Air Quality and Fertilization Practices: Establishing a Calendar of Nitrogen Fertilizer Application Timing Practices for Major Crops in the San Joaquin Valley

FREP Contract # 98-0471 II

Project Leader
Jack King, Jr.
Research for Hire

Cooperators
Nat Dellavalle
Dellavalle Laboratories
Fresno, CA

Steve Beckley
California Fertilizer Association
Sacramento, CA

Dan Munk
UC Cooperative Extension Fresno County
Fresno, CA

Steve Spangler
UNOCAL
Fresno, CA

David Holden
AG RX
Oxnard, CA

Robert Fry
USDA/NRCS
Hanford, CA

G. Stuart Pettygrove
Department of Land, Air and Water Resources
University of California
Davis, CA

INTRODUCTION

Volatilization of nitrogen from nitrogen fertilizer at or near the time of application is a possible source of nitrogen oxides and ammonia in the atmosphere. Nitrogen oxides can play a role in generating ozone. Nitrogen oxides and ammonia together can play a role in generating PM10.

OBJECTIVES

1. Establish, by means of interviewing farmers, a calendar of nitrogen fertilizer application timing practices for major crops in the San Joaquin Valley.

2. Report information on rate, source, and method of application of nitrogen fertilizer gathered in the course of interviewing farmers for the nitrogen fertilizer application calendar.

3. Identify crop production regions in the San Joaquin Valley.

4. Identify precise time indicators for the application of nitrogen fertilizer in the San Joaquin Valley.

PROJECT DESCRIPTION

Target crops for this survey were selected on the basis of acreage per county. (Table 1) The distribution of major crops selected as target crops by county is as follows:

Fresno	16
Tulare	14
San Joaquin	12
Kern	11
Merced	10
Stanislaus	8
Madera	7
Kings	5

Table 1. County X Crop X Acreage Distribution with a T indicating a target county/crop for interviews.

	KERN	TULARE	KINGS	FRESNO	MADERA	MERCED	STANISLAUS	SAN JOAQUIN
Lettuce	3,208	0	0	22,360 T	0	0	0	0
Potatoes, Sweet Potatoes	23,307 T	0	0	0	0	7,858	1,482	3070
Tomatoes	5,040	0	4,657	106,710 T	20,367 T	21,990 T	1,369	38230 T
Vegetables, Melons	71,163 T	11,432 T	9,611	111,300 T	0	16,479 T	19,389 T	48900 T
Barley	13,824 T	7,000 T	9,709	6,580	1,056	4,200	1,700	367
Corn	0	139,000 T	42,179 T	25,100 T	15,333	73,583 T	57,650 T	96200 T
Safflower	7,800	0	32,298 T	2,840	0	114	0	14300 T

Wheat	72,000 T	59,100 T	65,500 T	64,300 T	14,000 T	21,663 T	8,370	40600 T
Alfalfa	120,000 T	104,000 T	47,024 T	76,300 T	37,313 T	77,479 T	40,844 T	63800 T
Grain and Wild Hay	25,000 T	0	3,226	46,800 T	0	26,959 T	27,700 T	19000
Cotton	193,720 T	62,100 T	156,329 T	302,400 T	27,130 T	68,772 T	0	0
Dry Beans/Peas	6,331	7,600	8,074	15,300 T	2,100	6,102	18,900 T	22300 T
Sugar Beets	5,191	3,760	3,446	27,800 T	440	12,658 T	0	7600
Almonds	79,587 T	13,395 T	2,097	49,968 T	43,635 T	74,182 T	87,000 T	38500 T
Citrus	43,647 T	109,893 T	0	28,230 T	3,931	0	0	0
Cherries	0	476	0	0	0	0	1550	12500 T
Grapes	81,289 T	76,225 T	4,870	221,179 T	86,708 T	15,502	13,000	76800 T
Olives	1,154	16,621 T	0	1,456	1160	0	0	0
Peaches	2,091	13,169 T	4,024	20,019 T	876	6,101	9,220	2190
Pistachio	25,932 T	7,266	5,670	3,989	17,854 T	4,437	0	0
Plums	2,379	23,011 T	1,721	17,871 T	2,150	2,125	0	0
Walnuts	1,461	27,346 T	6,719	3,239	977	5,218	27,630 T	39300 T
Irrigated Pasture	8,000	86,200 T	10,000	40,000 T	5,500	58,500 T	75,000 T	23900 T

Based on: *California Farmer*, CALIFORNIA AT A GLANCE, A comprehensive analysis of acreage, head and dollar values for California's principal crop and livestock commodities by county and state totals. 1998 Crop Year. Published: August 1999. Crops not qualifying in any county as target crops were removed from this list.

The goal of this survey was to have at least two farm interviews conducted per target crop per county. For all of the crops reported here, this goal was achieved or surpassed. Names of farmers growing target crops were obtained from the California Cotton Growers Association, the Nisei Farmers League, referrals from other farmers and farm bureaus in the following counties: Kern, Tulare, Fresno, Madera, Merced, Stanislaus, and San Joaquin.

The interviews covered the following questions: crop acreage, timing of nitrogen applications, nitrogen fertilizer used, and the amount of actual nitrogen applied.

RESULTS AND CONCLUSIONS

Spring and Summer Nitrogen Fertilizer Application Calendar

Table 2 Nitrogen fertilizer application calendar for selected target crops for spring and summer

CROP	MAR	APR	MAY	JUN	JUL	AUG	SEP
Alfalfa[1]		----------	----------	---------	--------		
Almonds	----------	----------	----------	---------	--------	----------	--------
Citrus	----------	----------	----------	---------			
Corn		----------	----------	---------	--------	----------	
Cotton	+++++[2]	+++++ +	----------	---------	--------		
Wheat	++++++						

[1]See narrative below for each crop.
[2]See narrative under Table 3 for + symbols.

Alfalfa Fifteen percent of alfalfa growers interviewed applied an average of 30 lbs./acre of nitrogen sometime during the months of April, May, June, and July. Quantities of nitrogen applied ranged from 22lbs/acre to 60 lbs./acre. Sixty percent of these farmers broadcast[1] and then watered in 11-52-0. Twenty percent water ran CAN17 and twenty percent water ran ammonium sulfate.

Almonds All almond growers interviewed applied nitrogen fertilizer to their almonds sometime during the time period of March through September. Amounts of nitrogen applied averaged 150 lbs./acre and ranged from 50 lbs./acre to 350 lbs./acre. Seventy-five percent of these farmers used UN32 as their source of nitrogen. Fifteen percent of these farmers used CAN17 as their source of nitrogen. The remaining fifteen- percent used various mixes of fertilizer or manure. Fifty-five percent of these farmers applied nitrogen to their almonds via a pressurized irrigation system. Thirty percent broadcast the nitrogen and then watered it in. Ten percent shanked the nitrogen in. Five percent ran the nitrogen with flood irrigation.

Corn Ninety-five percent of corn growers interviewed applied nitrogen fertilizer to their corn sometime during the time period of April through August. The remaining five- percent used manure as a source of nitrogen. Amounts of nitrogen applied averaged 205 lbs./acre and ranged from 120 lbs./acre to 305 lbs./acre. Fifty-five percent of these farmers used UN32 as their source of nitrogen. Fifteen percent of these farmers used urea as their source of nitrogen. Anhydrous ammonia, ammonium sulfate and various blends each accounted for ten percent of the nitrogen fertilizer applied by corn growers. Fifty-five percent of these farmers applied nitrogen to their corn by means of shanking it in. Twenty percent broadcast the nitrogen and then watered it in. Fifteen percent watered the nitrogen in with furrow or flood irrigation.

Cotton All of the cotton growers interviewed applied nitrogen fertilizer to their cotton sometime during the time period of May through July. Amounts of nitrogen applied averaged 120 lbs./acre and ranged from 70 lbs./acre to 200 lbs./acre. Eighty percent of these farmers used UN32 as their source of nitrogen. Fifteen percent of these farmers used anhydrous ammonia as their source of nitrogen. Ammonium sulfate accounted for five percent of the nitrogen fertilizer applied by cotton growers. Fifty-five percent of these farmers applied nitrogen to their cotton by means of shanking it in. Twenty percent broadcast the nitrogen and then watered it in. Fifteen percent watered the nitrogen in with furrow or flood irrigation.

Wheat: See narrative under Table 3.

Fall and Winter Nitrogen Fertilizer Application Calendar

Table 3 Nitrogen fertilizer application calendar for selected target crops for fall and winter

CROP	OCT	NOV	DEC	JAN	FEB
Alfalfa[1]			+++++	+++++	+++++
Almonds	+++++				
Citrus				+++++	+++++
Corn					
Cotton	+++++	++++++	+++++	+++++	+++++
Wheat		++++++	+++++	+++++	+++++

[1]Please see narrative below for each crop.

Alfalfa Eighteen percent of alfalfa growers interviewed applied an average of 25 lbs./acre of nitrogen sometime during the time period of December through February. Quantities of nitrogen applied ranged from 22 lbs./acre to 40 lbs./acre. All of these farmers broadcast and watered in 11-52-0.

Almonds Thirty-three percent of almond growers interviewed applied nitrogen fertilizer to their almonds sometime during the month of October. Amounts of nitrogen applied averaged 70 lbs./acre and ranged from 35 lbs./acre to 100 lbs./acre. Eighty percent of these farmers used UN32 as their source of nitrogen. The remaining fifteen- percent used various mixes of fertilizer. Forty-five percent of these farmers broadcast the nitrogen and then watered it in. Thirty-five percent applied nitrogen to their almonds via a pressurized irrigation system. Twenty percent shanked the nitrogen in. Five percent ran the nitrogen with flood irrigation.

Corn None

Cotton Forty-five percent of cotton growers interviewed applied nitrogen fertilizer to their cotton sometime during the time period of October through April. Amounts of nitrogen applied averaged 85 lbs./acre and ranged from 17 lbs./acre

to 150 lbs./acre. Forty-five percent of these farmers used various fertilizer blends as their source of nitrogen. Thirty-five percent used UN32 as their source of nitrogen. The remaining twenty- percent used anhydrous ammonia as their source of nitrogen. Eighty-five percent of these farmers shanked the nitrogen in. Fifteen percent broadcast the nitrogen and watered it in.

Wheat Seventy percent of wheat growers interviewed applied nitrogen fertilizer to their wheat sometime during the time period of November through March. (The remaining fifteen- percent either used manure or depended on the residual nitrogen from a previous crop for nitrogen for their wheat crop.) Amounts of nitrogen applied averaged 80 lbs./acre and ranged from 0 lbs./acre to 200 lbs./acre. Twenty-five percent of these farmers used urea as their source of nitrogen. Twenty percent used UN32 as their source of nitrogen. Fifteen percent used anhydrous ammonia as their source of nitrogen and ten percent used ammonium sulfate. The remaining thirty- percent did not use chemical fertilizer as a source of nitrogen for their wheat crop. Fifty-five percent of these farmers broadcast the nitrogen and watered it in or disced it in. Twenty-five percent of these farmers watered the nitrogen in by means of sprinklers or flood irrigation. Fifteen percent shanked the nitrogen in.

Crop Production Regions in the San Joaquin Valley

Identifying target crops had the effect also of identifying some production regions in the San Joaquin Valley.

Only alfalfa qualified as a target crop in all eight counties of the San Joaquin Valley. Wheat qualified as a target crop in every county except one, Stanislaus, as did almonds, which qualified as a target crop in every county except Kings. Corn and cotton were also well distributed. Corn qualified as a target crop in all counties except Kern and Madera. Cotton qualified as a target crop in the six southern counties of the San Joaquin valley but not in the northern two. There was also a series of one county crops. These crops qualified as target crops in only one county and are as follows: Olives/Tulare, Cherries/San Joaquin, Potatoes/Kern, Lettuce/Fresno and Safflower/Kings.

The citrus belt was clearly identified with citrus qualifying as a target crop in Kern, Tulare and Fresno counties. Also the center of stone fruit production in the San Joaquin Valley was identified with peaches and plums qualifying as target crops only in Fresno and Tulare counties.

Precise Time Indicators

Only one precise time indicator was identified and it was an obvious one. In the event of a wet winter and spring, a lot of nitrogen will be applied during the brief, dry interludes.

[1]For the purposes of this survey, “broadcast” refers to any method of applying fertilizer to the surface of the soil whether by dribbling or spraying liquid or spreading dry fertilizer. Nitrogen fertilizer that has been broadcast is usually watered in with flood irrigation. Sometimes it is “rained” in or disced in.