



Oregon
Department
of Agriculture

Summary of the 2019 Field-Burning Season

As prepared by
Natural Resources Program Area
Smoke Management Program
635 Capitol St. NE
Salem, OR 97301
503-986-4701
www.ODA.direct/Burning



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The Oregon Department of Agriculture
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1. Introduction

This summary is prepared annually by Oregon Department of Agriculture (ODA) Smoke Management Program staffers to report the statistics for each field-burning season.

2. Weather Discussion: Prepared by the Oregon Department of Forestry Weather Office

Predicting weather patterns that will promote the lifting and evacuation of smoke out of the Willamette Valley and away from populated areas is vital to the efficient operation of the Smoke Management Program. There are usually only a few days each summer with “excellent” ventilation conditions, so days with “marginal-to-good” ventilation conditions must be efficiently utilized to keep overall smoke impacts to a minimum.

June-July

A dry and fairly warm spring turned wetter and cooler as Memorial Day weekend arrived as a persistent upper-level trough moved in and lingered offshore of Oregon and Washington through June. This kept temperatures just below average and rainfall above average in June as summer officially arrived. Mostly cloudy skies with frequent rain showers and a week of intense thundershowers over the Cascades and Eastern Oregon at the end of June preceded the July 4 weekend ahead of the first field-burning conference call on Tuesday, July 9, that marked the beginning of the season.

Continued cool, damp weather brought measurable rain to the Silverton Hills through early Thursday, July 11, but the high July sun created sun breaks that helped dry out the already-parched soils in Marion County. Mostly clear skies with gentle onshore flow and a well-mixed atmosphere on Friday, July 12, allowed the first field-burning of the season. Growers burned 182 acres with no recorded smoke impacts and one complaint.

A weak summer gale pushed into the Pacific Northwest on Monday, July 15, bringing about one-tenth of an inch of rain to the Willamette Valley with elevated humidity and flat pressure gradients persisting until late afternoon. Mostly cloudy skies slowly opened up to allow drying over the Silverton Hills, on Tuesday, July 16, with southwesterly winds ahead of an incoming storm system. That allowed for the burning of 730 acres with no smoke impacts and three complaints.

After a weekend with typical July weather conditions (mild, cloudy mornings giving way to warm afternoons under mostly clear skies), the third week of July began with another fair period of field burning opportunities. A disturbance over the Gulf of Alaska on Monday, July 22, created south-southwesterly flow aloft throughout the Silverton Hills, with increasing cloud cover and moisture in the late afternoon ahead of a marine surge. Favorable conditions allowed for the burning of 879 acres with two hours of light impact in Lyons and one hour of light impact in Mill City. Three complaints were received.

The influence of marine air on Tuesday, July 23, was fairly strong, keeping onshore pressure gradients from becoming positively stacked. Winds turned more northerly on Wednesday, July 24, as is common during the summer months, as a thermal trough formed east of the Willamette River. Oregon State Fire Marshal Burn-Ban conditions developed in the afternoon with low humidity and breezy conditions, so no burning was conducted. Field burning is prohibited when any two of the following criteria are met: a.) Temperature of 95 degrees or above; b.) Relative humidity of 30 percent or below; and c.) Wind speed of 15 miles per hour or higher.

Similar conditions occurred again on Thursday, July 25, with Fire Marshal Burn-Ban conditions in place by 2 p.m. The disturbance over the Gulf of Alaska energized overnight Thursday, enhancing the onshore flow with positively stacked gradients all day on Friday, July 26. This allowed for the burning of 486 acres ahead of a deep marine push Friday evening, with no impacts and five complaints.

The deep marine layer contained a few embedded rain showers north of the Silverton Hills on Saturday, July 27, before clouds began to part and slowly lift out in the afternoon hours. Sunday saw the influence of ridging aloft beginning to nudge further north off the coast of Oregon, allowing fairly clear skies and drying. Monday, July 29, saw a shallow marine layer mix out by mid-day, allowing for 571 acres to be burned by late afternoon. This included 10 acres of preparatory burning. (Preparatory or prep burning is the burning of small amounts of acreage to prepare fields for open-burning.) The day's burning resulted in one hour of moderate impact and one hour of light impact in Lyons and three complaints.

A deep marine layer with clouds over the Willamette Valley on Tuesday, July 30, lingered into the early afternoon and produced negatively stacked onshore pressure gradients, making conditions unfavorable to burn. Wednesday, July 31, began much more favorably, with a surface ridge over Western Oregon that was slowly forced south by a storm system developing over the Pacific Ocean. Onshore gradients went from flat to a positive stack early in the afternoon, with southwesterly flow from the surface through the entire mixed layer, allowing 856 acres to be burned with no impacts and three complaints.

August

Conditions remained favorable on Thursday, August 1, as southwesterly flow maintained ahead of an approaching storm system, allowing field burning to begin in the early afternoon. A total of 998 acres were burned with no impacts and four complaints. However, it should be noted that weaker pressure gradients over the Cascades as a result of afternoon thunderstorms slowed the evacuation and dispersion of elevated smoke until

after sunset. The storm system pushed into Oregon overnight, bringing light rainfall to the northern Willamette Valley after sunrise on Friday, August 2. Although only one-one-hundredth of an inch was recorded at McNary Field in Salem, rainfall was much more widespread over the Silverton Hills, and onshore gradients remained negatively stacked. This did limit burning, with the exception of 27 acres of preparatory burning that resulted in no impacts and no complaints.

That would be the end of burning for some time, as hot and unstable conditions halted operations for more than a week.

A weakening storm system fell apart and began to drift northward into Washington, making way for a broad area of ridging aloft from the south. This helped to clear skies and form a stable weather pattern for the weekend, drying out the atmosphere as temperatures rose back above seasonal averages on Saturday, August 3, and well above seasonal averages on Sunday, August 4.

The heat wave continued across much of Oregon on Monday, August 5, and helped fuel thunderstorms over the Cascades, keeping onshore pressure gradients unsuitable for field burning. Similar conditions persisted on Tuesday, August 6, with a thermal trough over the Silverton Hills actually contributing to offshore flow out of the Cascades as thunderstorms developed mid-afternoon. Warming air aloft stifled mixing of the atmosphere, with smoke from regional wildfires contributing to hazy conditions throughout the Willamette Valley.

A period of damp and unstable weather began on Wednesday, August 7, and persisted through Sunday, August 11. Widespread cloud cover brought ample moisture and scattered rain showers to the Willamette Valley, with mountain thunderstorms along the Cascades. Though mixing conditions and rainfall both helped improve air quality, erratic wind directions and unreliable gradient flow made field burning unfavorable. Cloud cover delayed the drying of fields as well and many areas near the Silverton Hills recorded more than one-quarter of an inch of rain.

An upper-level ridge began to reestablish itself over the Pacific Northwest on Monday, August 12, and open skies allowed temperatures to rise back near seasonal averages. A lack of pressure gradient flow across the Cascades prevented widespread field burning outside of some minor preparatory burning. A total of 34 acres were burned with no impacts and no complaints. Similar conditions were seen on Tuesday, August 13, but a brief period of positively stacked onshore pressure gradients provided time to burn 451 acres with no impacts and two complaints. The upper-level ridge slowly weakened on Wednesday, August 14, allowing for a mild sea breeze during the afternoon. Onshore pressure gradients were positively stacked all day, enabling 735 acres to be burned before sunset with one hour of moderate impact and one hour of light impact in Lyons. Six complaints were received.

On Thursday, August 15, onshore pressure gradients struggled to even out, with northerly winds showing only hints of a northwestern tack ahead of a marine push overnight. As such, only 224 acres were able to be successfully burned with no impacts and one

complaint. Friday, August 16, proved to be unsuitable for field burning, as onshore pressure gradients remained negatively stacked as the result of a deep marine layer over the Willamette Valley.

A building upper-level ridge over the region helped to keep skies clear during the weekend, with fairly weak winds during the afternoon hours. Temperatures rose back up to seasonal averages after a recent cool spell, with sea breezes in the evening hours bringing marine clouds up the Columbia River and shallow fog throughout the northern Willamette Valley. Monday, August 19, saw conditions limited by persistent northerly winds, so minor preparatory burning was the only activity permitted; a total of 66 acres were burned with no impacts and one complaint.

Flow aloft turned more southwesterly on Tuesday, August 20, ahead of a building summer gale, and onshore gradients developed by early afternoon to allow the burning of 3,021 acres ahead of the approaching rains. The burning resulted in no impacts and 31 complaints, the majority of which were received from the Silverton area. Wetting rains arrived on Wednesday, August 21, as a cold front swept across northwestern Oregon, bringing about a quarter-inch of rain to the Silverton Hills. This proved to be the start of a two-week period when unfavorable conditions prevented any burning.

Poor conditions prevented burning on Thursday, August 22, as fields began to dry aided by steady north winds under clear skies. Northerly winds continued on Friday, August 23, and even showed signs of becoming northeasterly at times, with poor pressure gradients across the Cascades, so no field burning was accomplished once again.

The reemergence of a broad upper-level ridge near the Pacific Coast kept winds light and skies fairly clear through the weekend, bringing temperatures back above seasonal averages for much of Oregon on Saturday and Sunday, August 24-25. These conditions developed into a heat wave by Monday, August 26, with temperatures rising well above seasonal averages throughout Western Oregon. Fire Marshal Burn-Ban conditions were observed, stopping any field burning from taking place. These conditions persisted on Tuesday, August 27, with a thermal trough extending north from California along the Interstate 5 corridor. Fire Marshal Burn-Ban conditions developed early in the afternoon hours, with strong offshore gradients, making field burning inadvisable.

The atmosphere began to destabilize on Wednesday, August 28, as a disturbance shifted into Oregon from the California coast. Incoming clouds limited heating and prevented pressure gradients across the Cascades from developing enough to support field burning before isolated thundershowers formed over the Cascades. Scattered rain showers produced little measurable rainfall overnight, but the majority of what occurred was in the Salem area, where seventeen hundredths of an inch fell in a pre-dawn thunderstorm. Widespread clouds with some pockets of light drizzle kept humidity elevated over the Silverton Hills, and fields were too wet to burn as a result on Thursday, August 29.

An upper-level ridge that was displaced into northwestern Nevada slowly began to regroup on Friday, August 30, and slowly expanded northward through the coming Labor Day

weekend. Southerly transport winds persisted west of the Cascades, making field burning unsuitable, and a negatively stacked onshore pressure gradient threatened to pool smoke in the Silverton Hills without adequate ventilation.

September

Labor Day weekend passed with warm, mild conditions that helped dry fields after the late August showers. A weak upper-level disturbance moving near the Canadian coast turned the flow aloft more southwesterly on Monday, September 2. The southwesterly flow aloft persisted into Tuesday, September 3, and was enhanced by another weak disturbance approaching the California coast. Onshore pressure gradients were positively stacked shortly after sunrise and allowed burning to begin in the early afternoon ahead of a sea breeze. A total of 2,101 acres were burned with no impacts and six complaints.

Cool, northerly flow developed early on Wednesday, September 4, as an upper-level ridge built up over the Pacific Ocean. North-northeasterly surface winds proved unsuitable for field burning. The upper-level ridge was displaced further north on Wednesday evening as another disturbance rolled through northern California, turning upper-level winds back to the south-southwest. The instability and moisture pumped up along the Cascades helped fuel afternoon thundershowers, breaking up onshore gradients in the mountains on Thursday, September 5.

The weather pattern took a favorable turn on Friday, September 6, when weak southwesterly flow at the surface and aloft helped draw in a stronger afternoon sea breeze, providing the conditions needed to burn 244 acres with no impacts and four complaints.

The second weekend of September featured foul weather, with a weak disturbance on Saturday, September 7, and a stronger gale forming offshore that brought significant rainfall and thundershowers to northwest Oregon on the evening of Sunday, September 8. Some areas in the Willamette Valley recorded three-quarters of an inch of rain by sunrise on Monday, September 9. Cool, showery weather persisted into the beginning of the week, dropping another one-quarter of an inch of rain with isolated thundershowers over the Cascades. Cloudy conditions with showers tapering off on Tuesday, September 10, saw a final one-tenth of an inch of rain fall over the Silverton Hills.

A passing upper-level ridge helped break up clouds that evening, creating morning fog throughout the Willamette Valley on Wednesday, September 11, for a touch of autumnal weather. Once fog lifted, sunny skies and temperature to the mid 70s helped evaporate any standing water. The upper-level ridge began to shift east beyond the Cascades on Thursday, September 12, leaving southwesterly flow aloft behind it. The onshore flow became enhanced mid-morning as another gale formed out over the Pacific Ocean, deepening the mixed layer of the atmosphere and supporting the burning of 1,277 acres before sunset with no impacts and two complaints.

A weak cold front from this passing weather system only brought trace amounts of rainfall to Salem and the nearby Silverton Hills, and westerly flow behind it on Friday,

September 13, allowed an additional 63 acres to be burned with no impacts and no complaints.

The weekend brought another storm system on Sunday, September 15, and a wet beginning to the week throughout the Willamette Valley. This continued into Monday, September 16, when one-quarter of an inch of rain fell in showers across the Silverton Hills. A stronger storm pushed in on Tuesday, September 17, and brought scattered showers and squall lines into the Willamette Valley; rainfall was less of an issue compared to winds, but the gusty conditions helped to dry fields out in spite of cloud cover that kept temperatures below seasonal averages.

Showery weather persisted into Wednesday, September 18, with isolated thunderstorms over the Cascades. Skies began to clear up on Thursday, September 19, as the upper-level trough shifted southeast toward southern Idaho and Nevada. Cooler air aloft remained to promote mixing with northwesterly winds, allowing 52 acres to be burned with no impacts and no complaints. Fields continued to dry overnight and into early Friday, September 20, as another disturbance passed north of the Willamette Valley. A total of 317 acres were burned with no impacts and no complaints. An upper-level ridge moved in after sunset, helping to further break open skies and allow more drying to take place, so the Oregon Department of Forestry Weather Office and Oregon Department of Agriculture Smoke Management Program both opened up for Saturday, September 21. Temperatures climbed back into the mid-70s, as is typical for the end of summer, and once humidity lowered sufficiently, 414 acres were burned with no impacts and no complaints. An approaching storm system brought rain back to the Silverton Hills on Sunday, September 22, with nearly one-quarter of an inch falling throughout the day.

The first official day of autumn, Monday, September 23, saw persistent cloud cover that limited the amount of drying. A warm frontal boundary passed over the northern Willamette Valley with the Silverton Hills dodging late-night rains. Tuesday, September 24, saw an upper-level ridge build back into Oregon, keeping the passing storm system well away from Marion County. Sunbreaks gradually formed and improved drying conditions across the Silverton Hills, allowing 88 acres to be burned under light onshore flow with no impacts and no complaints.

On Wednesday, September 25, the influence of the upper-level ridge along the Oregon Coast kept flow aloft west-northwesterly, with cooler air from the Pacific Ocean mixing the atmosphere well into the afternoon hours. A total of 56 acres were burned in the few remaining fields near Lyons, with no impacts and no complaints. An upper-level disturbance forced a storm system into Oregon on Thursday, September 26, when the season officially ended.

A total of 13,872 acres were burned during the 2019 field-burning season during 23 burn days. Detailed smoke impact data can be seen in Section 5.

Figure 1
Observed Temperatures at McNary Field (Salem Municipal Airport)

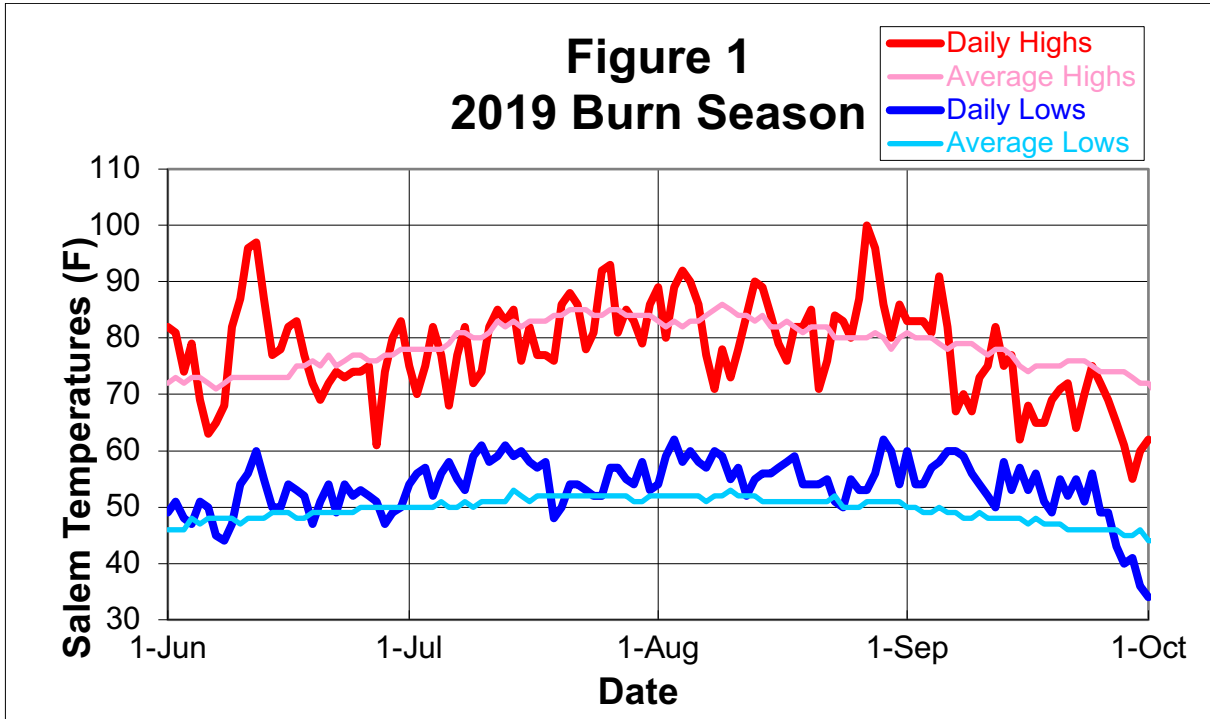
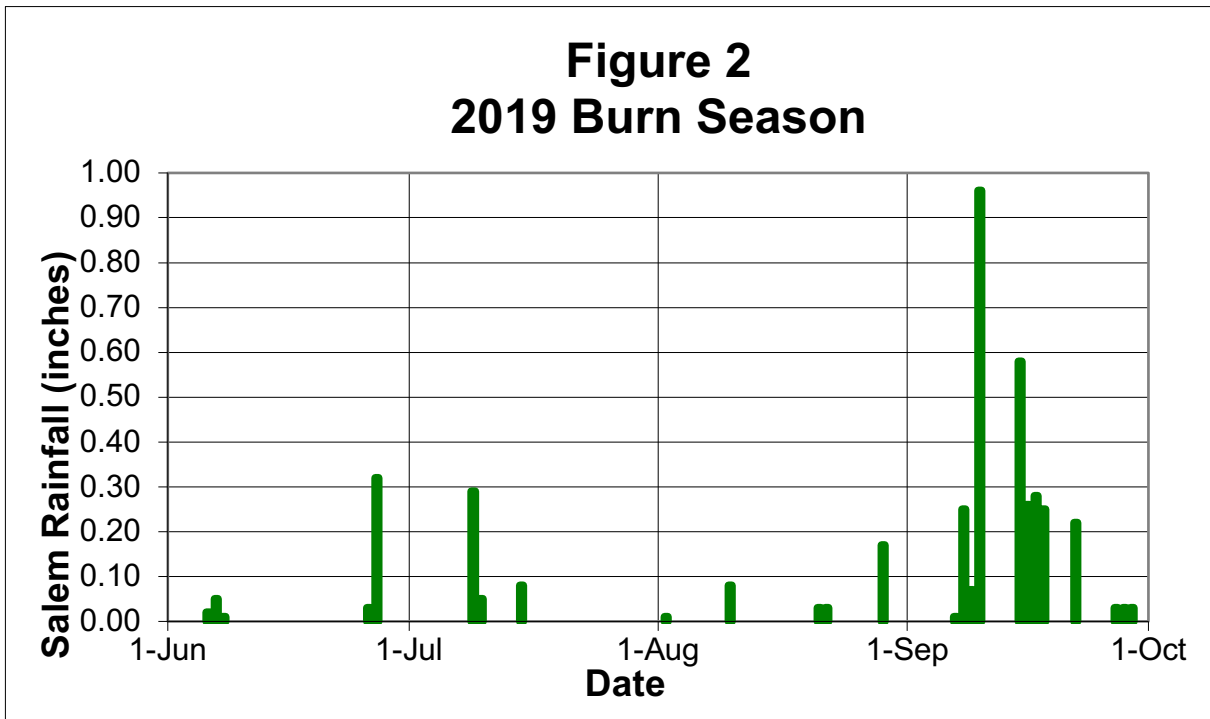


Figure 2
Observed Precipitation at McNary Field (Salem Municipal Airport)



3. Registered and Burned Acres

Open field-burning acreage registration begins in March and continues through April 1. Table 1 shows the breakdown of acres registered, the statutory limitation of each type, and the final allocation. The registration amounts show “on-time” registered acres. Registration totals can fluctuate slightly after “late registration” is conducted.

Table 1
Acres Registered On-time and Total Burned

Type	Limitation (Maximum burnable acres)	Acres Registered (As of April 1, 2019)	Allocation	2019 Acres Burned
Identified Species and Steep Terrain	15,000	15,470	96%	13,872

Definitions

Type: Open-Field Burning

- **Identified Species:** Research has identified some species of grass seed that cannot be profitably produced without thermal sanitation. These identified species are Chewings Fescue, Creeping Red Fescue, and Highland Bentgrass.
- **Steep Terrain:** Fields located in the Willamette Valley where grass seed or cereal grain is grown; however, because of the steepness of the terrain, it is extremely difficult to apply alternatives to open field burning, and the perennial varieties of grass seed grown prevent erosion on steep hillsides.

4. Enforcement

The 2019 field-burning season marked the 22nd year that ODA has performed the enforcement function of the Smoke Management Program. This is stipulated under a Memorandum of Understanding with the Oregon Department of Environmental Quality, pursuant to Oregon Revised Statutes 468A.585.

There was one enforcement contact during the 2019 field-burning season. The enforcement action resulted in a Letter of Warning.

5. Smoke Impacts

It is the goal of the ODA Smoke Management Program, with the cooperation of the Willamette Valley grass seed and cereal grain growers, to reduce and/or eliminate smoke impacts in all populated areas. The combination of accurate weather prediction for open field burning, ODA field personnel observations, and grower experience all contribute to alleviate smoke impacts; however, smoke impacts still occur. Unexpected wind shifts,

changes in mixing heights, transport wind speeds, and wind directions, along with inefficient lighting techniques, can all contribute to the occurrence of impacts.

The number of hours recorded for smoke impacts in 2019 in cities monitored are outlined in Table 2 (below).

There were a total of 23 days when burning was conducted during the 2019 season; 3 of the 23 days resulted in impacts.

Table 2
2019 Open Field Burning Impacts

Date	Acres Burned	Impact Hours			Location
		Heavy	Moderate	Light	
July 22, 2019	879			2	Lyons
				1	Mill City
July 29, 2019	571		1	1	Lyons
August 14, 2019	735		1	1	Lyons
Totals		0	2	5	

As defined in Oregon Administrative Rule (OAR) 603-077-0105, cumulative hours of smoke impact result in hourly nephelometer measurements that exceed 1.8×10^{-4} b-scat above the average prior three-hour background levels. For the purposes of this report, “heavy” hours of smoke impact are 5.0×10^{-4} b-scat or more above background (equivalent to visual range of 5 miles or less); “moderate” hours of smoke impact are 1.8×10^{-4} to 5.0×10^{-4} b-scat above background (equivalent to visual range of 12 miles or less); and “light” hours of smoke impact are 1.0×10^{-4} to 1.8×10^{-4} b-scat above the background. “Light” hours of smoke impact were not recorded before the 1999 season. The terms “light,” “moderate,” and “heavy” as used in relation to smoke impacts are not defined in OAR but are used by ODA to quantify the level of smoke impact on residents of the Willamette Valley. Nephelometers are located in Carus, Detroit, Eugene, Lyons, Mill City, Portland, Salem, Silverton, Springfield, and Sweet Home.

6. Complaints

A total of 75 Willamette Valley residents submitted complaints to the Smoke Management Program during the 2019 field-burning season. Table 3 (below) identifies the number of field-burning complaints originating from individual cities/areas.

Table 3
Complaints by City/Area

Albany	0	Salem/Keizer	0
Detroit	0	Scio	0
Eugene/Springfield	0	Silverton	33
Idanha	0	Stayton	3
Lebanon	1	Sublimity	2
Lyons/Mehama	16	Unknown	5
Mill City/Gates	2	Other	11
Portland Metro	2		
		Total	75

7. Research

The Oregon Seed Council and Oregon Department of Agriculture made available approximately \$150,000 in June to fund alternatives to field burning research projects through the Alternatives to Field Burning Research Financial Assistance Program. In cooperation with the Oregon State University Office for Sponsored Research and Award Administration, the funding is available for projects lasting one to three years. Funding comes from fees growers pay to register and burn their fields.

Two projects received funding. They are as follows:

- 1.) Applicant: Betsy Verhoeven
Mid Valley Field Crops
Oregon State University Extension Service, Marion and Clackamas Counties
Project title: Fall mowing and management options to increase yield in nonburned fine fescue stands
Amount: \$12,000
Duration: One year

- 2.) Applicant: Andrew Hulting and Caio Brunharo
Weed Science Program
Department of Crop and Soil Science, Oregon State University
Project title: Expanding chemical weed management options for fine fescue growers
Amount: 2019-20: \$44,470
Anticipated
2020-21: \$45,000
2021-22: \$45,000
Duration: Three years