

# 2019 NAAA Aerial Application Industry Survey: Pilots

Conducted for:

National Agricultural Aviation Association (NAAA)



Conducted by:

Tim Struttman and Jackie Zawada

Supported by NAAA

and the Southwest Center for Agricultural Health, Injury Prevention and Education  
NIOSH CA U50-OH07541

## IMPORTANT DATES

Survey data was collected among operators from January - April 2018. Questions on the survey asked respondents about operations during 2017. This report was finalized in 2019.

June 2019

## Contents

1. Executive Summary .....	5
2. Background .....	5
3. Methods .....	6
4. Results .....	7
1.1. Responses .....	7
1.1.1. Demographics .....	8
1.1.2. Equipment and standard practices .....	22
1.1.3. Risk Perceptions .....	41
1.1.4. Injury .....	45
1.1.5. Workload.....	46
1.1.6. Health.....	48
5. Summary / Conclusions .....	53
6. Appendix A - Pilot Survey .....	54

## List of Figures

Figure 1 – Total responses from pilots and operators .....	8
Figure 2 – Map of states where pilots make applications .....	9
Figure 2 – Pilot age .....	11
Figure 4 – Pilot members of NAAA .....	12
Figure 5 – Membership in state/regional organization .....	13
Figure 6 – Years in aerial application industry .....	14
Figure 7 – Total flight time (hours) .....	15
Figure 8 – Total ag hours flight time (hours).....	16
Figure 9 – Years as an agricultural pilot .....	17
Figure 10 – Agricultural flight time.....	18
Figure 11 – Full-time, part-time.....	19
Figure 12 – Attend PAASS program .....	21
Figure 13 – On board wind/met measurement system.....	22

Figure 14 – Liquid flow control equipment for making constant or variable rate applications..... 23

Figure 15 – Dry flow control equipment for making constant or variable rate applications ..... 24

Figure 16 – Percent of all spray jobs where pilot mixes and loads ..... 26

Figure 17 – Treatments after dark ..... 30

Figure 18 – Percent of acres treated with sprayers and spreaders..... 32

Figure 19 – Percent of acres treated using a sprayer that were pesticide only..... 33

Figure 20 – Percent of acres treated with a sprayer that were fertilizer only..... 34

Figure 21 – Percent of acres treated with a sprayer with a mixture of pesticide and fertilizer ..... 35

Figure 22 – Percent of acres treated using a spreader applying fertilizer only ..... 36

Figure 23 – Percent of acres treated using a spreader applying to cover crops ..... 37

Figure 24 – Percent of acres treated using a spreader to conduct harvestable crop seeding such as rice ..... 38

Figure 25 – Percent of acres treated using a spreader for applying pesticides ..... 39

Figure 26 – Average field size treated ..... 40

Figure 27 – Encounters with unmarked communications towers ..... 42

Figure 28 – Encounters with wind turbines or unmarked meteorological tower ..... 43

Figure 29 – Encounters with unmanned aircraft systems (UAS) or drones..... 44

Figure 30 – Frequency of contact with Air Traffic Control (ATC) ..... 45

**List of Tables**

Table 1 – States where pilots perform aerial application..... 10

Table 2 – Part-time and full-time comparisons..... 20

Table 3 – Methods used to identify and track sensitive areas..... 25

Table 4 – Other methods used to identify and track sensitive areas ..... 25

Table 5 – Percent of pilots who use these drift control methods ..... 27

Table 6 – Swath guidance used..... 28

Table 7 – Frequency of smoker use in smoker-equipped aircraft..... 28

Table 8 – Ranked reasons for doing applications during hours of darkness..... 31

Table 9 – Risk perception ranking highest to lowest ..... 41

Table 10 – Average days per year flight operations are conducted ..... 46

Table 11 – Average hours worked per day during application season ..... 46

Table 12 – Average hours of sleep ..... 46

Table 13 – Average number of consecutive days worked ..... 47

Table 14 – Frequency of feeling tired.....	47
Table 15 – Overall health rating .....	48
Table 16 – Physical problems limit activity .....	48
Table 17 – Difficulty doing daily work because of physical health .....	48
Table 18 – Amount of body pain .....	49
Table 19 – Energy in the past four weeks.....	49
Table 20 – Social activity limited by physical/emotional problems .....	49
Table 21 – Bothered by emotional problems .....	50
Table 22 – Emotional problems prevent usual work .....	50
Table 23 – Work outside of industry .....	50
Table 24 – List of other jobs held by pilots during off season.....	51
Table 25 – Earnings .....	51
Table 26 – Earnings and average number of years in the industry .....	52
Table 27 – Earnings and the average number of hours flown.....	52
Table 28 – Education level .....	53

## 1. Executive Summary

This web-based survey of Part 137 operators and pilots between January 26, 2018 and April 29, 2018 was supported by the National Agricultural Aviation Association (NAAA) and the Southwest Center for Agricultural Health Injury Prevention, and Education. This secure-site survey was designed in partnership with the NAAA and modeled after a similar paper-based survey conducted in 1992, 1994, 1998, 2004 and a web-based survey in 2011. Careful outreach activities were planned and executed before and during the survey to ensure a high response rate. After pilot testing the questionnaire, it was loaded to a secure site. Although the focus was surveying Federal Aviation Regulations (FAR) Part 137 (hereafter referred to as Part 137) certificate holders, pilots were also asked to complete a survey. This data summary describes the responses given by the pilots. Three hundred five pilots responded to the survey.

Average age of pilots was 47.4 years and they have been in the industry an average of 19.4 years. Thirty nine percent of the pilots have been in the industry less than 10 years. Pilots have an average of 9,564 total flight hours and an average of 7,450 agricultural flight hours. Eighty-three percent are members of a state/regional agricultural aviation association and 54% are pilot members of the NAAA.

Ninety-nine percent of the aircraft used were GPS-equipped and 88% were smoker equipped. Very few pilots reported routinely mixing and loading their own aircraft. To minimize spray drift, buffer zones, drift-control additives, smokers and modifications to droplet size are most often employed. Power lines, communication towers, and meteorological towers were the three leading perceived risks followed by adverse weather conditions, rotating prop, and mechanical failure. Very few pilots reported conducting applications during hours of darkness, however, when they did, the primary reason for doing so was to protect pollinators. Only two work related injuries were reported by the pilots over the past year and their self-reported overall health is very good.

This was the second survey focusing exclusively on agricultural pilots conducted by the NAAA. The results provide not only a representative picture of the agricultural pilot compared to the FAA Part 137 certificate holder (operators) but the trends among pilots between 2012 and 2019.

## 2. Background

Through deliberate planning, the NAAA Executive Director, the Director of Education and Safety, the NAAA Government Relations Committee, and survey researchers worked to balance survey length, the need for consistent representative data and the survey's administration date. Gathering data from this geographically dispersed population, often working long hours in fairly small operations presented challenges to the team. A survey focusing only on agricultural pilots who were not the Part 137 certificate holder has not been conducted by the NAAA since 2011. This pilot survey was conducted in conjunction with the 2019 NAAA Operator Survey. Confidentiality was paramount. The e-mail addresses of those responding were collected by researchers only for the purpose of sending follow-up requests to those who had not previously responded and were not made a part of the final report to NAAA. Assurances were imbedded in the

survey outreach promotion campaign assuring respondents their identification would not be shared along with the information they provided; the web site was restricted and secure; and the data obtained belonged to the NAAA.

The purpose of the survey was to:

- Gather data from the population of agricultural pilots on demographics, experience, scope of work operations, equipment, standard practices, and drift mitigation techniques.
- Gather data on risks, safety practices, risk perceptions and health for future training purposes.
- Compare these data with data obtained from pilots surveyed in 2011 and to Operators where appropriate.

The overriding principles were to make a survey that could be answered by pilots that was short, precise and gathered only the necessary data in a secure, cost effective manner.

### 3. Methods

The target audience for this web-based survey was pilots who conduct agricultural aircraft operations. In collaboration with the NAAA, the survey team crafted questions on demographics, operations, practices, risk perception, injuries and health. Questions were modeled after prior NAAA surveys of operators but modified as appropriate because pilots are not always involved in the business portions of the operation. The questionnaire was pilot tested among six operator- pilots whose comments were incorporated into the questionnaire to improve question clarity. The survey was then loaded into Qualtrics, a data collection and statistical analysis tool used for survey authoring and deployment, for administration on a secure web site and tested by the survey team and six pilot/operators

The final questionnaire was loaded in January 2018. The initial question on the survey asked if the respondent was an operator (Part 137 certificate holder), a pilot employee or other. If the respondent answered 'Operator', the Operator Survey was presented and if the respondent answered 'Pilot', the Pilot Survey was presented. See Appendix A - Pilot Survey.

The initial survey web page contained the supporting signatures of the NAAA President, NAAREF President and NAAA Executive Director, giving credibility and legitimacy to the survey. The first email was sent on 2/10 and reminders sent on 2/23, 3/4, 3/15, 3/23, 3/30, 4/5, 4/12, 4/18, 4/22, and 4/26 each with slightly varying text. The survey was closed on April 29.

To ensure confidentiality and clarify data ownership, a Data Use Agreement (DUA) between NAAA and the survey team was written and approved by both parties assuring the data belongs to NAAA and only NAAA can authorize disclosing the data.

Multi-stage outreach to potential participants included emails, faxes, magazine and e-newsletter

announcements and a booth at the NAAA Convention and Exposition in Savannah, Ga. The NAAA database of member and non-member operators and pilots was used to create a contact list for the outreach. In the absence of a complete list of non-operator pilots, all requests for participation were sent to the entire mailing list whether they were operators or pilots. When completing the questionnaire, the respondent decided which survey was applicable to their employment situation. NAAA's list of pilot contact information came from state and regional agricultural aviation associations, data collected from pilots registering as pilot members of NAAA, data collected from pilots attending the NAAA convention, and data NAAA received from pilots attending the National Agricultural Aviation Research and Education Foundation's Operation S.A.F.E. calibration clinics and Professional Aerial Applicators' Support System educational program.

No specific FAA pilot certificate or rating is required for an ag pilot but instead they must pass a knowledge and skill test administered by the Part 137 holder. We have used survey data to estimate the number of pilots employed in the industry.

The returned surveys were exported from the web survey tool into an MS Excel spreadsheet. These data were screened for missing responses and information believed to be erroneous. When a respondent completed fewer than six questions, the data were removed because the respondents had failed to provide critical information.

## 4. Results

Results are presented here for pilot respondents. Where appropriate, comparisons to prior NAAA surveys or the 2012 pilot survey are made. Unless noted, all tables, figures, and values are from the 2019 survey, which collected survey responses between January and April 2018.

### 1.1. Responses

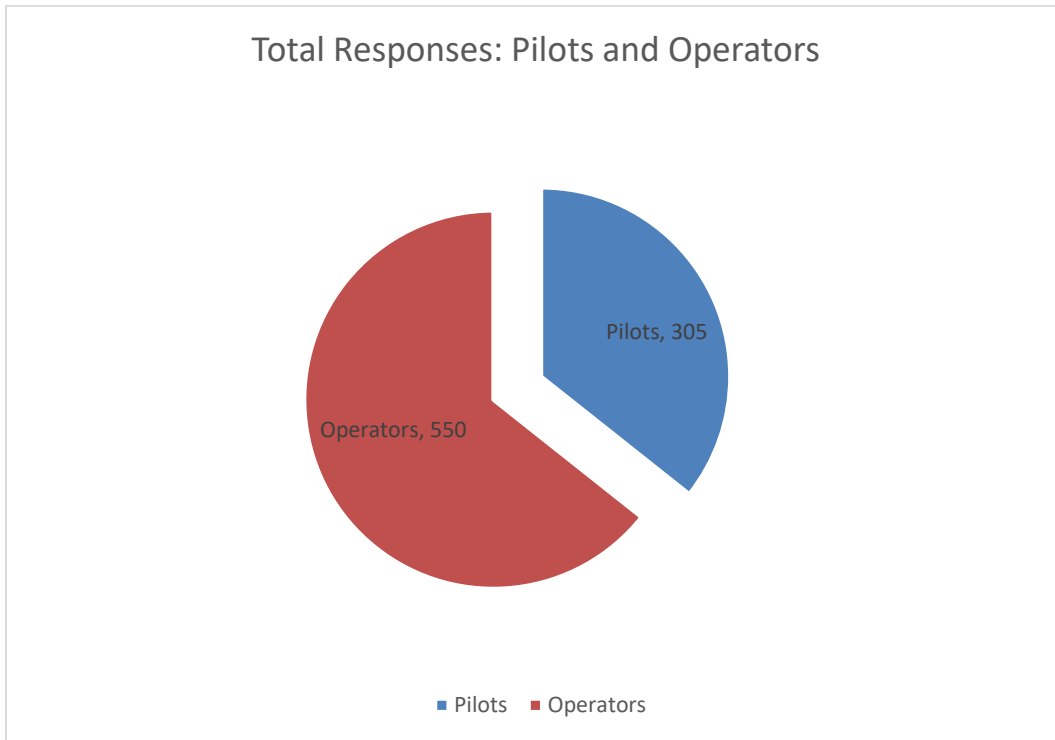
A total of 305 pilots responded. Two hundred fifty-two (83%) answered all the questions on the survey and thirty (17%) answered some but not all of the questions. Results presented here include both complete and partial surveys.

The 57-question survey took an average of 14.7 minutes to complete. Results are presented generally in the order the survey questions were asked.

1.1.1. Demographics

**Survey Question: I am an \_\_\_Operator/Pilot Operator  
\_\_\_Pilot Employee**

**Figure 1 – Total responses from pilots and operators**

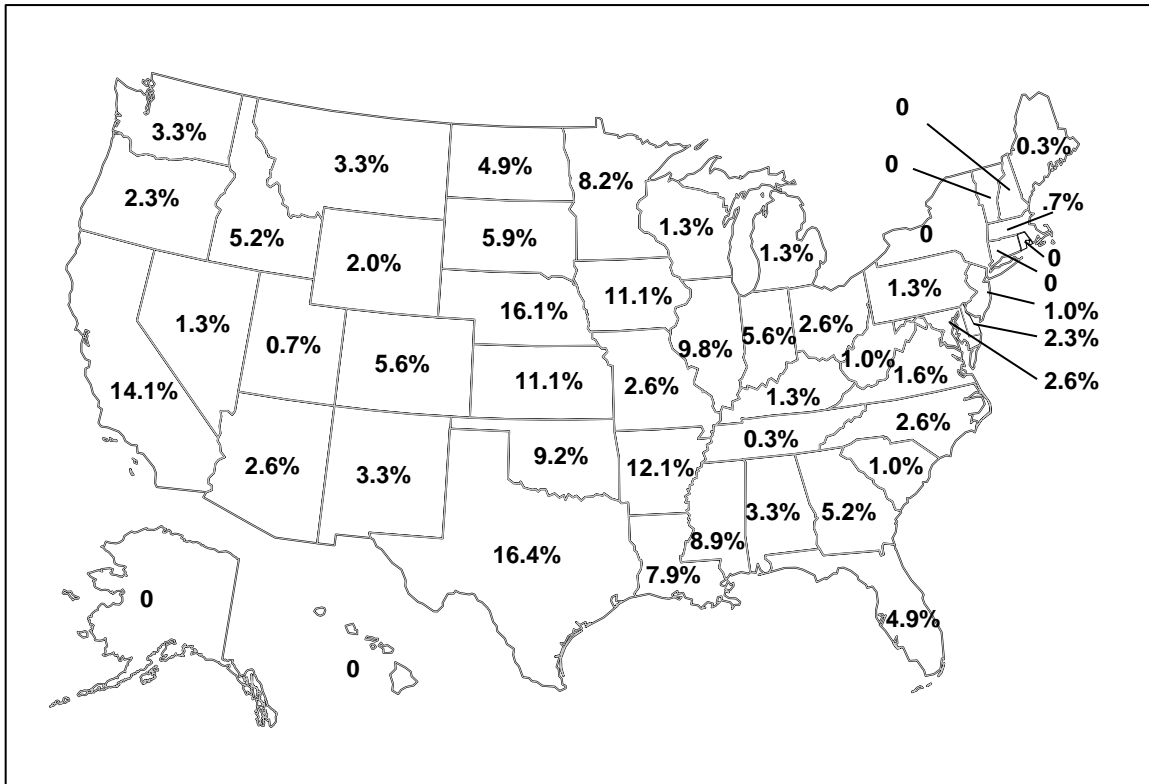


Results presented here are for the 305 (39%) of the respondents who reported they were a Pilot/Employee, not an Operator.



**Survey Question: In which state(s) did you conduct aerial applications in 2017?**

**Figure 2 – Map of states where pilots make applications**



\*305 responses

Locations of where pilots reported making applications are shown. Note that pilots reported making applications in multiple states. For example, 9.8% of the 305 pilots reported they made applications in Illinois. A comparison of responses between 2019 and 2012 survey is shown.

**Table 1 – States where pilots perform aerial application**

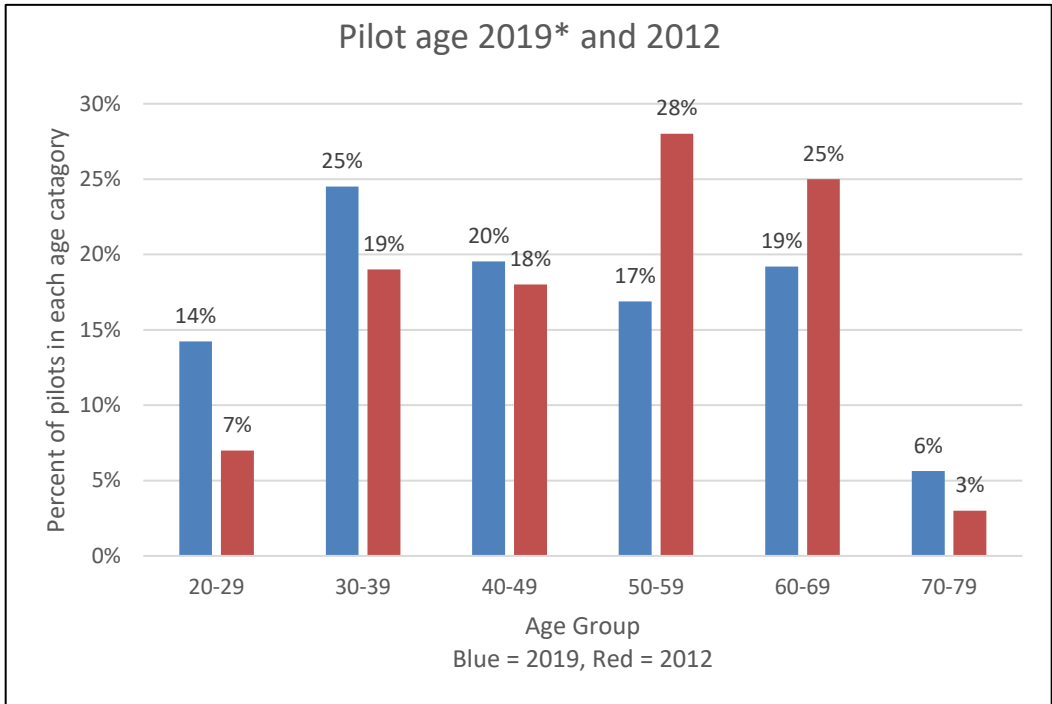
State	2019**	2012*	State	2019 **	2012*	State	2019**	2012*
AL	3.3%	4.0%	LA	7.9%	14.2%	OH	2.6%	6.8%
AK	0.0%	0.0%	ME	.3%	0.6%	OK	9.2%	8.6%
AZ	2.6%	1.9%	MD	2.6%	2.2%	OR	2.3%	3.7%
AR	12.1%	14.2%	MA	0.7%	1.2%	PA	1.3%	1.9%
CA	14.1%	10.2%	MI	1.3%	2.8%	RI	0.0%	0.0%
CO	5.6%	4.9%	MN	8.2%	14.2%	SC	1.0%	2.5%
CT	0.0%	0.0%	MS	8.9%	10.8%	SD	5.9%	13.3%
DE	2.3%	1.9%	MO	4.6%	4.0%	TN	0.3%	2.2%
FL	4.9%	5.2%	MT	3.3%	3.1%	TX	16.4%	22.5%
GA	5.2%	5.9%	NE	16.1%	16.4%	UT	0.7%	0.9%
HI	0.0%	0.0%	NV	1.3%	1.2%	VT	0.0%	0.0%
ID	5.2%	5.2%	NH	0.0%	0.3%	VA	1.6%	4.3%
IL	9.8%	13.0%	NJ	1.0%	2.5%	WA	3.3%	4.3%
IN	5.6%	7.1%	NM	3.3%	7.1%	WV	1.0%	2.2%
IA	11.1%	18.8%	NY	0.0%	1.9%	WI	1.3%	2.2%
KS	11.1%	16.0%	NC	2.6%	4.3%	WY	2.0%	2.8%
KY	1.3%	0.6%	ND	4.3%	11.1%			

\*Percent of 324 respondents \*\*Percent of 305 respondents

None of the pilots reported doing agricultural work in Alaska, Connecticut, Hawaii, New Hampshire, New York, Rhode Island, or Vermont. States in which pilots said they worked most often were Texas- 50 (16.4% of pilots), Nebraska - 49 (16.1%), California 43 (14.1%) Iowa 34 – (11.1%) and Kansas 34 (11.1%). In 2012, states in which pilots said they worked most often were Texas - 73 (22.5%), Iowa - 61 (18.8%), Nebraska - 53 (16.4%), Kansas - 52 (16%), Arkansas - 46 (14.2%) and Minnesota - 46 (14.2%). In 2012, 324 pilots reported working in an average of 2.8 states per pilot. In 2019 305 pilots reported working in an average of 2.2 states per pilot.

**Survey Question: In what year were you born?**

**Figure 3 – Pilot age**

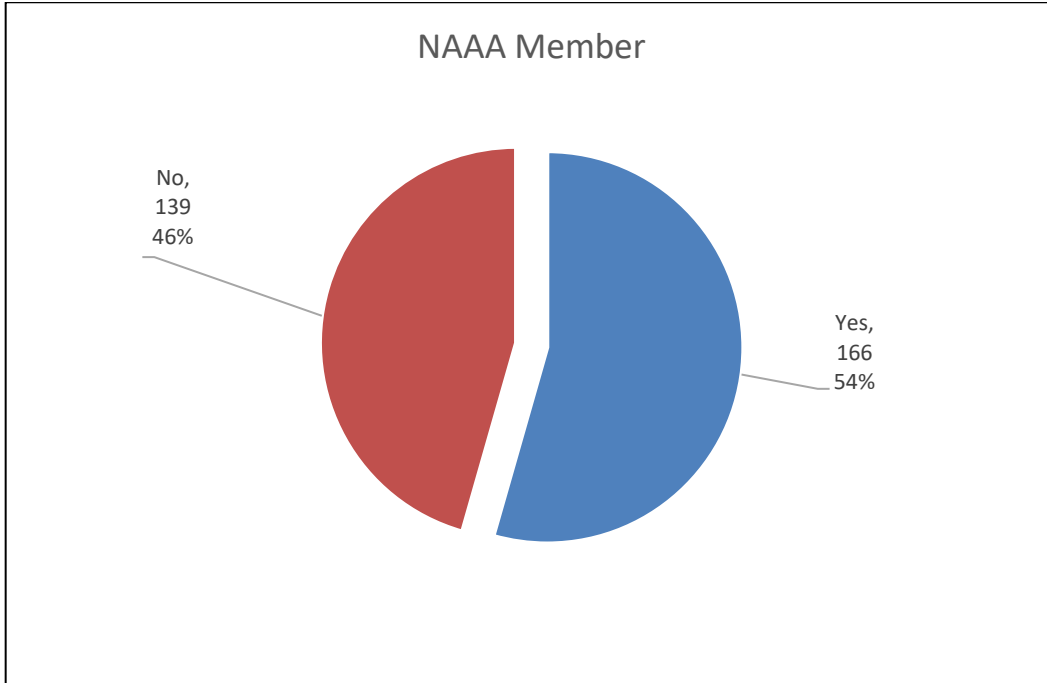


\*302 responses

Age was recorded on 302 responses. Respondent ages ranged from 21 to 79 years. The average age of pilots was 47.4 years (49.9 years in 2012 survey). The proportion of pilot responses in the 20-29 age group doubled between 2012 and 2019. All of the respondents were male.

**Survey Question: Are you a pilot member of the National Agricultural Aviation Association (NAAA)?**

**Figure 4 – Pilot members of NAAA**

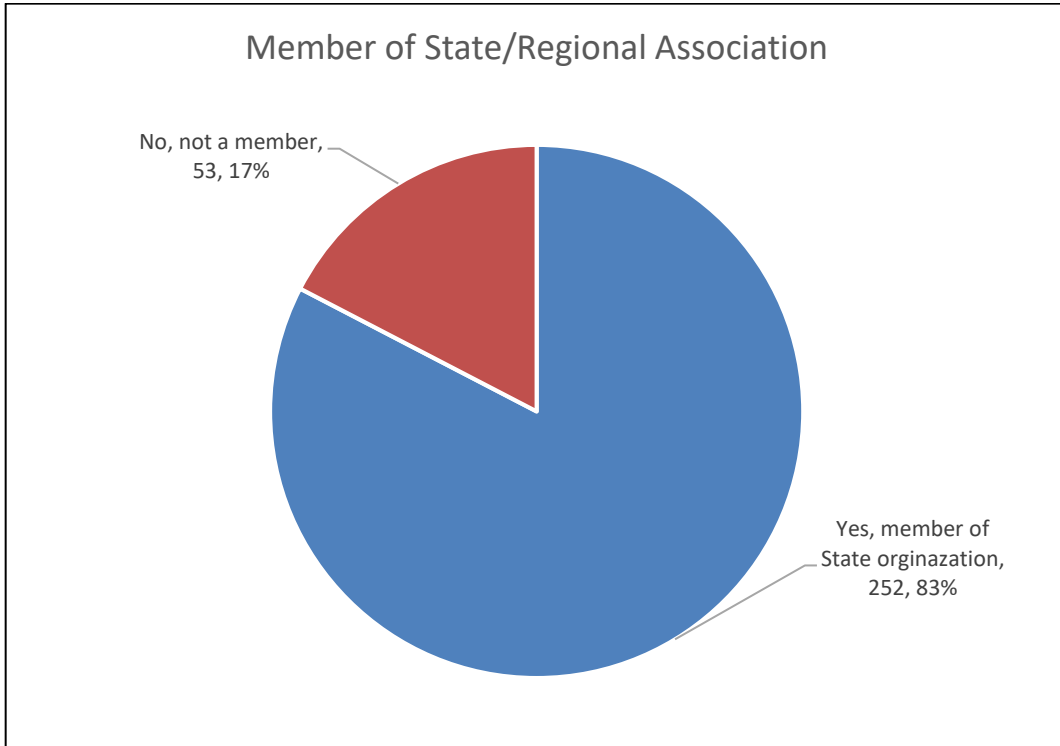


\*305 responses

One hundred sixty-six (54%) were members of NAAA. In 2012 survey, 63% of the respondents were pilot members of NAAA.

**Survey Question: Are you a pilot member of state or regional agricultural aviation association?**

**Figure 5 – Membership in state/regional organization**

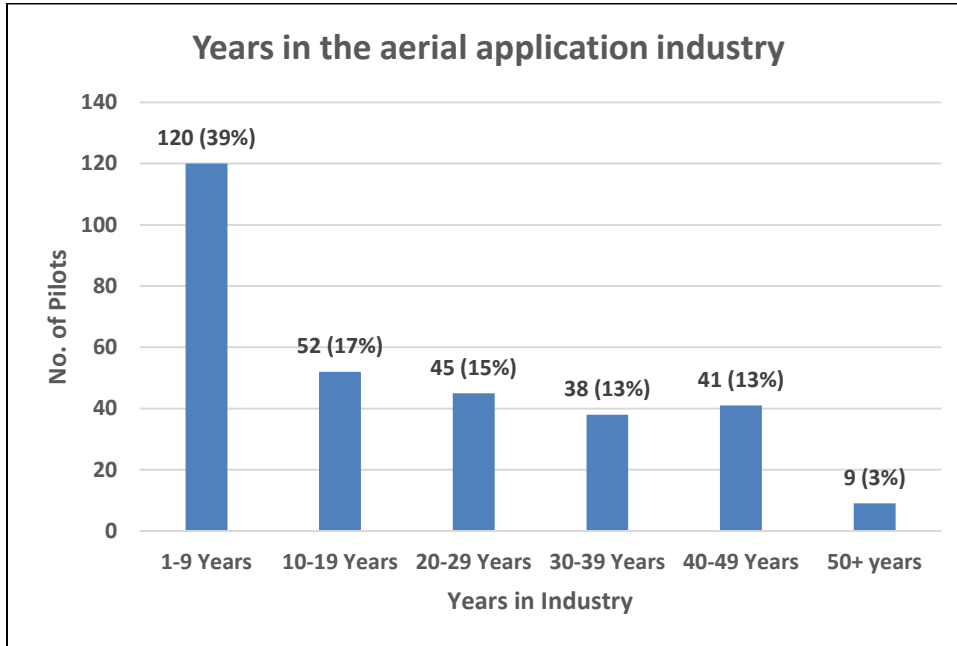


\*305 responses

Two hundred fifty-two (83%) of the pilots reported being a member of a state or regional organization.

**Survey Question: How long have you been in the Aerial Application industry?**

**Figure 6 – Years in aerial application industry**

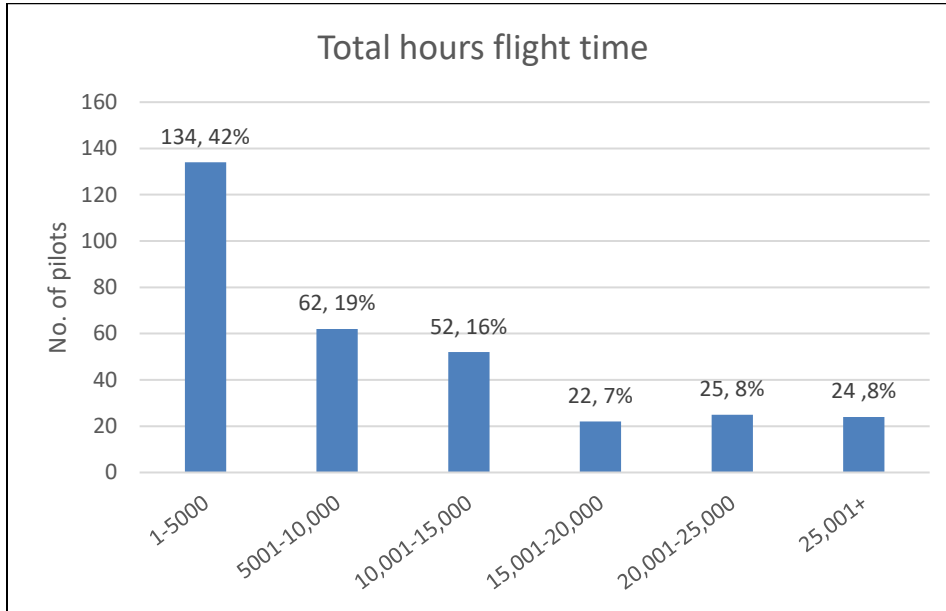


\*304 responses

Responses ranged from one to 55 years. One-hundred-twenty (39%) of the pilots have been in the industry less than ten years. In the 2012 survey, 30% of the pilots had been in the industry less than 10 years. The largest change was in the 30-39-year experience group; in 2012, 26% of the respondents said they had been in the industry between 30-39 years and in 2019, just 13% said they had been in the industry 30-39 years. Other age categories remained the same. Pilots have been in the industry an average of 19.4 years (21.3 years in 2012).

**Survey Question: How many hours of total flight time do you have?**

**Figure 7 – Total flight time (hours)**

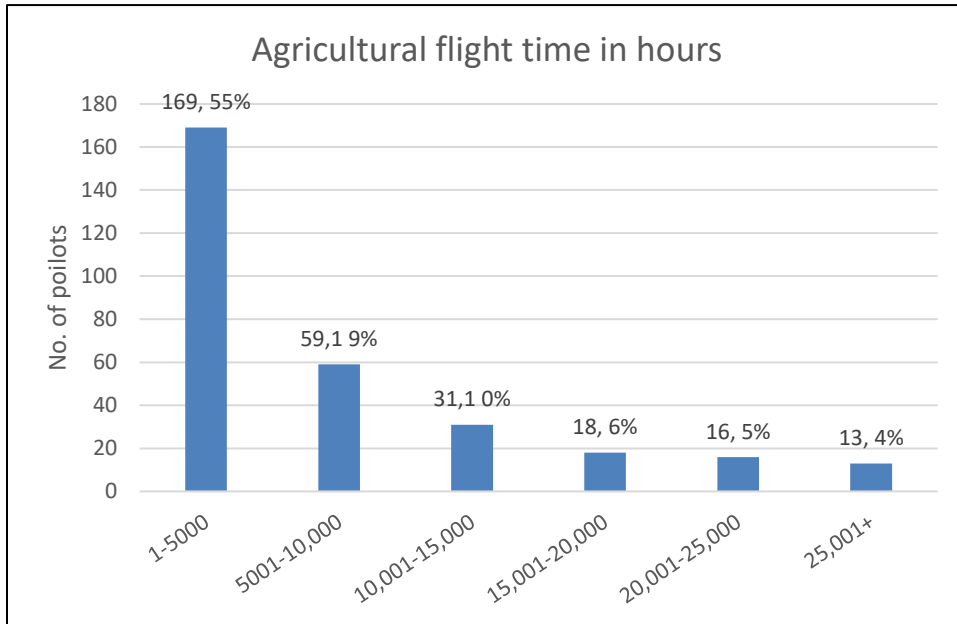


\*319 responses

Twenty-five pilots (8.2%) reported having less than 1,000 hours (5.6% had less than 1,000 hours in 2012). In 2012, 31% of the pilots reported less than 5,000 hours whereas in 2019, 41% reported less than 5000 hours. Average total flight time in 2019 was 9,564 and in 2012 it was an average of 10,997.

**Survey Question: How many hours of ag time do you have?**

**Figure 8 – Total ag hours flight time (hours)**



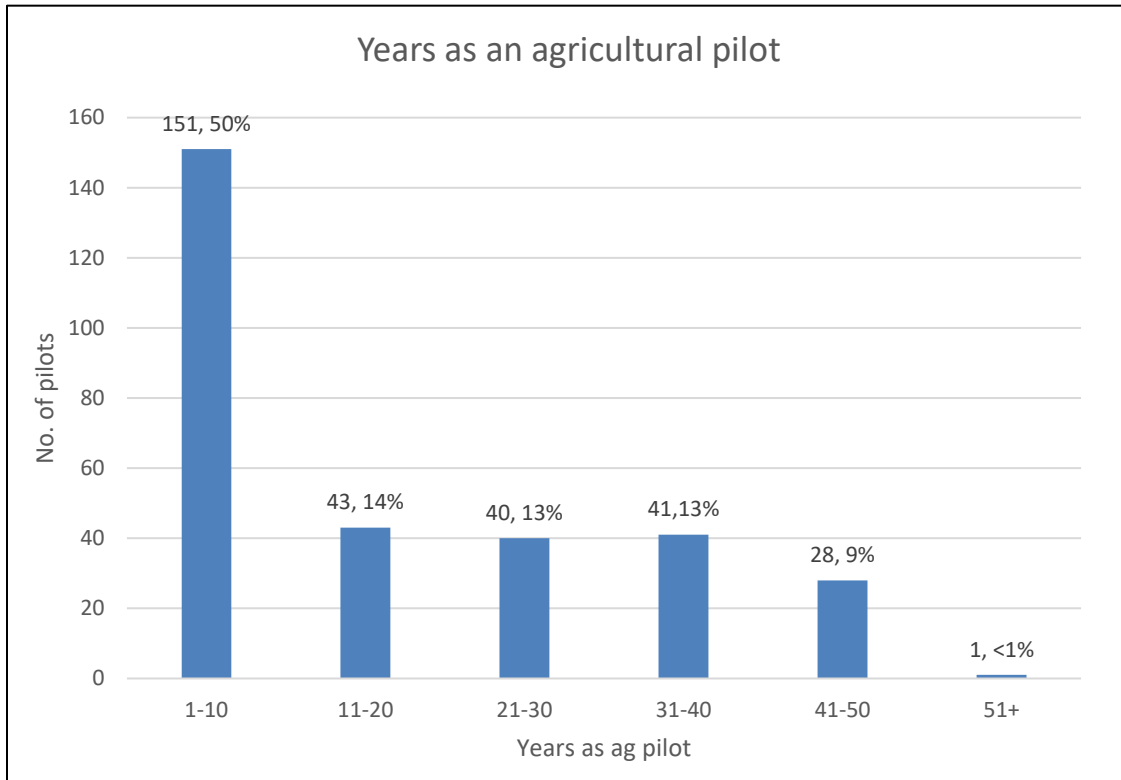
\*306 responses

Fifty (16%) of the pilots reported having less than 1000 hours (18% of the pilots reported having less than 1,000 hours agricultural flight time in 2012). Total agricultural flight time averaged 7,450 in 2019 and 8,510 in 2012.



**Survey Question: How many years have you been an agricultural pilot?**

**Figure 9 – Years as an agricultural pilot**

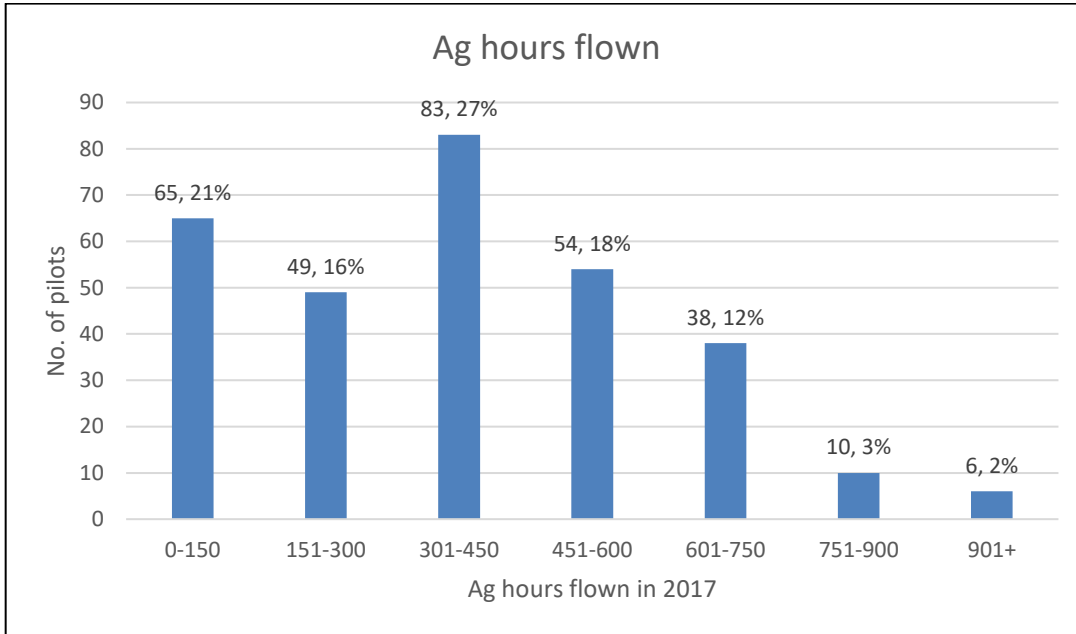


\*304 responses

Of the 302 who reported the number of years they had been a pilot, nearly one half (46.7%) have been an ag pilot for ten or fewer years. In 2012, 33% had been an agricultural pilot for ten or fewer years. Ninety of the respondents, (30%) reported being in the industry 5 or less years. The average number of years as an agricultural pilot is 17.2 years and in 2012, the average was 19.7 years.

**Survey Question: How many agricultural hours did you fly in 2017?**

**Figure 10 – Agricultural flight time**

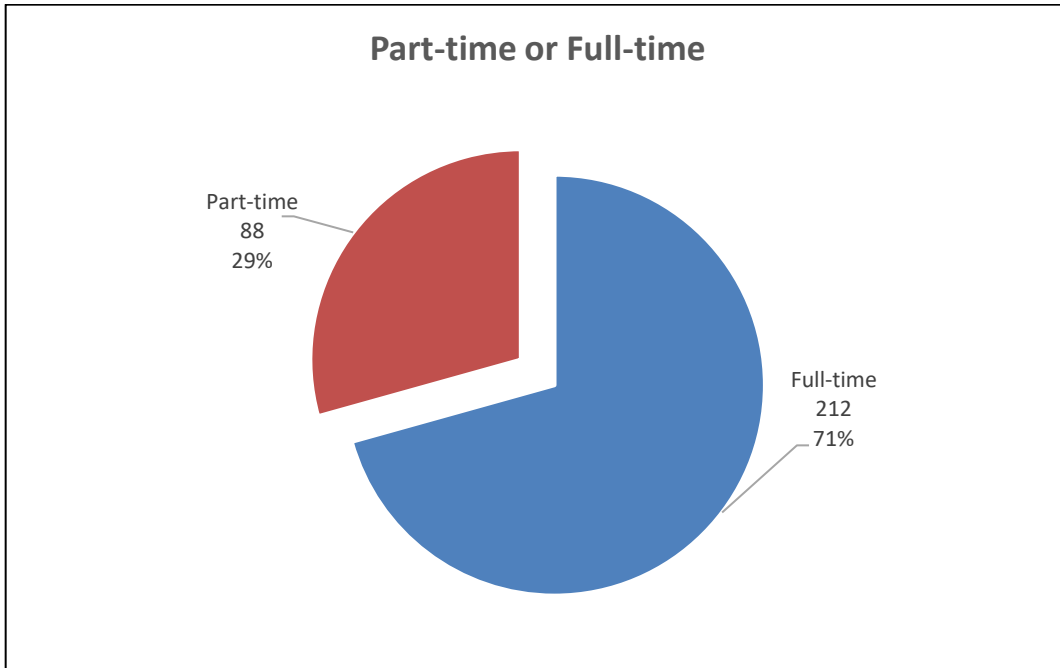


\*304 responses

Twenty-six pilots (8.9%) reported they did not fly at all. Of those who did fly, pilots flew an average of 412 (median 400) agricultural hours and ranged from 0 to 1,100 hours. In the 2012 survey, pilots flew an average of 396 hours.

Survey question: Do you work as an ag pilot full-time or part-time?

Figure 11 – Full-time, part-time



\*300 responses

Three-hundred respondents answered the question about part-time and full-time work. The majority (71%) work full time. Of those pilots who reported flying zero hours, (n=26), and who responded to the part time/full-time question (n=21), just four respondents said they work full time. Table 2 below compares part time and full time across several parameters.

**Table 2 – Part-time and full-time comparisons**

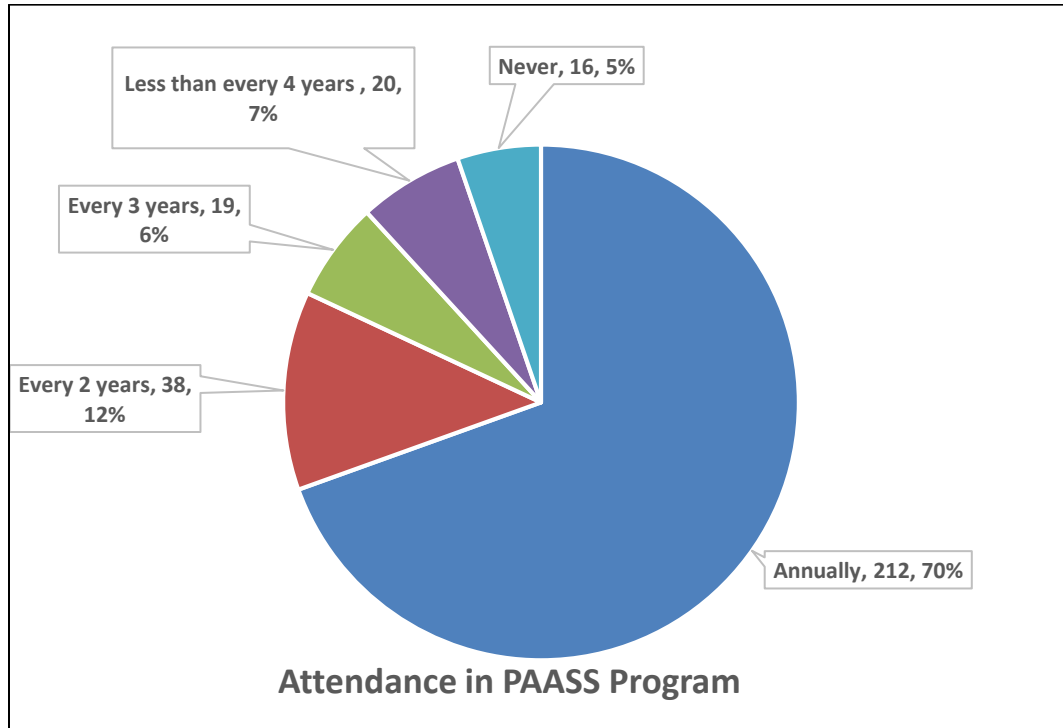
	Part-time	Full-time
Average hours flown*	229.8	465.8
Average years in the industry	21.9	18.3
Average age in years	52.9	45
Earnings**	(n) (%)	(n) (%)
0-\$20,000	20 (30.3%)	5 (3.3%)
\$20,001-\$40,000	14 (21.2%)	10 (6.5%)
\$40,001-\$60,000	8 (12.1%)	13 (8.5%)
\$60,001-\$80,000	4 (6.1%)	17 (11.1%)
\$80,001-\$100,000	10 (15.2%)	26 (17%)
\$100,001-\$120,000	6 (9.1%)	22 (14.4%)
\$120,001+	4 (6.1%)	60 (39.3%)
Work outside the industry during off season		
Yes	47 (68.1%)	72 (39.8%)
No	22 (31.9%)	109 (60.2%)

\*Excludes those who flew zero hours \*\*66 Part-time & 153 Full-time responses

One-half of pilots who said they worked part-time reported earning \$40,000 or less whereas half the pilots who said they worked full-time reported earning \$100,000 or more. Mid-point weighted average earnings for those reporting part-time work as a pilot in the Agricultural aviation industry was \$50,506 and for full-time was \$92,484.

**Survey Question: How often do you attend the PAASS Program?**

**Figure 12 – Attend PAASS program**



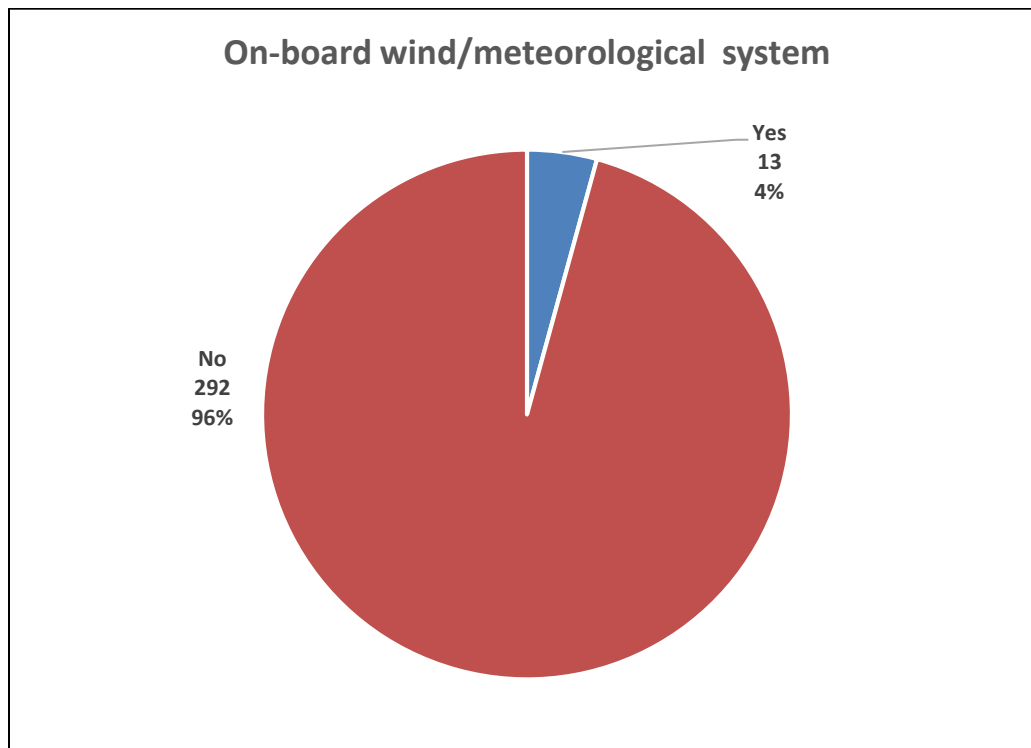
\*305 responses

Three hundred-five pilots reported how often they attend the PAASS Program. The majority (70%) said they attend annually and only 5% said they had never attended a PAASS Program. Of those 16 who reported never having participated in a PAASS Program, one-half are members of NAAA and 9 of the 16 reported working part-time.

## 1.1.2. Equipment and standard practices

**Survey Question: Does the aircraft you use most often have an on-board wind/meteorological measurement system that displays wind speed and direction in the cockpit (e.g. Aircraft Integrated Meteorological Measurement System, AIMMS)?**

**Figure 13 – On board wind/met measurement system**

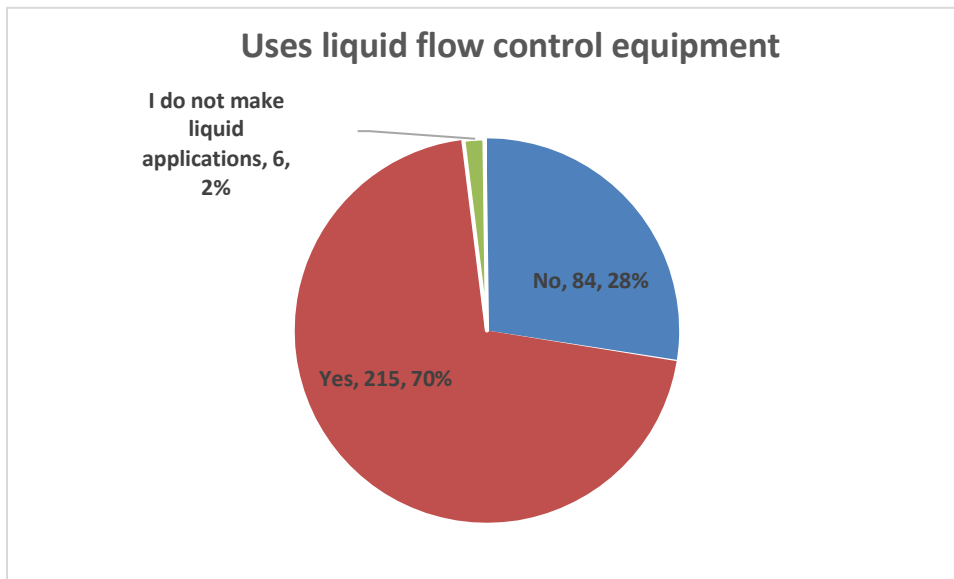


\*305 responses

Most (92%) of the 305 respondents indicated the aircraft they use most often does not have an on-board meteorological measurement device in the cockpit that can display wind velocity and direction.

**Survey Question: Does the aircraft you use most often for liquid applications have equipment for making constant rate applications (apply a constant application regardless of speed) or making variable rate application (varies the application rate across the field according to a prescription map of soil or crop conditions)?**

**Figure 14 – Liquid flow control equipment for making constant or variable rate applications**

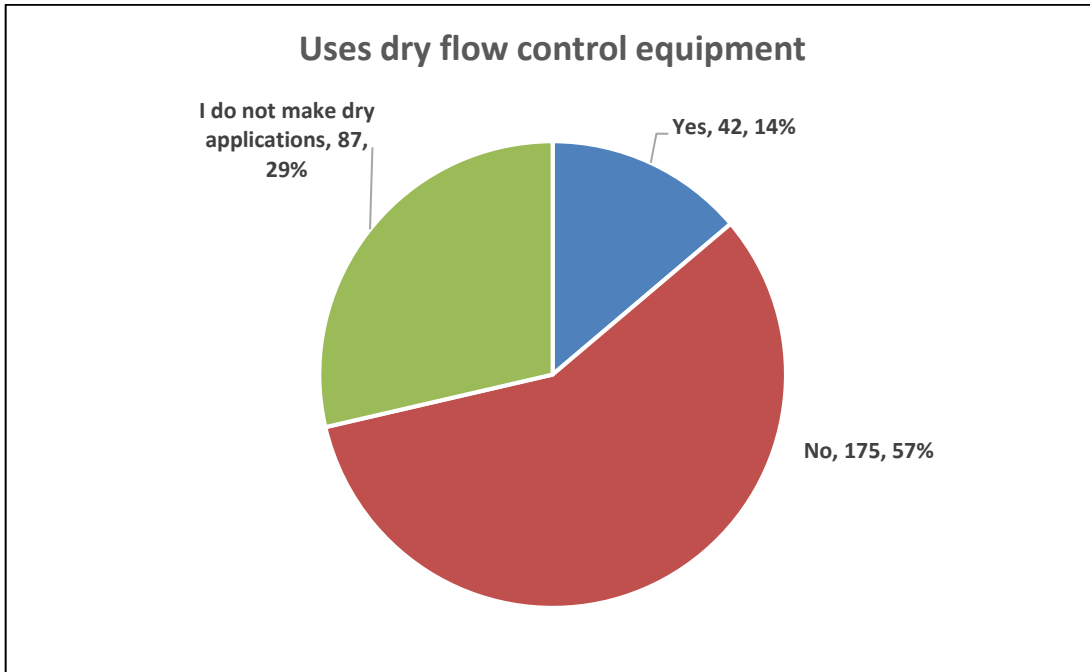


\*305 responses

Nearly three quarters of the aircraft used for making liquid applications have equipment necessary to make constant or variable rate applications.

**Survey Question: Does the aircraft you use most often for dry applications have equipment for making constant rate applications (apply a constant application regardless of speed) or making variable rate application (varies the application rate across the field according to a prescription map of soil or crop conditions)?**

**Figure 15 – Dry flow control equipment for making constant or variable rate applications**



\*304 responses

Forty-two pilots (14%) reported the equipment they use most often is equipped to make constant or variable rate applications when making dry applications. Nearly 1/3 of the pilots said they do not make dry applications.



**Survey Question: To identify and track sensitive areas, I use: (Please check all that apply.)**  
**a) A sensitive crop registry (i.e FieldWatch, b) Data we collected, c) Data retrieved and given to me digitally, d) Data retrieved and given to me on hand-drawn maps, e) Other, please specify.**

**Table 3 – Methods used to identify and track sensitive areas**

Methods to track sensitive areas	Responses	Percent
Data I collect myself	183	61%
Data stored and given to pilots on hand-drawn maps	188	63%
Sensitive crop registry (i.e.FieldWatch)	77	26%
Data stored and given to pilots digitally	92	31%

Three hundred pilots responded to the question selecting an average of 1.9 methods they use to identify and track sensitive areas. Sixty-three percent said they use data retrieved and given to them on hand-drawn maps.

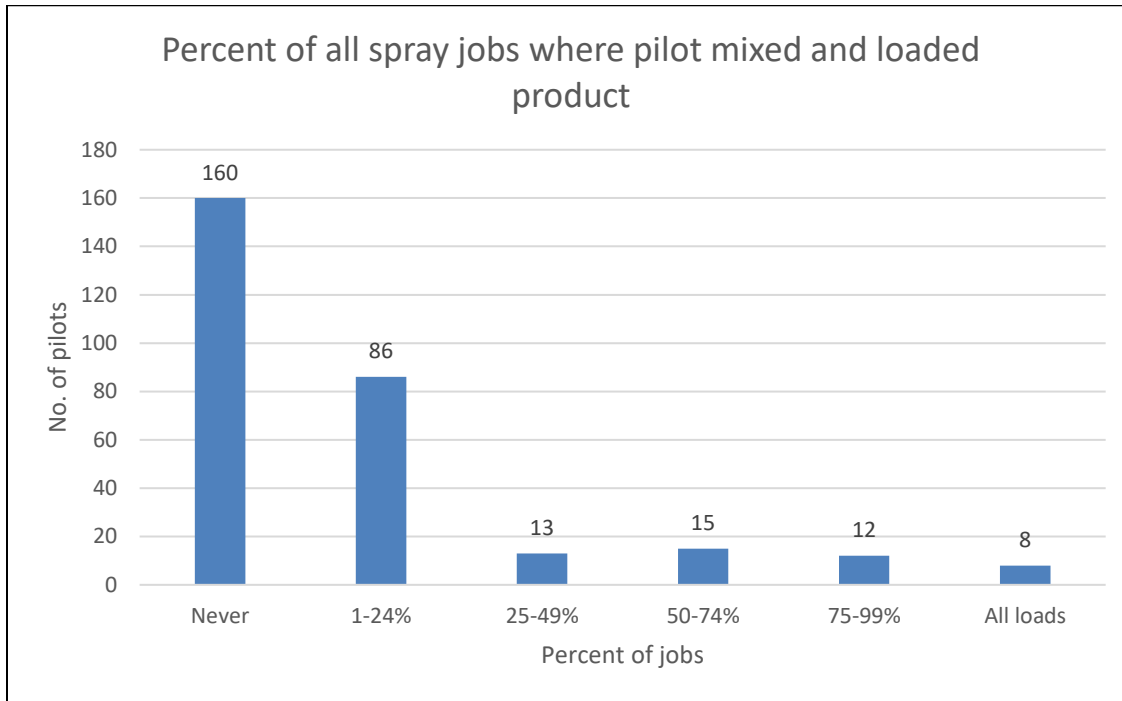
Other methods recorded by pilots to identify and track sensitive areas are listed below.

**Table 4 – Other methods used to identify and track sensitive areas**

Google earth	Drive out to the sensitive areas, call the farmers, check with PCAs
We rely upon info provided by the farmer or Co-op, each year.	Riding and checking the surrounding area surrounding fields!
Data provided to me on aerial maps	Knowledge I get from asking questions of the grower
Driftwatch	Grower knowledge

**Survey Question: In a normal workday, what percentage of all spray jobs do you, as the pilot, also mix and load product?**

**Figure 16 – Percent of all spray jobs where pilot mixes and loads**



\*294 responses

Two hundred-ninety-four pilots responded. The majority (87%) said they mix and load less than or equal to 25% of the time and over half the pilots (54%) said they never mix and load. Eight pilots (2.7%) said they always mix and load. In the 2012 survey, 53% said they never mix and load and approximately 75% of the pilots reported mixing and loading less than 25% of the time.

Survey question: Which of the following do you use to control spray drift? (Please check all that apply.) a) Drift control additives, b) Wind detectors on the ground, c) Smoker to monitor wind speed and direction, d) Smoker to monitor inversions, e) Modify droplet size by changing pressure, f) Modify droplet size by changing the nozzle orifice size, g) Modify droplet size by changing nozzle type, h) Modify droplet size by changing nozzle angle, i) Modify droplet size by changing airspeed, j) Change in-flight patterns, k) Right or left boom shut off, l) Reduce effective boom length, on the ground or in-flight, using adjustable valves or shut-offs, m) Buffer zones on the downwind side of the field, n) On-board wind/meteorological measurement system (e.g. AIMMS)

**Table 5 – Percent of pilots who use these drift control methods**

Pilots*	Methods used to control spray drift
87.0%	(m) Buffer zones on the downwind side of the field
86.0%	(a) Drift control additives
84.6%	(c) Smoker to monitor wind speed and direction
62.1%	(f) Modify droplet size by changing the nozzle orifice size
61.1%	(d) Smoker to monitor inversions
52.6%	(h) Modify droplet size by changing nozzle angle
46.8%	(j) Change in flight patterns
44.7%	(b) Wind detectors on the ground
43.0%	(e) Modify droplet size by changing pressure
34.5%	(i) Modify droplet size by changing airspeed
33.4%	(k) Right or left boom shut off
30.0%	(l) Reduce effective boom length, on the ground or in-flight, using adjustable valves or shut-offs
22.9%	(g) Modify droplet size by changing nozzle type
3.1%	(n) On-board wind/meteorological measurement system (e.g. AIMMS)

\*293 responses

Two hundred ninety-three pilots responded to the question selecting an average of seven methods they use to control spray drift. The three most common methods used by over 80% of pilots were buffer zones on the downwind side of the field, drift control additives, and a smoker to monitor wind speed and direction. Just 9 pilots (3.1%) reported having on board wind/meteorological measurement systems. In the 2012 survey, 78% of the pilots reported using drift control additives and 72% said they change in-flight patterns. Presence of on-board wind/meteorological measurement systems was the same during the two surveys. Direct comparisons to other drift control methods cannot be made because the questions changed between the two surveys.

AIMMS (Aircraft Integrated Meteorological Measurement System) is an on-board system which measures real time, site specific atmospheric data, including wind speed, direction, altitude, humidity and temperature. AIMMS enables pilots to line up their swath in a manner that takes into account wind direction and speed to mitigate drift. Meteorological data is collected and synced with the GPS latitudinal and longitudinal coordinates. Smokers are mechanical devices that inject oil into the aircraft’s exhaust system. The smoke produced aids the pilot in determining many factors such as wind direction and velocity and the existence of an inversion.

**Survey Question: When applying pesticides by air, which of the following do you use for swath guidance? (Please check all that apply.) a) GPS, b) Automatic flaggers, c) Human flaggers, d) other.**

**Table 6 – Swath guidance used**

Method	2019 Survey*	2012 Survey**
Human Flaggers	1%	1%
Automatic Flaggers	6%	17%
GPS	99%	95%
Other	1%	1%

\*294 responses

Two hundred ninety-four pilots responded to the question and 99.7% (all but one) said they use GPS for swath guidance. In the 2012 survey, 95% of pilots relied on GPS, 17% on automatic flaggers and 1% human flaggers. Other methods reported by pilots were: sprinkler heads, training and experience, markers and irrigation system spacing, and visual ground references.

**Survey Question: If your aircraft is equipped with smoker(s) to determine wind direction while performing aerial applications, how often is it used? (Check all that apply.) a) Do not use an aircraft equipped with a smoker, b) Before an application near a sensitive area, c) Every swath run, d) Every 2-4 swath runs, e) Every 5-7 swath runs, f) Every load, g) Other, please specify**

**Table 7 – Frequency of smoker use in smoker-equipped aircraft**

% of pilots*	responses	Frequency of smoker use
64.9%	189	Before an application near a sensitive area
33.7%	98	Every load
28.5%	83	Every 2-4 swath runs
21.0%	61	Every 5-7 swath runs
8.6%	25	Other, please specify
2.1%	6	Every swath run
12.0%	35	Do not use an aircraft equipped with a smoker

\*497 responses among 291 pilots (multiple responses allowed)

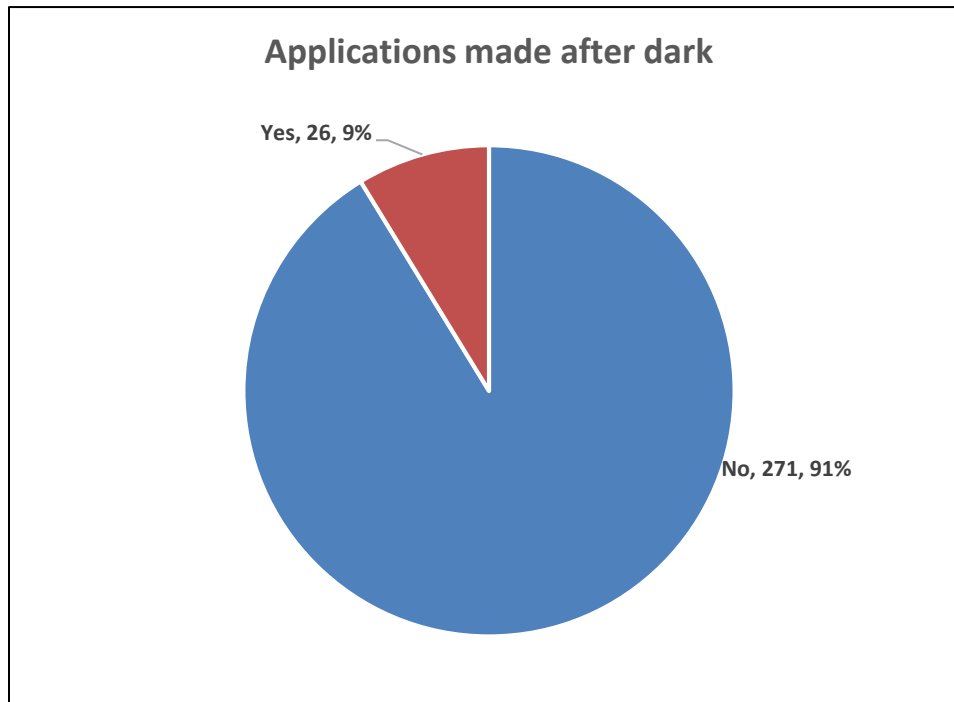
Twelve percent of the pilots reported they do not fly an aircraft that is equipped with a smoker. In the 2012 survey, 16% of the aircraft were not smoker-equipped. Pilots who fly aircraft with a smoker, 73.8% said they use it before an application near a sensitive area and 38.3% said they use the smoker on every load. Other responses were:

- 2 or 3 times during an application;
- Depends on condition, material, surroundings etc.;
- When unsure if conditions changed;
- When needed;
- Frequency of use depends upon conditions in the field, according to meteorological factors;
- Randomly during an application near a sensitive area;
- Depending on conditions and crops and sensitive areas;
- As needed depending on physical and visual clues;
- Beginning, halfway, end of job;
- Before and during every herbicide job;
- Before and during near sensitive areas;
- Whenever drift is a concern;
- When I can sense a wind shift;
- Every swath run near sensitive areas;
- Whenever I want to see what the wind is doing; rarely;
- All passes near sensitive areas if wind is light;
- Depends on product and proximity to sensitive areas;
- Sometimes every pass, sometimes only before I start and last pass;
- Depends if a light and variable wind;
- When apply herbicides, more often, sometimes every pass.

In the 2012 survey, 84% of the aircraft were smoker-equipped and in 2019, 88% were smoker-equipped. Phrasing of the questions changed. In 2012 survey, pilots were asked to select only one answer whereas in 2019 survey, pilots could select all that apply.

**Survey Question: Do you make applications during the hours of darkness?**

**Figure 17 – Treatments after dark**



Twenty-six pilots out of 297 who responded to the question said they make applications during the hours of darkness. These pilots were asked if they use a) Night vision goggles, or b) Night lights, or both. Twenty-two of the twenty-six pilots who said they make applications during hours of darkness responded to this question. Twenty-one of the 23 (95%) said they use night lights, one said they use night vision goggles alone, and one said they use both night vision goggles and night lights.

**Survey question: Please rank the reasons for doing applications during hours of darkness. (Drag and drop the reasons into the appropriate order where 1 is the primary reason.)**

- To protect pollinators
- Because of cooler temperatures
- Because there's less wind
- Because field workers are not present
- Other, please specify

**Table 8 – Ranked reasons for doing applications during hours of darkness**

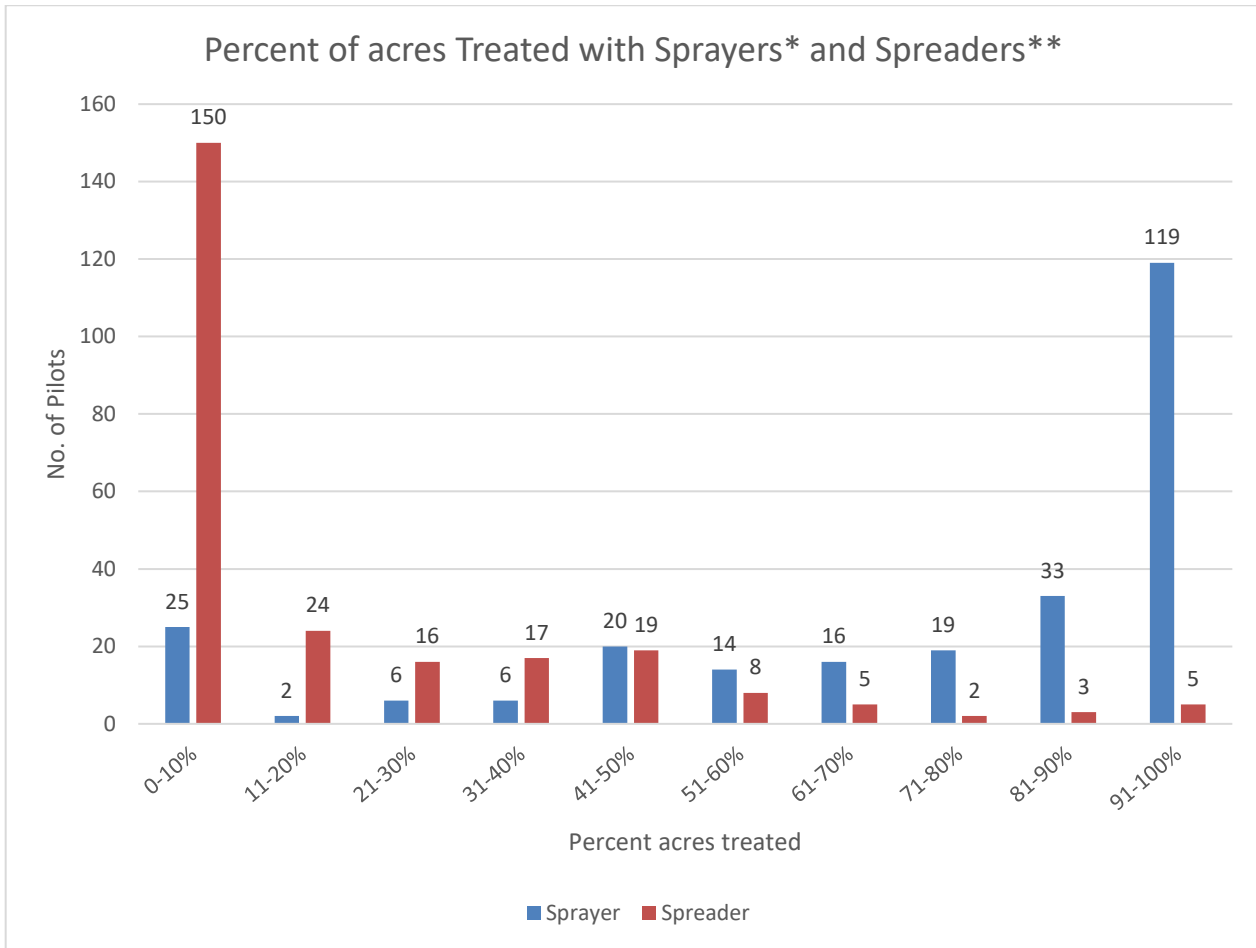
Reason	Average	Mode
To protect pollinators	2.09	1
Because field workers are not present	2.18	1
Because of cooler temperatures	3.0	3
Because there's less wind	3.55	4

Twenty-two pilots responded to the question and rank ordered the four choices. The leading two reasons were to protect pollinators and because field workers are not present. Additionally, five pilots expressed additional reasons for doing applications during hours of darkness. These were: To kill mosquitos- ranked 1; To finish field-ranked 1; Request of grower-ranked 2; High ambient temperatures- ranked 4; and Temperature and wind-ranked 5.

The next few questions are about equipment used in Dry and Liquid applications.

Survey Question: Please tell me the percentage of all acres you treated in 2017 using sprayers or spreaders. (Must equal 100%.)

Figure 18 – Percent of acres treated with sprayers and spreaders



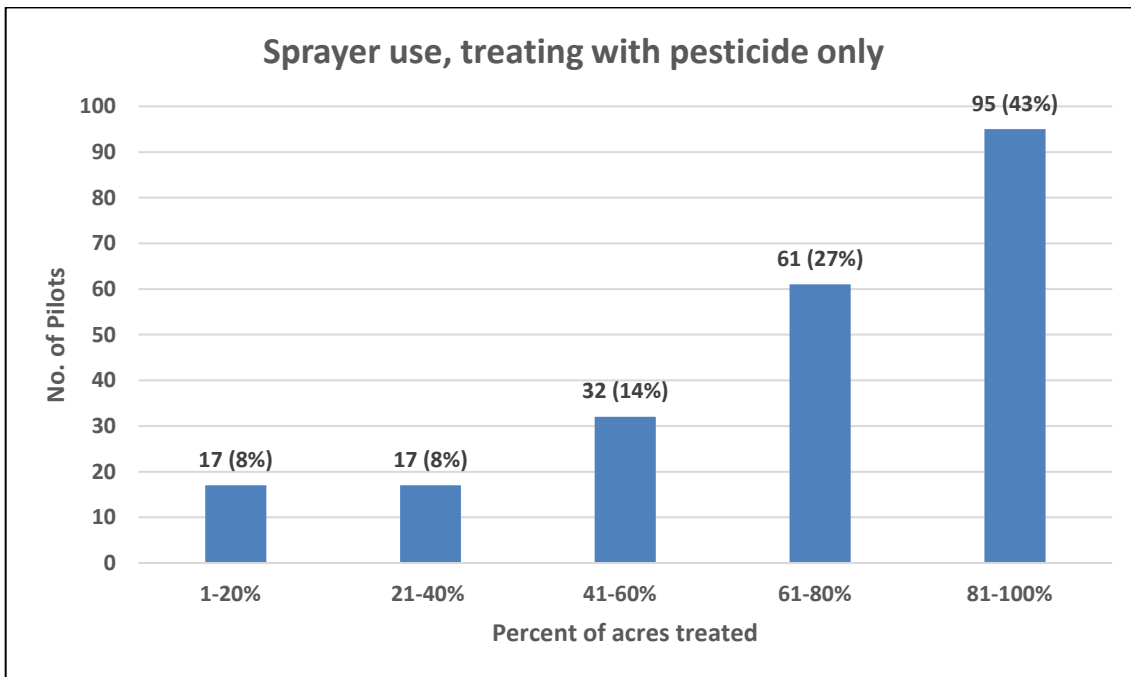
\*260 responses \*\*249 responses

Two hundred sixty pilots responded to the question about the percentage of acres treated using a sprayer and 249 responded to the question about spreaders. Spreaders are used on far fewer acres than sprayers. Over half (58%) of the pilots reported using a sprayer on 80% or more of the acres treated. Seventy percent of the pilots reported using a spreader on less than 20% of the acres treated. One hundred pilots (40%) said they did not use a spreader.



**Survey Question: If you used a sprayer in 2017, - what percent of these acres treated were pesticide only?**

**Figure 19 – Percent of acres treated using a sprayer that were pesticide only**

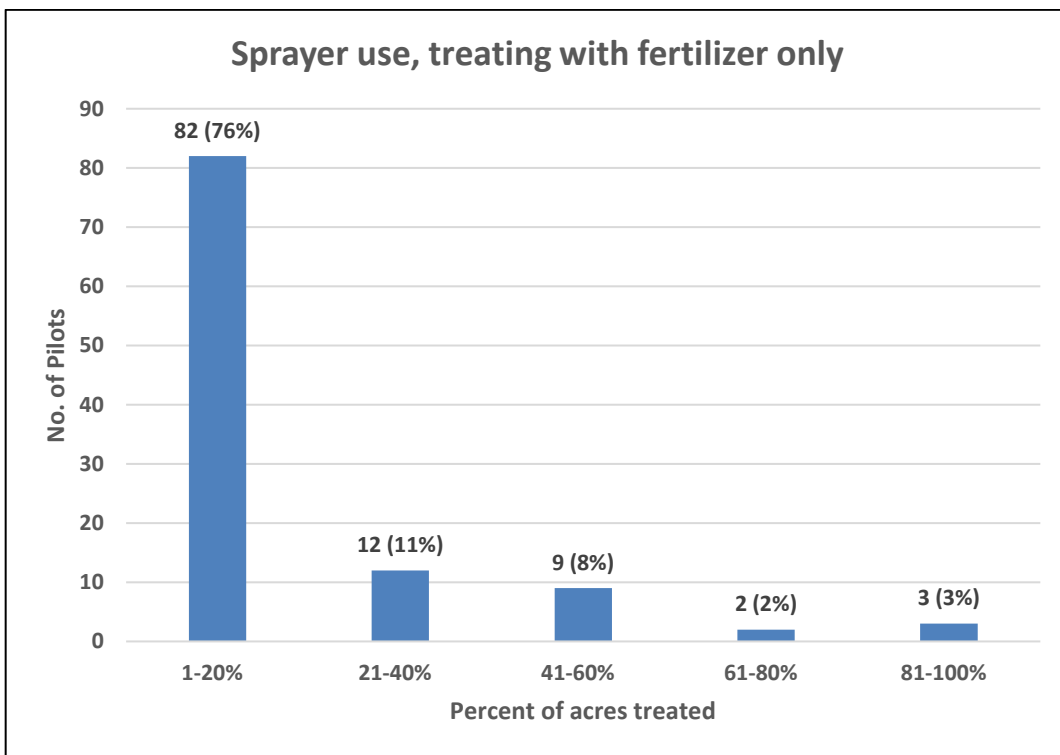


\*222 responses

Ninety-five pilots, (43% of the 222 reporting) said 80% or more of the acres treated were sprayed with pesticides alone. Seventeen pilots (8%) said fewer than 20% of the total acres treated were treated with pesticides alone. Thirty-seven pilots said 100% of the sprayed acres was pesticide only treatment.

**Survey question: If you used a sprayer in 2017, - what percent of these acres treated were fertilizer alone?**

**Figure 20 – Percent of acres treated with a sprayer that were fertilizer only**

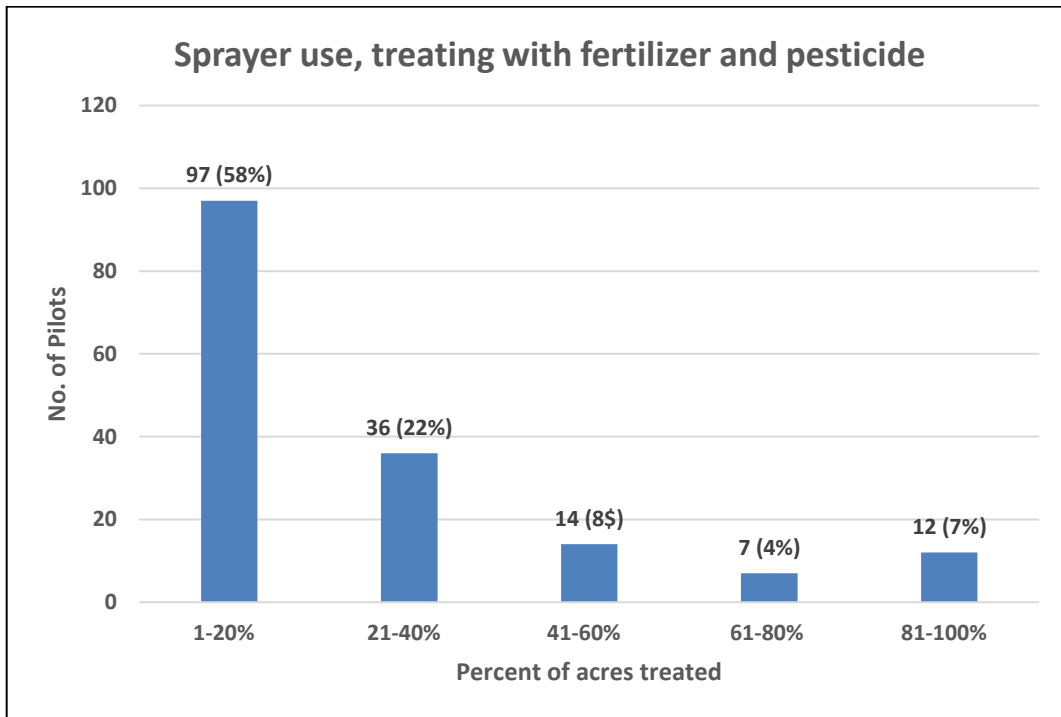


\*108 responses

The majority, (82) of the 108 pilots reporting said they treat fewer than 21% of the acres treated with fertilizer alone using a sprayer.

**Survey Question: If you used a sprayer in 2017, - what percent of these acres treated were a mixture of both pesticide and fertilizer?**

**Figure 21 – Percent of acres treated with a sprayer with a mixture of pesticide and fertilizer**

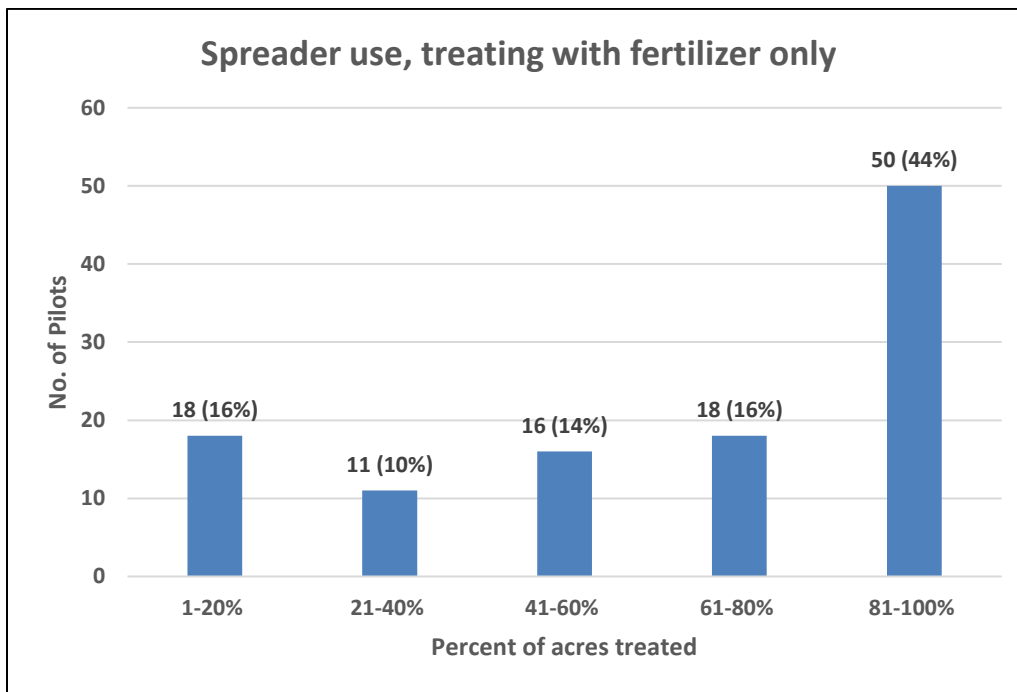


\*167 responses

Ninety-seven (58% of pilots) said 20% or fewer of the acres treated were a mixture of both a pesticide and a fertilizer. Eleven pilots reported that 100% of the acres treated were a pesticide and fertilizer mixture.

**Survey question: If you used a spreader in 2017, - what percent of these acres treated were fertilizers?**

**Figure 22 – Percent of acres treated using a spreader applying fertilizer only**

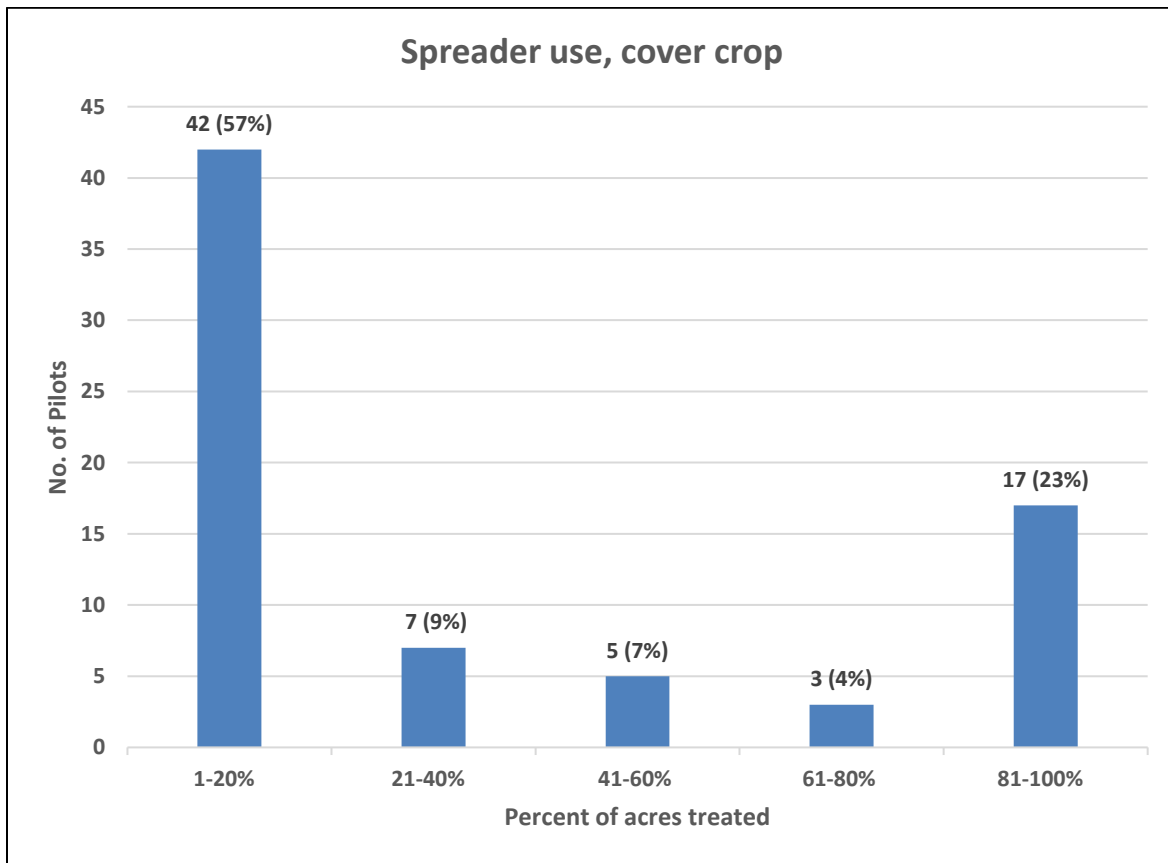


\*113 responses

Fifty of the 113 pilots reporting (44%) said more than 80% of the acres treated with a spreader were fertilizer loads. Twenty pilots reported that 100% of the acres treated using a spreader were fertilizer.

**Survey Question: If you used a spreader in 2017, - what percent of these acres treated were cover crop(s)?**

**Figure 23 – Percent of acres treated using a spreader applying to cover crops**

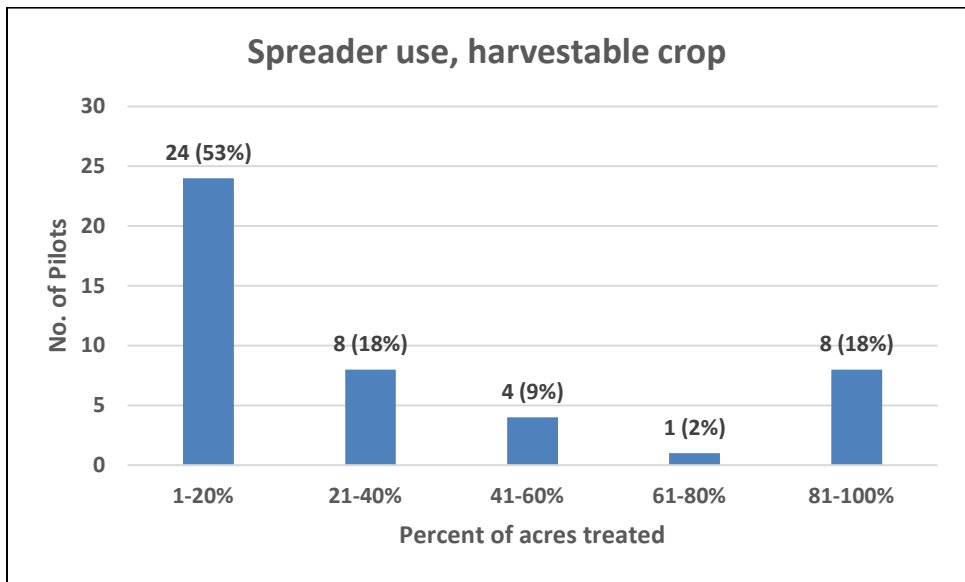


\*74 responses

Seventeen of the 74 pilots reporting (23%) said 80% or more of the acres treated with a spreader were cover crops. Twelve pilots (16%) said that 100% of the acres treated with a spreader were cover crops. The majority of pilots (57%) said 20% or less of the acres treated with a spreader were cover crop treatments.

**Survey Question: If you used a spreader in 2017, - what percent of these acres treated were harvestable crop seeding (e.g. rice)?**

**Figure 24 – Percent of acres treated using a spreader to conduct harvestable crop seeding such as rice**

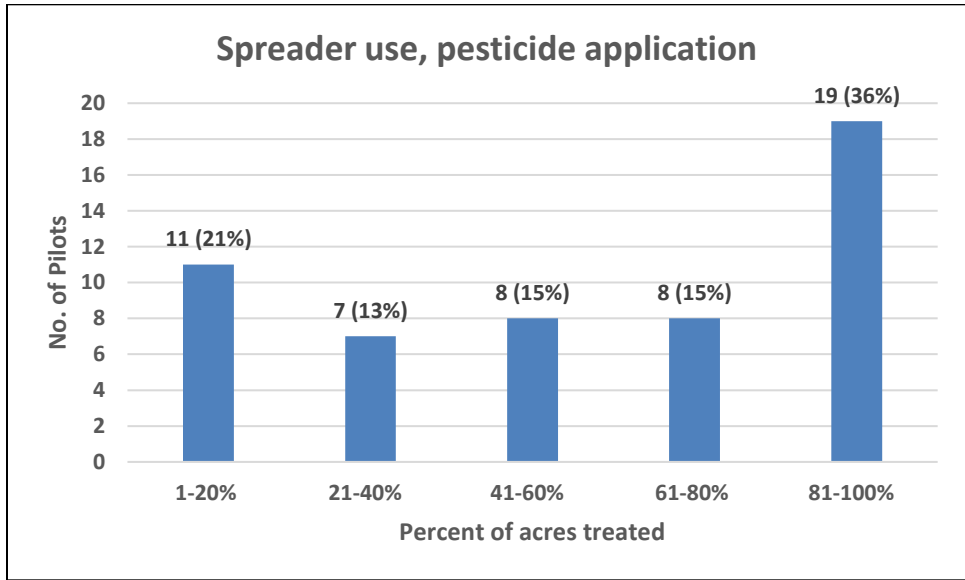


\*45 responses

Most of the 45 pilots who responded (53%) said that they do 20% or less of the acres treated doing crop seeding. Eight pilots (18%) said that 90% or more of the acres treated were seeding operations.

**Survey Question: If you used a spreader in 2017, - what percent of these acres treated were pesticide applications?**

**Figure 25 – Percent of acres treated using a spreader for applying pesticides**

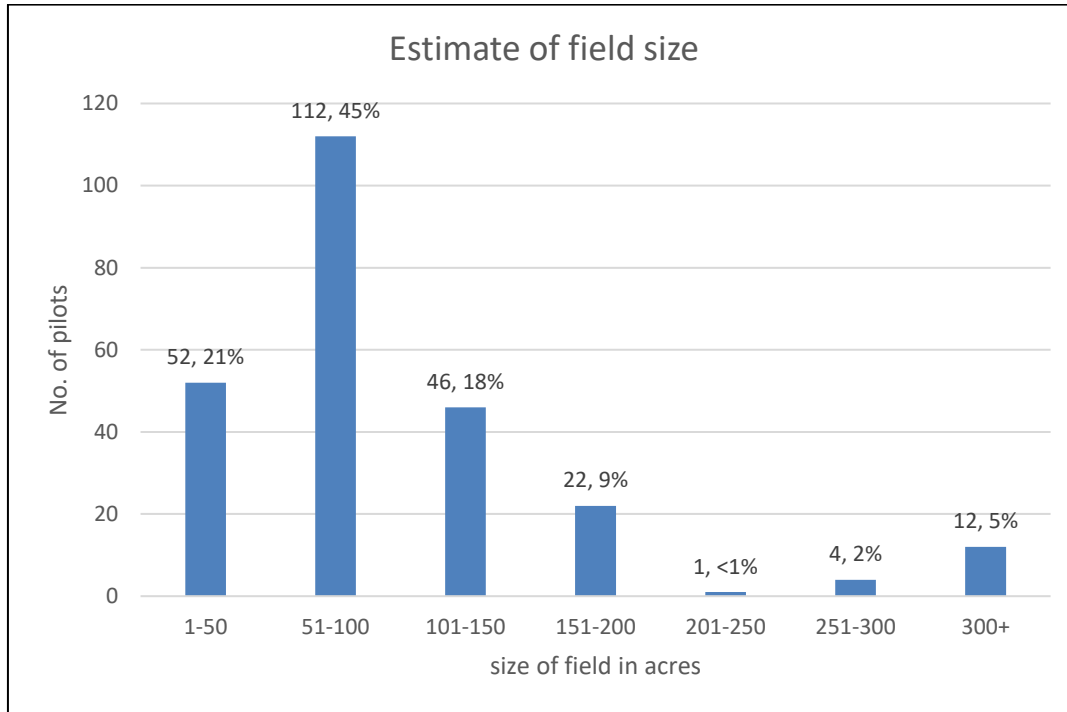


\*53 responses

Nineteen of 53 pilots reporting, (36%) said 81% or more of the acres treated with a spreader were pesticide treatments. Eleven of the 53 (21%) said that 100% of the acres treated using a spreader were pesticides.

**Survey Question: Think of the size of all the fields you treated, in acres, in 2017. Please estimate average of these field sizes.**

**Figure 26 – Average field size treated**



\*249 responses

The average field size among the 248 respondents was 126.4 acres. Most (66%) were between 10 and 100 acres. Ninety-three percent of the pilots estimated a field size of 200 acres or less.



1.1.3. Risk Perceptions

Survey Question: During the active spray seasons you may be exposed to many hazards. Score each item below where 1 is considered 'not a risk' and 10 is 'very risky'

- \_\_\_\_\_ Chemicals
- \_\_\_\_\_ Rotating prop
- \_\_\_\_\_ Engine noise
- \_\_\_\_\_ Cockpit clutter
- \_\_\_\_\_ Birds
- \_\_\_\_\_ Power lines
- \_\_\_\_\_ Communications towers
- \_\_\_\_\_ Mechanical failure
- \_\_\_\_\_ Adverse weather conditions
- \_\_\_\_\_ Limited space for maneuvering
- \_\_\_\_\_ Wind turbines
- \_\_\_\_\_ Meteorological towers
- \_\_\_\_\_ Unmanned Aircraft Systems (drones)
- \_\_\_\_\_ Aircraft being shot at
- \_\_\_\_\_ Night applications
- \_\_\_\_\_ Other \_\_\_\_\_

Example:

Crossing the street without looking 7

Mowing lawn with bare feet 7

Running with scissors 2

Table 9 – Risk perception ranking highest to lowest

Risk and/or Hazard	2019 Pilot's average	2012* Pilot's Average	2019 No. of Responses	2019 Operator's average	2012 Operator's Average
Power lines	7.7	7.0	251	7.1	6.5
Communication towers	6.8	6.6	252	6.3	6.1
Meteorological towers	6.0	5.7	251	5.9	5.5
Adverse weather conditions	5.0	4.1	251	4.2	3.6
Rotating Prop	4.7	4.3	251	5	4.4
Mechanical failure	4.6	4.4	251	4.1	3.9
Limited space for maneuvering	4.6	3.9	252	3.7	3.4
Wind Turbines	4.4	4.4	249	4.5	4.0
Birds	4.4	4.2	253	4.1	4.5
Chemicals	4.4	3.8	254	4.7	3.7
Engine Noise	3.9	3.5	252	3.9	3.2
Cockpit clutter	2.6	2.2	252	2.2	2.0
UAS (Drones)	3.9	n/a	250	3.6	n/a
Night Applications	3.0	n/a	242	1.7	n/a

Aircraft being shot at	3.2	n/a	249	2.9	n/a
------------------------	-----	-----	-----	-----	-----

\*~ 301 responses, n/a-not asked

‘Other’ responses included: close proximity aircraft, dealing with customers unrealistic expectations, gusty winds, guy wires, midair collision with other aircraft, misapplication, other aircraft, people approach work area, pilot fatigue, runways, and water in fuel. These were not always numerically ranked.

Table 9 above lists the occupational risks and/or hazards as reported by pilots including the number of responses and contrasted with the way operators in their survey rated these same risks. Additionally, 2012 data and 2019 data are compared.

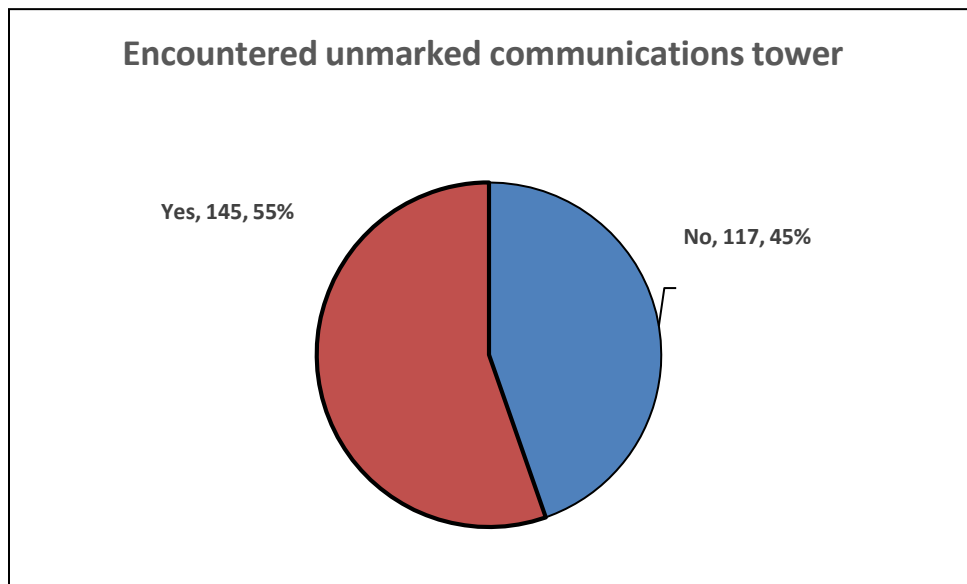
Overall risk perception was 4.5 in 2012 and 4.9 in 2019 for the same risks thus overall risks rankings were higher in 2019 than 2012.

The greatest perceived risks by pilots in 2012 and 2019 were power lines, communication towers, and meteorological towers. This matched exactly the leading three risks reported by operators in the same two time periods.

Adverse weather conditions are perceived as a higher risk in 2019 than in 2012. Additionally, ‘limited space for maneuvering is perceived as a higher risk in 2019.

**Survey Question: In 2017, did you encounter unmarked communication tower(s) when making aerial applications?**

**Figure 27 – Encounters with unmarked communications towers**



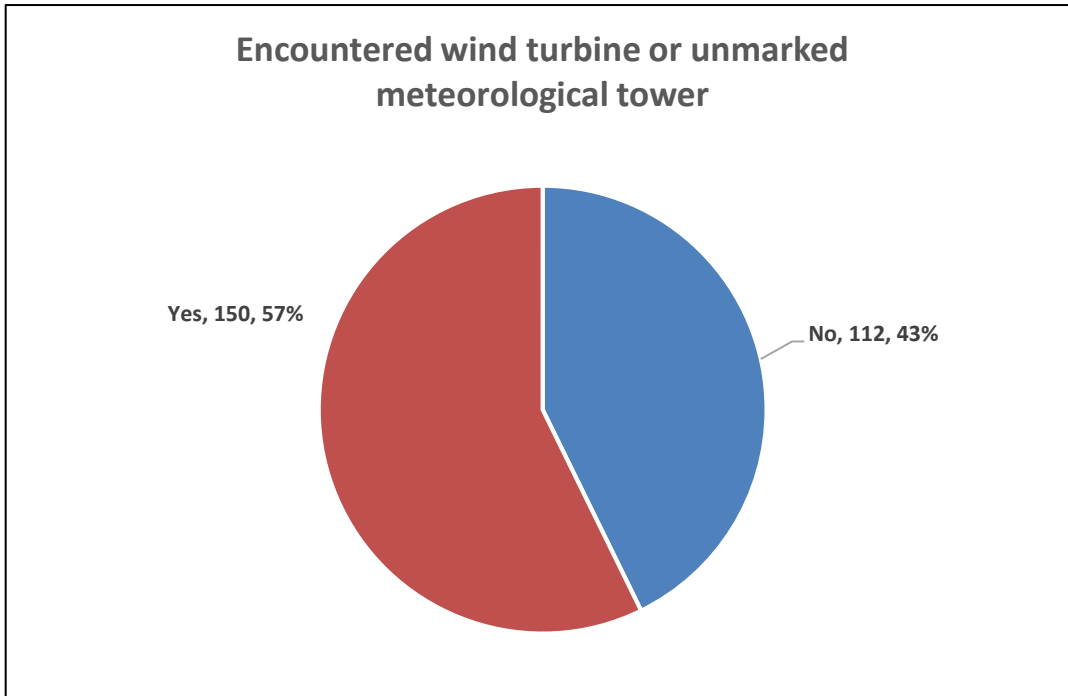
\*262 responses

Over one-half (55%) of the 262 pilots who responded said they encountered an unmarked

communications tower.

**Survey Question: In 2017, did you encounter wind turbine(s) and/or unmarked meteorological tower(s) when making aerial applications?**

**Figure 28 – Encounters with wind turbines or unmarked meteorological tower**

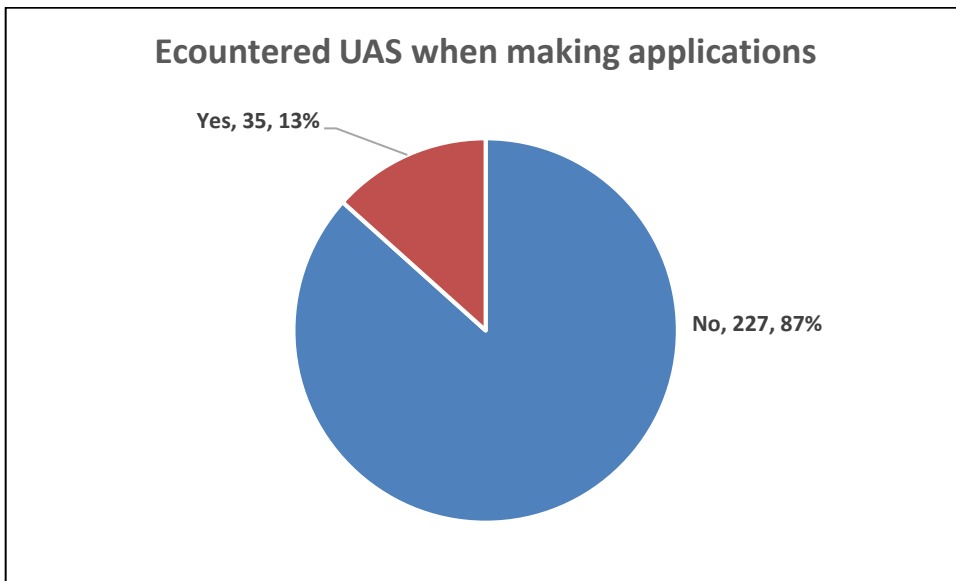


\*262 responses

Over one-half of 262 pilots encountered a wind turbine or an unmarked meteorological tower.

**Survey Question: In 2017, did you encounter Unmanned Aircraft Systems (UAS or drones) when making aerial applications?**

**Figure 29 – Encounters with unmanned aircraft systems (UAS) or drones**

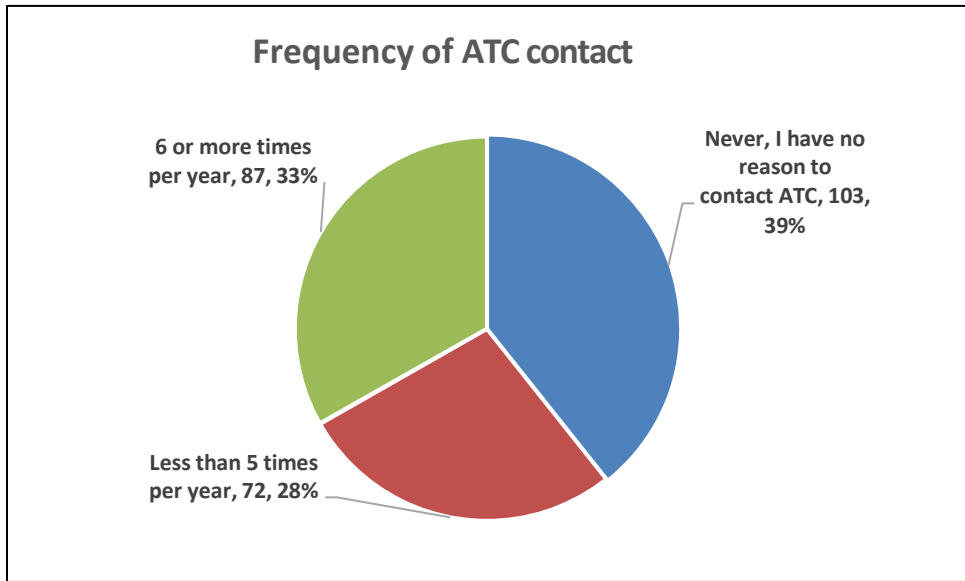


\*262 responses

Thirty-five pilots (13%) of the 262 pilots encountered an Unmanned Aircraft System (UAS).

**Survey Question: During normal operations, how often do you contact Air Traffic Control? (e.g. operating near controlled airspace.)**

**Figure 30 – Frequency of contact with Air Traffic Control (ATC)**



\*262 responses

Sixty percent of the 262 pilots said they had at least some communications with ATC in the past year. Thirty three percent said it was 6 or fewer times during the year and 28% said it was fewer than five times.

#### 1.1.4. Injury

**Survey question: In 2017 did you have a work-related injury that required treatment at a hospital or doctor's office?**

Two hundred sixty-two pilots responded to the question. Only two pilots reported an injury that required a doctor visit or a trip to a hospital. These are summarized below.

One pilot had one injury and the other had two injuries. One was a neck injury and one was an injury to the eye. One pilot missed one day of work as a result of the injury and the other missed two days work. One pilot was 33 years old the other 39. One pilot has been in the industry 15 years the other 6. Both consider themselves full time pilots in the industry.

1.1.5. Workload

**Survey Question: What is the average number of days per year that you fly?**

Two-hundred sixty-two pilots responded to the question. Nearly one-half reported they fly between 101-200 days. The greatest increase is the number of pilots who reported flying more than 200 days a year compared to 2012. See table below.

**Table 10 – Average days per year flight operations are conducted**

Days flying per year	2019 n* (%)	2012 n** (%)
Fewer than 50 days	26 (10%)	36 (12%)
50-100 days	57 (22%)	82 (27%)
101-200 days	123 (47%)	139 (46%)
More than 200 days	54 (21%)	45 (15%)

\*260 responses, \*\* 302 responses

**Survey Question: In your ag industry occupation, what is the average number of hours worked per day (flying and non-flying) during the application season(s)?**

Two hundred sixty pilots responded to the question. The largest majority work 8-12 hours per day during the application season. Proportions are similar to those in 2012. See table below.

**Table 11 – Average hours worked per day during application season**

Hours worked per day	2019 n* (%)	2012 n** (%)
Fewer than 8 hours	30 (11%)	36 (12%)
8-12 hours	144 (55%)	175 (58%)
13-16 hours	82 (32%)	85 (28%)
More than 16 hours	4 (2%)	6 (2%)

\*260 responses \*\* 302 responses

**Survey Question: What is the average number of hours of sleep per day during the application season?**

Two hundred sixty pilots responded to the question, the majority said they get 7-8 hours of sleep during the application season. A comparison to 2012 is given in the table below.

**Table 12 – Average hours of sleep**

Hours of sleep per day	2019 n* (%)	2012 n** (%)
Fewer than 4 hours	1 (<1%)	0 (0%)
4-6 hours	112 (43%)	106 (35%)
7-8 hours	140 (54%)	187 (62%)
More than 8 hours	7 (3%)	9 (3%)

\*260 responses \*\* 302 responses

## 2018 NAAA Pilot Survey Report

### Survey Question: What is the average number of days worked per month during the application season(s)?

Two hundred sixty pilots responded. Two hundred four (78%) said they work 24 or more days per month during the application season. In 2012, 63% of the pilots said they worked 24 or more days per month.

### Survey Question: What is the average number of consecutive days worked per month during the application season(s)?

**Table 13 – Average number of consecutive days worked**

Consecutive days/month	2019	2012
Fewer than 7	12%	17%
7-10 days	20%	23%
11-14 days	21%	16%
More than 14 days	47%	44%

Two hundred sixty pilots responded. Nearly half (47%) said they work more than 14 consecutive days during the application season. In 2012, 44% said 14 or more days, 16% said 11-14 days, 23% said 7-10 days and 17% said they work fewer than 7 consecutive days during the application season.

### Survey question: During the application season(s), how often do you feel tired at work even with adequate sleep?

**Table 14 – Frequency of feeling tired**

Frequency of feeling tired	2019	2012
Never	12%	9%
Sometimes	76%	78%
Frequently	10%	13%
Always	2%	1%

Two hundred sixty pilots responded. The majority (76%) said they feel tired, even with adequate sleep. These proportions were nearly the same as 2012: 78% said they feel tired sometimes, 13% frequently, 9% never and .3% always.

## 2018 NAAA Pilot Survey Report

### 1.1.6. Health

The next series of questions describe overall health. These specific questions were selected because they have been validated in other health studies and are a general indicator of health.

#### **Survey Question: Overall, how would you rate your health in the past 4 weeks?**

Two hundred fifty-four responded to the overall health question. Table 11 below compares the responses from the 2012 survey to the 2019 survey responses which were nearly identical.

**Table 15 – Overall health rating**

Overall health rating	2019*	2012**
Very poor	<1%	0%
Poor	<1%	0%
Fair	4%	4%
Good	20%	21%
Very Good	44%	44%
Excellent	32%	31%

\*254 responses \*\*280 responses

#### **Survey Question: During the past 4 weeks, how much did physical health problems limit your usual physical activities (such as walking or climbing stairs)?**

**Table 16 – Physical problems limit activity**

How much limitation	2019*	2012**
Could not do physical	0%	<1%
Quite a lot	<1%	<1%
Somewhat	4%	3%
Very little	20%	20%
Not at all	76%	76%

\*255 responses \*\*301 responses

#### **Survey Question: During the past 4 weeks, how much difficulty did you have doing your daily work, both at home and away from home, because of your physical health?**

**Table 17 – Difficulty doing daily work because of physical health**

Amount of difficulty	2019*	2012**
Could not do daily work	0%	<1%
Quite a lot	<1%	0%
Some	3%	1%
A little bit	17%	10%
Not at all	80%	88%

\*255 responses \*\*301 responses

A higher proportion of pilots said they had ‘a little bit’ of difficulty doing daily work because of physical health in the 2019 survey.



## 2018 NAAA Pilot Survey Report

**Survey Question: How much bodily pain have you had in the past 4 weeks?**

**Table 18 – Amount of body pain**

Amount of body pain	2019*	2012**
None	43%	38%
Very mild	41%	45%
Mild	12%	14%
Moderate	4%	4%
Severe	0%	<1%
Very severe	0%	0%

\*255 responses \*\* 301 responses

**Survey Question: During the past 4 weeks, how much energy did you have?**

**Table 19 – Energy in the past four weeks**

Amount of Energy	2019*	2012**
None	0%	<1%
A little	1%	2%
Some	20%	16%
Quite a lot	63%	69%
Very much	17%	13%

\*254 responses \*301 responses

**Survey Question: During the past 4 weeks, how much did your physical health or emotional problems limit your usual social activities with family or friends?**

**Table 20 – Social activity limited by physical/emotional problems**

Health problems limit social activities	2019*	2012**
Not at all	67%	58%
Very little	26%	34%
Somewhat	6%	7%
Quite a lot	1%	2%
Could not do social activities	0%	0%

\*254 responses \*\* 301 responses

## 2018 NAAA Pilot Survey Report

**Survey Question: During the past 4 weeks, how much have you been bothered by emotional problems (such as feeling anxious, depressed or irritable)?**

**Table 21 – Bothered by emotional problems**

How much bothered	2019*	2012**
Not at all	68%	70%
Slightly	26%	23%
Moderately	5%	6%
Quite a lot	1%	1%
Extremely	0%	0%

**Survey Question: During the past 4 weeks, how much did personal or emotional problems keep you from doing your usual work, school or other daily activities?**

**Table 22 – Emotional problems prevent usual work**

How much	2019*	2012**
Not at all	82%	84%
Very little	17%	13%
Somewhat	1%	2%
Quite a lot	1%	<1%
Could not do daily activities	0%	<1 %

\*254 responses\*\* 301 responses

**Survey Question: Do you work for pay outside the aerial application industry during the off season?**

**Table 23 – Work outside of industry**

Work outside industry?	2019*	2012**
Yes	(122) 48%	(154) 51%
No	(131) 52%	(147) 49%

\*253 responses \*\*301 responses

Slightly less than half of the 253 pilots who responded said they work for pay outside the aerial application industry. In the 2012 survey, 51% of the respondents said they worked outside the industry.

## 2018 NAAA Pilot Survey Report

### Survey Question: If yes, what work do you do?

Table 24 lists the responses pilot gave to the question of what kind of work they do outside of agricultural flying in the off season.

**Table 24 – List of other jobs held by pilots during off season**

A & P Mechanic (16)	Gunsmith (1)
Farming (17)	Flight instructor (14)
Aircraft check pilot, Aircraft Ferry Pilot, Flight Instructor, Contract Pilot, Survey pilot, other pilot (25)	Other business owner (4)
Retail or other sales (4)	Real Estate
Truck Driver (5)	Firefighting (5)
Airport Manager (2)	Law Enforcement (1)
Diesel or other mechanic (6)	Meteorologist (1)
Carpentry/construction/equipment operator (10)	

Responses have been grouped into categories, the number in parenthesis indicates the number of responses.

### Survey question: Approximately how much did you earn in 2017 as an ag pilot?

**Table 25 – Earnings**

Earnings range	(n)	(%)*
\$0-\$20,000	27	12.2%
\$20,001-\$40,000	24	10.2%
\$40,001-\$60,000	21	9.5%
\$60,001-\$80,000	22	9.9%
\$80,001-\$100,000	36	16.2%
\$100,001-\$120,000	28	12.6%
\$120,000+	64	28.8%
Prefer not to answer	33	13.0%

\*Percent of those who responded (222)

Eighty-seven percent of the respondents answered the question by selecting an earnings range. Thirty three of the 255 respondents (13%) choose not to select an earnings range. Forty-one percent said they earned \$100,001 or more.

**Table 26 – Earnings and average number of years in the industry**

Earnings range	(n)	Average years in the ag aviation industry
\$0-\$20,000	27	18.0
\$20,001-\$40,000	24	19.3
\$40,000-\$60,000	21	17.4
\$60,001-\$80,000	22	16.1
\$80,001-\$100,000	36	17.5
\$100,001-\$120,000	28	25.5
\$120,000+	64	19.6

There does not appear to be a relationship between the average number of years in the agricultural aviation industry and earnings.

**Table 27 – Earnings and the average number of hours flown**

Earnings range	(n)*	Hours
\$0-\$20,000	17	98.5
\$20,001-\$40,000	24	205
\$40,000-\$60,000	21	296
\$60,001-\$80,000	21	399
\$80,001-\$100,000	35	377
\$100,001-\$120,000	28	458
\$120,000+	63	608

\*excludes those who flew zero hours

Two hundred nine responded to both earnings and hours flown questions and flew more than 1 hour. As expected, the more hours flown appears to be related with higher earnings.

**Survey Question: What is your highest level of education?**

**Table 28 – Education level**

Education level	No of operators	Percent
College or technical college graduate	114	45%
High school graduate	44	17%
Master's degree	4	2%
Some college	82	33%
Some high school	6	2%

\*250 responses

Nearly half (45%) of the 252 pilots who responded were college or technical college graduates.

## 5. Summary / Conclusions

This pilot survey has provided valuable information on the population of pilots who conduct agricultural aviation operations. Results were very similar to the survey of Part 137 operators suggesting the reliability of both surveys is high. Risk safety practices, and health information as well as demographic data and experience were very similar to the 2012 survey and will help shape safety training programs.

It is estimated that over 20% of the pilots who conduct aerial applications are captured in this survey. Additional analysis of the survey results is needed to better characterize the risk perceptions. This may lead to a better understanding of risk-taking habits and therefore safety interventions.

Very few injuries were reported among pilots indicating there is already a high degree of safety awareness that translates to safer work habits and the nature of the work is more prone to severe catastrophic injury and minor injury is rare.

The relatively low cost of this survey combined with the high return value of the results suggest this type of survey should be conducted again in future years paying careful attention to the phrasing of the questions. Some questions should be modified to facilitate analysis and conclusions. These include the questions on liquid and dry applications, questions asking respondents to provide an average and questions about drift control methods and questions asking for a percent. A question should be added asking about a ‘home’ state, not just the states a pilot works. As the industry evolves, additional questions about UAS use is suggested.

## 6. Appendix A - Pilot Survey

# NAAA 2018 Survey

---

Q This survey requires a password.

---

Q1 Thank you for participating in the 2018 Survey of Part 137 Operators and Pilots. It's been six years since the last survey, and now more than ever we need current and accurate data about what's happening in the industry. Completing this survey, which should take no more than 20 minutes, will help the industry communicate with farmers, constituents, policy makers and further inform decision makers. As in the 2011 survey, the NAAA will be summarizing the results and sharing with you and your colleagues. Please dedicate a few minutes to responding to the following questions.

Thank you,

Gary Jerger – 2018 NAAA President

Rod Thomas – 2018 NAAREF President

Andrew Moore – NAAA Executive Director

[Throughout the survey, use your mouse to navigate.]

Are you an owner/operator of a business that holds a Part 137 Certificate?

Yes (1)

No (2)

Q2 I am a Pilot Employee.

Yes (1)

No (2)

---

Q3 In what year were you born?

\_\_\_\_\_

Q4 Are you?

Male (1)

Female (2)

Q5 Are you a member of the National Agricultural Aviation Association (NAAA)?

Yes (4)

No (5)

Q6 Are you a member of a state or regional agricultural aviation association?

Yes (5)

No (6)

Q7 In which state(s) did you conduct aerial applications in 2017?

- Alabama (1)
- Alaska (2)
- Arizona (3)
- Arkansas (4)
- California (5)
- Colorado (6)
- Connecticut (7)
- Delaware (8)
- District of Columbia (9)
- Florida (10)
- Georgia (11)
- Hawaii (12)
- Idaho (13)
- Illinois (14)
- Indiana (15)



## 2018 NAAA Pilot Survey Report

---

- Iowa (16)
- Kansas (17)
- Kentucky (18)
- Louisiana (19)
- Maine (20)
- Maryland (21)
- Massachusetts (22)
- Michigan (23)
- Minnesota (24)
- Mississippi (25)
- Missouri (26)
- Montana (27)
- Nebraska (28)
- Nevada (29)
- New Hampshire (30)
- New Jersey (31)

- New Mexico (32)
- New York (33)
- North Carolina (34)
- North Dakota (35)
- Ohio (36)
- Oklahoma (37)
- Oregon (38)
- Pennsylvania (39)
- Rhode Island (40)
- South Carolina (41)
- South Dakota (42)
- Tennessee (43)
- Texas (44)
- Utah (45)
- Vermont (46)
- Virginia (47)

## 2018 NAAA Pilot Survey Report

---



Washington (48)

West Virginia (49)

Wisconsin (50)

Wyoming (51)

---

---

Q8 How many years have you been in the aerial application industry?

\_\_\_\_\_

---

Q9 How many total hours of flight time do you have?

\_\_\_\_\_

---

Q10 How many total hours ag time do you have?

\_\_\_\_\_

---

Q11 How many years have you been an agricultural pilot?

\_\_\_\_\_

---

Q12 How many agricultural hours did you fly in 2017?

Q13 Do you work as an ag pilot full-time or part-time?

- Full-time (1)
- Part-time (2)

Q14 How often do you attend the PAASS Program?

- Annually (1)
- Every 2 years (2)
- Every 3 years (3)
- Less than every 4 years (4)
- Never (5)

Q15

The next series of questions asks about the aircraft you use most often during normal operations.

Does the aircraft you use most often have:

An on-board wind/meteorological measurement system that displays wind speed and direction in the cockpit (e.g. Aircraft Integrated Meteorological Measurement System, AIMMS)?

- Yes (1)
- No (2)

Q16 Does the aircraft you use most often for **dry** applications have:

## 2018 NAAA Pilot Survey Report

equipment for making constant rate applications (apply a constant application regardless of speed) or making variable rate application (varies the application rate across the field according to a prescription map of soil or crop conditions)?

- Yes (5)
  - No (6)
  - I do not make dry applications (7)
- 

Q17 Does the aircraft you use most often for liquid applications have:

equipment for making constant rate applications (apply a constant application regardless of speed) or making variable rate application (varies the application rate across the field according to a prescription map of soil or crop conditions)?

- Yes (1)
  - No (2)
  - I do not make liquid applications (3)
- 

Q18 To identify and track sensitive areas, I use:  
(Please check all that apply.)

- A sensitive crop registry (i.e. FieldWatch) (1)
- Data we collected (2)
- Data retrieved and given to me digitally (3)
- Data retrieved and given to me on hand-drawn maps (4)
- Other, please specify (5) \_\_\_\_\_

Q19 In a normal workday, what percentage of all spray jobs do you, as the pilot, also mix and load product?

(Do not type in '%'.)

---

Q20 Which of the following do you use to control spray drift? (Please check all that apply.)

- Drift control additives (1)
- Wind detectors on the ground (2)
- Smoker to monitor wind speed and direction (3)
- Smoker to monitor inversions (4)
- Modify droplet size by changing pressure (5)
- Modify droplet size by changing the nozzle orifice size (6)
- Modify droplet size by changing nozzle type (7)
- Modify droplet size by changing nozzle angle (8)
- Modify droplet size by changing airspeed (9)
- Change in-flight patterns (10)
- Right or left boom shut off (11)
- Reduce effective boom length, on the ground or in-flight, using adjustable valves or

shut-offs (12)

- Buffer zones on the downwind side of the field (13)
- On-board wind/meteorological measurement system (e.g. AIMMS) (14)

---

Q21 When applying pesticides by air, which of the following do you use for swath guidance?  
(Please check all that apply.)

- GPS (1)
- Automatic flaggers (2)
- Human flaggers (3)
- Other, please specify (4) \_\_\_\_\_

---

Q22 If your aircraft is equipped with **smoker(s) to determine wind direction** while performing aerial applications, how often is it used? (Check all that apply.)

- Do not use an aircraft equipped with a smoker (7)
- Before an application near a sensitive area (1)
- Every swath run (2)
- Every 2-4 swath runs (3)
- Every 5-7 swath runs (4)



- Every load (5)
- Other, please specify (6) \_\_\_\_\_

Q23 Do you make applications during the hours of darkness?

- Yes (1)
- No (2)

*Skip To: Q26 If Do you make applications during the hours of darkness? = No*

Q24 During operations conducted at night, I use:

- Night lights (1)
- Night vision goggles (2)

Q25 Please rank the reasons for doing applications during hours of darkness. **(Drag and drop the reasons into the appropriate order where 1 is the primary reason.)**

- \_\_\_\_\_ To protect pollinators (1)
- \_\_\_\_\_ Because of cooler temperatures (2)
- \_\_\_\_\_ Because there's less wind (3)
- \_\_\_\_\_ Because field workers are not present (4)
- \_\_\_\_\_ Other, please specify (5)

Q26  
The next few questions are about sprayers used in Dry and Liquid applications.



## 2018 NAAA Pilot Survey Report



Please tell me the percentage of all acres you treated in 2017 using sprayers or spreaders. (Must equal 100%.)

Percent treated using a sprayer : \_\_\_\_\_(1)

Percent treated using a spreader : \_\_\_\_\_(2)

Total : \_\_\_\_\_

---

Q27 If you used a **sprayer** in 2017,

what percent of these acres treated were pesticide only? : \_\_\_\_\_(1)

what percent of these acres treated were fertilizer alone? : \_\_\_\_\_(2)

what percent of these acres treated were a mixture of both pesticide and fertilizer? : \_\_\_\_\_(3)

Total : \_\_\_\_\_

---

Q28 If you used a **spreader** in 2017,

what percent of these acres treated were fertilizers? : \_\_\_\_\_(1)

what percent of these acres treated were cover crop(s)? : \_\_\_\_\_(2)

what percent of these acres treated were harvestable crop seeding (e.g. rice)? : \_\_\_\_\_(3)

what percent of these acres treated were pesticide applications? : \_\_\_\_\_(4)

Total : \_\_\_\_\_

---

Q29 Think of the size of all the fields you treated, in acres, in 2017. Please estimate average of these field sizes.

\_\_\_\_\_

---

Q30 During the active spray seasons you may be exposed to many hazards. Score each item below where 1 is considered 'not a risk' and 10 is 'very risky'.

*Example:*

*Cross street without looking 7*

*Mowing lawn with bare feet 7*

*Running with scissors 2*

	Risk Ranking
	Type number in box (1)
Wind turbines (27)	
Unmanned Aircraft Systems (Drones) (28)	
Meteorological towers (32)	
Aircraft being shot at (29)	
Night application (30)	
Other, please specify (31)	

Q31 In 2017, did you encountered **unmarked communication tower(s)** when making aerial applications?

## 2018 NAAA Pilot Survey Report

---



Yes (1)

No (2)

-----

Q32 In 2017, did you encounter **wind turbine(s) and/or unmarked meteorological tower(s)** when making aerial applications?

- Yes (1)
  - No (2)
- 

Q33 In 2017, did you encounter **Unmanned Aircraft Systems (UAS or drones)** when making aerial applications?

- Yes (1)
  - No (2)
- 

Q178 During normal operations, how often do you contact Air Traffic Control? (e.g. operating near controlled airspace.)

- Never, I have no reason to contact ATC as part of my normal ag operations (1)
  - Less than 5 times per year (2)
  - 6 or more times per year (3)
- 

Q34 In 2017 did you have a work-related injury that required treatment at a hospital or doctor's office?

- Yes (1)
  - No (2)
- 

Q35 How many work-related injuries did you have? (If none, type in '0')

---

---

Q36 Thinking of your most severe injury in the past **two** years: What was the initial cause of the injury?

- Crash (1)
- Collision with other aircraft or fixed object while on the ground (2)
- Struck by object (3)
- Fire (4)
- Fall (5)
- Run over (6)
- Chemical (7)
- Electrocutation (8)
- Laceration (9)
- Other, please specify (10) \_\_\_\_\_

---

Q37 Thinking of the most severe injury in the past two years: What part(s) of your body was injured?

- Head (1)
- Back/spine (2)
- Side (3)
- Hand (4)
- Eye (5)
- Chest (6)

- Neck (7)
- Ear (8)
- Arm (9)
- Foot (10)
- Leg (11)
- Abdomen (12)
- Lung (14)
- Other, please specify (13) \_\_\_\_\_

-----

Q38 Thinking of the most severe injury in the past two years: Please estimate the number of workdays you missed because of the injury.

\_\_\_\_\_

Q39 The next few questions are about work load as a pilot.  
As the pilot, what is the average number of days per year that you fly?

- Fewer than 50 days (1)
- 50-100 days (2)
- 101-200 days (3)
- More than 200 days (4)

Q40 In your ag industry occupation, what is the average number of hours worked per day (flying and non-flying) during the application season(s)?

- Fewer than 8 hours (1)
  - 8-12 hours (2)
  - 13-16 hours (3)
  - More than 16 hours (4)
- 

Q41 What is the average number of hours of sleep per day during the application season?

- Fewer than 4 hours (1)
  - 4-6 hours (2)
  - 7-8 hours (3)
  - More than 8 hours (4)
- 

Q42 What is the average number of days worked per month during the application season(s)?

- Fewer than 24 (1)
  - 24 or more (2)
- 

Q43 What is the average number of consecutive days worked per month during the application season(s)?

- Fewer than 7 (1)
- 7-10 (2)
- 11-14 (3)

- More than 14 (4)
- 

Q44 During the application season(s), how often do you feel tired at work even with adequate sleep?

- Never (1)
- Sometimes (2)
- Frequently (3)
- Always (4)

Q45 Overall, how would you rate your health in the past 4 weeks?

- Excellent (1)
  - Very good (2)
  - Good (3)
  - Fair (4)
  - Poor (5)
  - Very poor (6)
- 

Q46 During the past 4 weeks, how much did physical health problems limit your usual physical activities (e.g. walking or climbing stairs)?

- Not at all (1)
- Very little (2)
- Somewhat (3)
- Quite a lot (4)



- Could not do physical activities (5)
- 

Q47 During the past 4 weeks, how much difficulty did you have doing your daily work, both at home and away from home, because of your physical health?

- Not at all (1)
- Very little (2)
- Somewhat (3)
- Quite a lot (4)
- Could not do daily work (5)
- 

Q48 How much bodily pain have you had in the past 4 weeks?

- None (1)
- Very mild (2)
- Mild (3)
- Moderate (4)
- Severe (5)
-

Q49 During the past 4 weeks, how much energy did you have?

- Very much (1)
  - Quite a lot (2)
  - Some (3)
  - A little (4)
  - None (5)
- 

Q50 During the past 4 weeks, how much did your physical or emotional problems limit your usual social activities with family or friends?

- Not at all (1)
  - Very little (2)
  - Somewhat (3)
  - Quite a lot (4)
  - Could not do social activities (5)
- 

Q51 During the past 4 weeks, how much have you been bothered by emotional problems (e.g. feeling anxious, depressed or irritable)?

- Not at all (1)
- Slightly (2)
- Moderately (3)
- Quite a lot (4)
- Extremely (5)

Q52 During the past 4 weeks, how much did personal or emotional problems keep you from doing your usual work, school or other daily activities?

- Not at all (1)
- Very little (2)
- Somewhat (3)
- Quite a lot (4)
- Could not do daily activities (5)

Q53 Approximately how much did you earn in 2017 as an ag pilot?

- \$0-\$20,000 (1)
- \$20,001-\$40,000 (2)
- \$40,001-\$60,000 (3)
- \$60,001-\$80,000 (4)
- \$80,001-\$100,000 (5)
- \$100,001- \$120,000 (6)
- \$120,001+ (7)
- Prefer not to answer (8)

Q54 Do you work for pay outside the aerial application industry during the off season?

- Yes (1)
- No (2)

Q55 What work do you do?

---

---

Q56 What is your highest level of education?

- Some high school (1)
  - High school graduate (2)
  - Some college (3)
  - College or technical college graduate (4)
  - Master's degree (5)
  - Doctorate (6)
  - Choose not to answer (7)
- 

Q57 Thank you for participating in this important survey. (Select Finish)

- Finish (1)