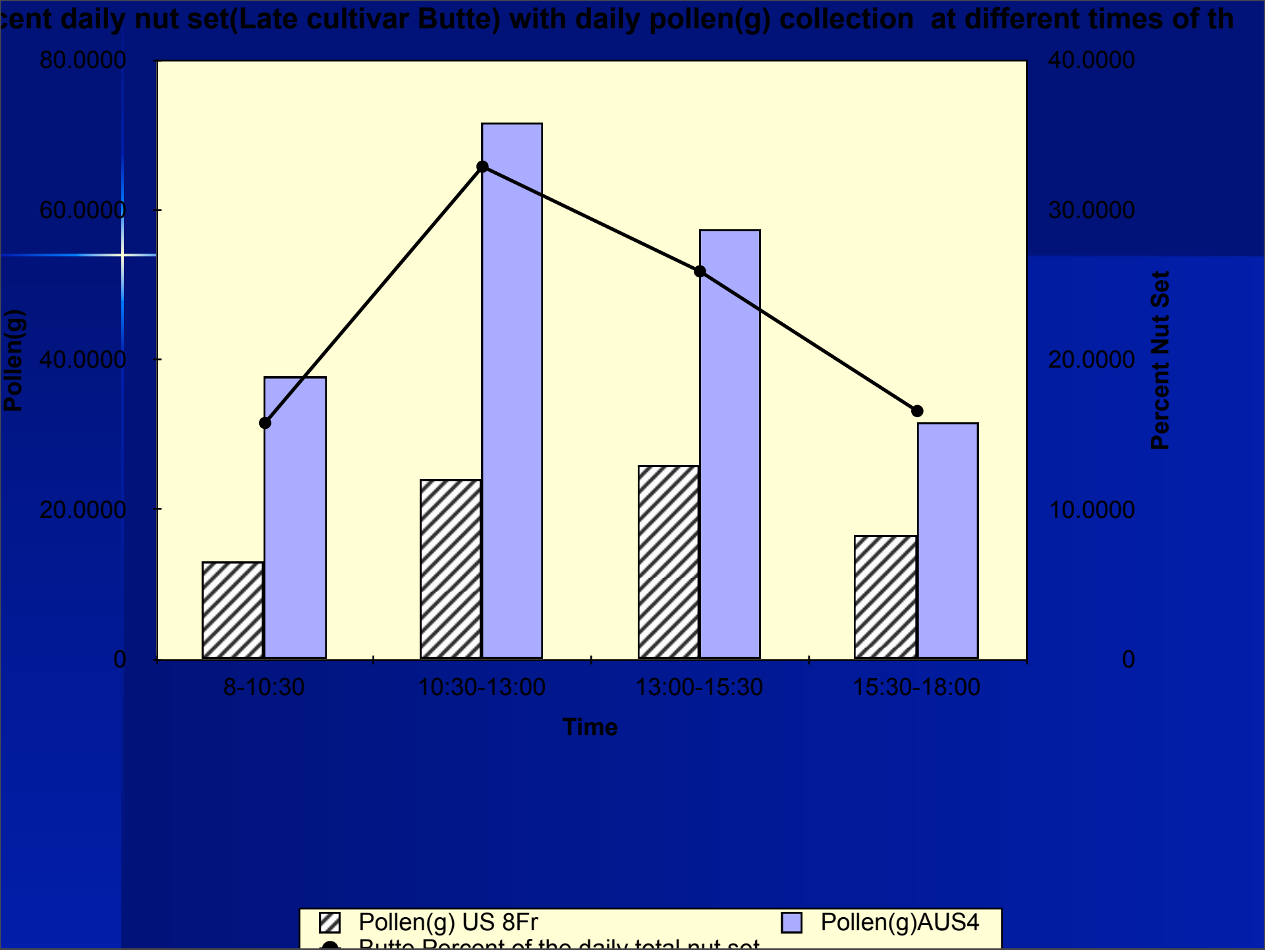
Pollen foraging trips per 1% of Fritz nut set

Hours	AUS 4-lb	US 8-frame
800 - 1030hrs	20.3 ab	40.5 a
1030 - 1300	30.1 a	45.6 a
1300 - 1530	35.4 a	50.9 a
1530 - 1800	9.7 b	13.7 b


cent daily nut set(Early cultivar Fritz) with daily pollen(g) collection at different times of th
30.0000
22.5000
15.0000
7.5000
0
Pollen(g)
Percent Nut Set
8-10:30
10:30-13:00
13:00-15:30
15:30-18:00
Time
Pollen(g) AUS4

Pollen foraging trips per 1% of Butte nut set

Hours	AUS 4-lb	US 8-frame
800 - 1030hrs	95.0 ab	251.6 ab
1030 - 1300	74.4 a	164.4 ab
1300 - 1530	124.2 a	297.4 a
1530 - 1800	50.0 b	129.4 b


cent daily nut set(Late cultivar Butte) with daily pollen(g) collection at different times of th
80.0000
60.0000
40.0000
20.0000
0
Pollen(g)
40.0000
30.0000
20.0000
10.0000
0
Percent Nut Set
8-10:30
10:30-13:00
13:00-15:30
15:30-18:00
Time
Pollen(g) US 8Fr
Pollen(g)AUS4

Significant findings

- Both AUS and US colonies foraged normally
- No observed differences in time of foraging
- US “8-frame” colonies collected about 2.5 times as much pollen as AUS 4-lb package colonies

Significant findings (con't)

- Though AUS package colony strength declined, their pollen foraging did not decline proportionately
- Most colonies collected a second pollen. AUS colonies collected about 55 times as much of this as did US colonies

Significant findings (con't)

- Based on pollen collection, a 4-lb package colony was worth, to a almond grower, about half that paid for a standard 8-frame colony

Significant findings (con't)

- Almond nut set occurred throughout the day, but when foraging activity was taken into account, a higher rate of nut set happened at the end of the day

Many Thanks

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