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2021 Almond Pollination Outlook: Economic Outlook and Other Considerations

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2020 has certainly been an interesting year on many accounts. It started off well for beekeepers and almond growers with near-perfect pollination weather in February, promising a large almond crop. Things changed quickly following almond bloom as the world shut down due to COVID-19. As we near the end of 2020, we hope things improve going into the new year. In this article we provide information that we believe will be useful as beekeepers begin to settle their agreements for the 2021 almond pollination season.

Almond Industry Update

Currently, almond prices are hovering around $1.50-$2.00/lb depending on variety, which is roughly 30% below their five-year average $2.90/lb. Due to the increasing demand for almond pollination services over the past two decades, pollination costs now represent a substantial share of annual operating expenses for almond growers, rivaling both harvest and irrigation costs (Champetier, Lee and Sumner, 2019). Tight profit margins mean almond operations will closely scrutinize any production expenses, and consequently will likely look closely into their pollination expenses as they establish contracts in the coming months.

There has been a lot of interest in recent years in planting self-compatible almond varieties (Independence and Shasta) as a way to decrease pollination and other production expenses. In 2020, an estimated 7% of bearing almond acreage in California was in self-compatible varieties, but in 2019, self-compatible varieties represented 21% of new plantings. Recently, an article published in *Nature* found the Independence variety showed an increase in yield by 20% from allowing bee visitation (Sáez et al. 2020). This study eliminates any claims that these self-compatible varieties do not require honey bee colonies for commercial production.

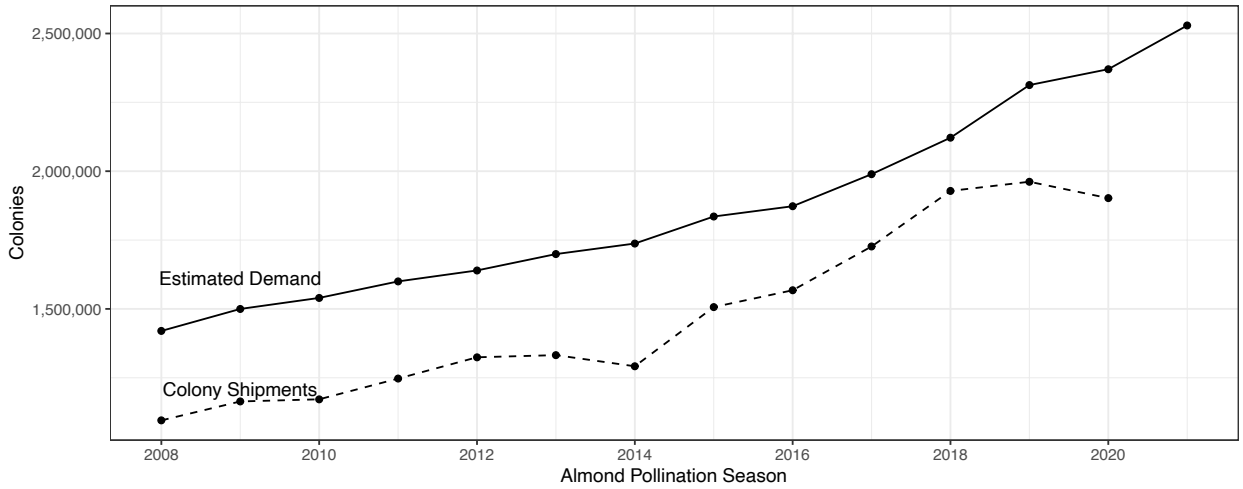
Colony Demand and Shipments into California

Figure 1 plots the estimated demand for colonies based on bearing almond acreage each year, compared with total colony shipments into California. Estimated demand is calculated using 2 colonies per acre for traditional varieties and 1 colony per acre for self-compatible varieties. There is consistently a gap between estimated demand and colony shipments, which is filled by colonies that remain in California year-round.

For the 2020 almond bloom, roughly 1.2 million almond acres required an estimated 2.4 million honey bee colonies for pollination (Figure 1). According to apiary shipment data provided by the California Department of Food and Agriculture, 1.9 million honey bee colonies were shipped into California from other states for the 2020 bloom; this was down 3% from 2019. For those who remember, 2019 likely required more colonies due to the rainy, cold weather compared with the 2020 bloom's warm and sunny weather. In February 2021, an estimated 2.5

million colonies will be required for almond pollination. This amounts to approximately 88% of the total colonies in the U.S. on January 1, 2020.

Figure 1 Estimated Demand and Colony Shipments, 2008-2021



Sources: 2008-2019 Almond Acreage Reports, USDA NASS and CDFA; Apiary Shipments through California Border Protection Stations, CDFA Plant Health and Pest Prevention Services

Weather Impacts on Colony Supply

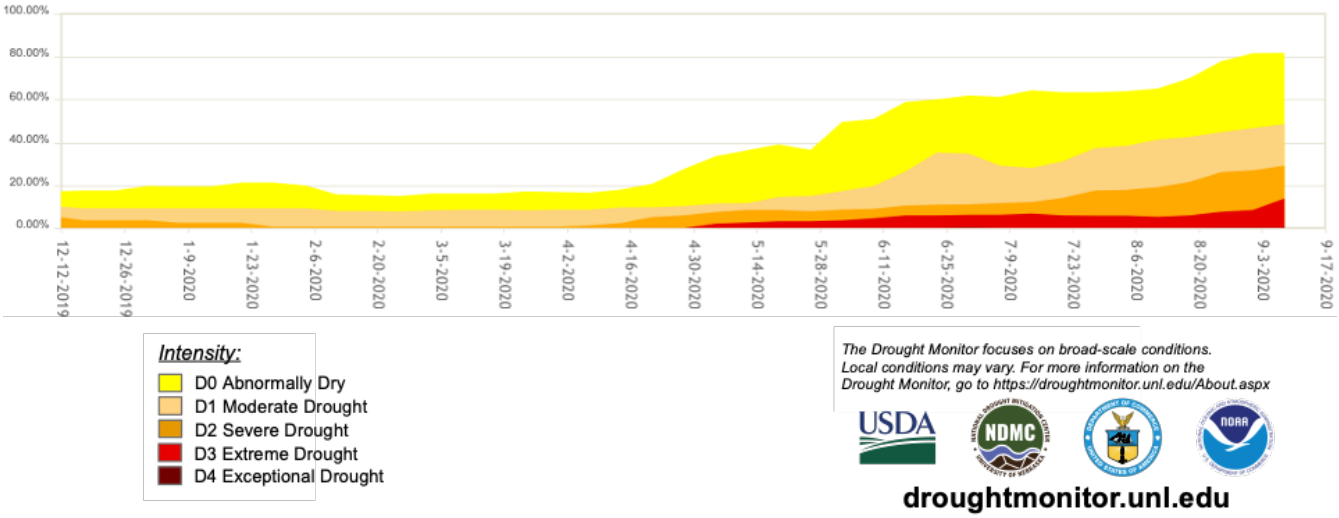
2020 has seen a number of weather incidents that have the potential to impact colony populations and overall colony health. By mid-September, over 3.4 million acres had burned due to wildfires in California, while over 1.5 million acres had burned across Oregon, Washington and Idaho. During July-September 2019, up to 1 million colonies were located in these states, roughly half of what is required for almond pollination. It is unclear how many of these colonies have been (or will be) impacted by the wildfires, but the wildfires have the potential to severely impact beekeeping operations in these areas, as well as the 2021 supply of colonies for almond pollination.

Another natural disaster, Hurricane Laura, devastated parts of Louisiana and Texas in August. These states supplied at least 6% of the colonies for almond pollination in 2020. Hurricane Sally was not as strong as Hurricane Laura, but still caused extensive damage in parts of Alabama and Florida in September. These states supplied at least 10% of colonies for almond pollination in 2020. The impact of these hurricanes on colony supplies may be minimized because they occurred at times when many colonies were likely still in the Northern Plains for honey production.

However, the Northern Plains may not have been its usual haven for honey bee colonies over the summer months. Figure 2 shows the percentage of area in the Northern Plains (Montana, Wyoming, Colorado, Nebraska, South Dakota, and North Dakota) that was abnormally dry or in worse drought conditions. At the beginning of June, 36% of the Northern Plains was at least abnormally dry. By the beginning of July this number had increased to 62%, with 12% of the

total area in a severe drought. It is possible honey flow in this area was affected, which ultimately may impact the health of colonies going into 2021.

Figure 2 Percentage of Northern Plains Area in Drought Monitor Categories



Note: USDA Climate Hub Region of Northern Plains includes: (Montana, Wyoming, Colorado, Nebraska, South Dakota, and North Dakota)

Almond Pollination Fees

We wrote this article early enough that the 2020 California State Beekeeper's Association (CSBA) pollination survey was not yet available, so we cannot report fees from the 2020 almond pollination market (which would have included projections for 2021). However, we can report on what is likely the largest survey of pollination fees to date. In December 2019-February 2020, researchers at UC Davis and Duke University conducted an online survey of over 300 almond growers to better understand pollination decisions. The sample represented roughly 14% of almond acreage in 2019.

75% of growers who rented colonies in 2019 provided the minimum colony strength requirement associated with their largest almond pollination contract.

Table 1 shows the average almond pollination fee by the minimum average frame count requirement for growers' largest pollination contracts in 2015 and 2019. 2015 pollination fees were converted to 2019 dollars to adjust for inflation. The 2015 data come from a survey conducted at the 2015 Almond Conference (Goodrich, 2019). The 2015 survey has a smaller sample size than the more recent survey, however, paired together these surveys provide the first documentation of how fees have changed across colony strength categories over time.

Across both surveys, the 8-frame minimum average frame count was the most frequently used colony strength requirement. In the 2019 survey, nearly a quarter of respondents who used

colony strength requirements used a 6-frame minimum average, compared to only 7% in the 2015 survey. This increase could signal an increase in popularity of 6-frame requirement over time, or may be due to the small sample size of the 2015 survey.

Table 1 Average almond pollination fees by average colony strength requirement, Seasons 2015 and 2019

	2015 Survey (N=74)			2019 Survey (N=205)			
Average Colony Strength Requirement	Percentage of Responses	Average Pollination Fee (2019 Dollars)	Premium/Discount compared to 8-frame	Percentage of Responses	Average Pollination Fee	Premium/Discount compared to 8-frame	Percentage Change in Real Pollination Fees 2015-2019
<6-frame	5%	$ 179.73	-1.9%	10%	$ 187.25	-3.1%	4.2%
6-frame	7%	$ 177.05	-3.4%	24%	$ 189.96	-1.7%	7.3%
7-frame	7%	$ 178.12	-2.8%	8%	$ 191.41	-1.0%	7.5%
8-frame	61%	$ 183.27	-	48%	$ 193.30	-	5.5%
>8-frame	20%	$ 187.57	2.3%	10%	$ 205.28	6.2%	9.4%
Total		$ 183.17			$ 192.78		5.2%

Note: 2015 fees adjusted to 2019 dollars using U.S. Bureau of Economic Analysis GDP Implicit Price Deflator
Sources: 2015 Almond Pollination Contract Survey, B. Goodrich and R. Goodhue (2015)
Survey on Bee-Friendly Practices in Almond Orchards, J. Durant and E. McNamara (2020)

It is clear across both surveys that pollination fees increase as the colony strength requirement increases. In 2019, the average premium associated with strong colonies (>8-frame average) compared to 8-frame colonies was 6.2%, 6-frame colonies were discounted on average by 1.7% compared to 8-frame colonies, and weak colonies (<6-frame average) were discounted on average 3.1% compared to 8-frame colonies.

Across all colony strength requirements, inflation-adjusted pollination fees increased by 5% between 2015 and 2019. This varied by category: the highest colony strength requirement of a minimum average above 8 frames increased by 9.4% on average, while the smallest colony strength requirement of less than 6 frames increased by 4.2%. The premiums associated with the highest colony strength category went from 2.3% to 6.2% above the 8-frame minimum average. This increase in premium could reflect either increased input costs associated with supplying high strength colonies, and/or an increase in the demand for high strength colonies relative to 8-frame colonies.

The 2019 CSBA survey included projections for 2020 almond pollination fees. On average, the projected 2020 fee was $200 per colony. Despite the slight increase in demand for colonies, we don't anticipate much difference between the 2020 and 2021 pollination fees, largely due to growers feeling the pressure of low almond prices. So assuming the average fee for an 8-frame colony is $200 in 2021, based on the premiums in Table 1, larger than 8-frame colonies will rent for approximately $212 per colony, 6-frame colonies will rent for $195 per colony and less than 6-frame colonies will rent for $189 per colony. Those are rough estimates based on a lot of assumptions, so take them with a grain of salt. Additionally, if any of the supply issues discussed

in the previous section materialize into significant colony losses, fees could increase substantially from 2020 levels.

For more discussion of the survey findings, see Goodrich and Durant (2020).

Evaluating Pollination Contracts

Given the tight profit margins of almond production going into 2021, we think it is a good time for beekeepers to take a close look at the net profitability of their pollination agreements. Specifically, this means evaluating the costs of meeting different colony strength requirements, and comparing those costs with the associated differences in pollination fees. For example, on average, what are your per-colony input costs of providing 6-frame average colonies compared to 8-frame average colonies? Is that input cost less than 1.7% of the expected 8-frame pollination fee? If not, it may make more sense for you to find a 6-frame contract, or talk to your grower/pollination broker about lowering colony strength requirements (and receiving a lower fee, of course).

Example Scenario: In 2019, the average difference between an 8-frame contract and a 6-frame contract was $3.34 per colony. Assuming the difference between supplying 6-frame and 8-frame average colonies requires one extra pollen patty at $1.25/lb and an extra half gallon of syrup at $3.81/gallon (Topitzhofer et al. 2020), that requires spending an additional of $3.16 per colony on average just in food supplements. This allows you only $0.18 per colony for any other additional costs between the 6-frame and 8-frame colonies. If you ship colonies into California immediately prior to almond bloom, shipping 6-frame colonies will likely cost you less than shipping 8-frame colonies (less weight/colony means more colonies/truck). Additionally, you will likely spend more in labor grading colonies to make an 8-frame average than a 6-frame average. In this scenario, it begins to look like you might be better off contracting for the lower colony strength. In other scenarios, a higher strength contract may be more profitable.

It may not be as easy as we make it sound to switch from a high colony strength contract to a lower colony strength contract (or vice versa), especially if you have been contracting with the same grower for many years. However, this year especially growers will likely be trying to decrease the per-colony fee they pay. Given that many growers are currently contracting for two 8-frame colonies per acre, switching to two 6-frame colonies per acre may be a mutually beneficial suggestion in some instances. It's worth knowing that the almond crop insurance standards state that a grower must use a "minimum of two six-frame colonies per acre or its equivalent (for example 1.5 eight frame colonies)…" (USDA, 2018). Growers also have the option to use less than the recommended two 6-frame colonies per acre (or its equivalent) as long as they have used that lower colony strength/hive density combination for at least one year without a crop insurance claim.

Border Station Inspections

Any beekeeper that has participated in almond pollination before is well aware that every shipment of bees entering the state of California has to be inspected for invasive species at one of California's border stations prior to being allowed entry (Figure 3). Delays at California's

border inspection stations can be detrimental to colony shipments entering California (especially those entering in southern California where temperatures may be warm even in January/February). Beekeepers can prevent delays by avoiding busy shipment times (if possible) and ensuring their shipments are clean and free of soil and other debris before leaving for California.

Table 2 displays the average three busiest days for apiary shipments for the top seven entry points in California over 2019 and 2020 almond pollination seasons. Table 3 shows the busiest day for the 2020 pollination season for each of these stations. Needles, Truckee and Blythe are the most frequented stations for apiary shipments and these tend to be busiest right before almond bloom-the end of January and early February. The Benton border station is busiest in late October, presumably as beekeepers bring colonies into California after honey flow in the Northern Plains. If possible, avoiding these shipment days at each location may lead to a quicker trip through the inspection station.

Conclusions

In 2021, low almond prices will likely have growers wanting colonies at a cheap price. For the business savvy beekeeper, this can provide opportunities. Can you negotiate a more profitable contract for yourself that is mutually beneficial? Are there any benefits you can request to provide your grower with a discount per colony? One thing that comes to mind is asking for a portion of the payment up front in exchange for a lower per-colony fee. This can provide some working capital to use to pay the transportation, treatment, or feeding costs required before almond bloom, in addition to providing additional security in your pollination agreement.

Figure 3 California Border Protection Station Locations

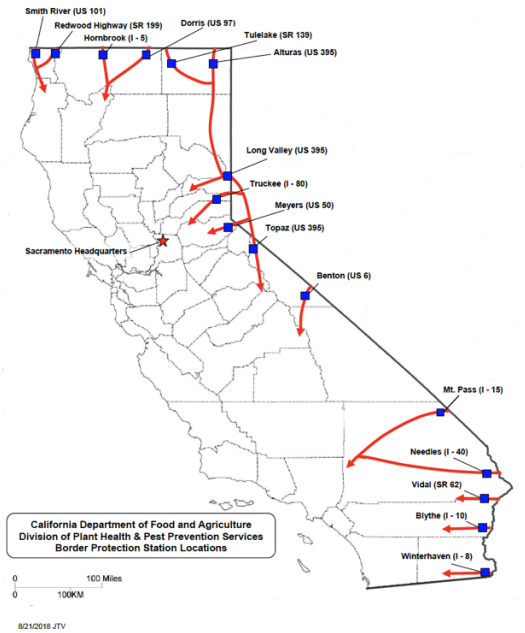


Table 2 Highest Shipping Days on Average for 2019 and 2020 Almond Pollination Seasons by California Border Station

Station	Date	Average 2019-2020 Apiary Shipments	Average 2019-2020 Colonies Shipped
Benton (US 6)	October 21	25	10,510
	October 27	19	8,029
	October 28	19	8,347
Blythe (I-10)	February 2	28	12,335
	February 6	21	9,204
	January 31	21	10,360
Dorris (US 97)	January 15	12	5,217
	January 17	11	4,347
	January 6	11	3,792
Hornbrook (I-5)	January 21	16	6,062
	January 30	12	3,489
	January 29	11	3,647
Needles (I-40)	February 3	32	14,239
	January 27	32	16,955
	January 30	31	13,665
Truckee (I-80)	January 24	46	20,391
	January 28	42	17,663
	January 29	40	16,933
Vidal (SR 62)	February 5	16	6,432
	February 8	16	7,134
	February 7	14	5,748

Source: Apiary Shipments through California Border Protection Stations, CDFA Plant Health and Pest Prevention Services

Table 3 Highest Apiary Shipment Day for 2020 Almond Pollination by California Border Station

Station	Date	Apiary Shipments	Colonies Shipped
Benton (US 6)	10/23/19	24	10,232
Blythe (I-10)	2/2/20	28	12,248
Dorris (US 97)	1/6/20	13	4,446
Hornbrook (I-5)	2/4/20	16	4,189
Needles (I-40)	1/30/20	36	16,346
Truckee (I-80)	1/24/20	45	20,494
Vidal (SR 62)	2/8/20	17	7,516

Source: Apiary Shipments through California Border Protection Stations, CDFA Plant Health and Pest Prevention Services

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