Animal Waste Management Plan

December 2005

Wismer Dairy

<u>Operated by:</u>

Fred and Janet Wismer
P.O. Box 69
Gaston, Oregon 97119
(503) 985-7489

MA# 63628
Plan# 06002
Reviewed on 1/5/2006

<u>Operation:</u>

Dairy
Medium Federal CAFO

Aprved
Jan 13/06

As owner and operator of **Wismer Dairy,** I intend to manage in accordance with the practices described in this Animal Waste Management Plan.

Signature Fred Wismer Date 1/3/06

RECEIVED

JAN 04 2006

NATURAL RESOURCES
DIVISION

GENERAL NARRATIVE DESCRIPTION

Wismer Dairy is located at **11130 Hwy 47, Gaston Oregon** and is owned by **Fred and Janet Wismer**. The operation is a dairy facility in Washington County. The facility is in full operation year round. The Wismer Dairy is located on approximately 108 acres in Gaston, Oregon. The mixed dairy herd is composed of 125 milking cows, 25 dry, 75 heifers, and 75 calves. The milk cows are milked 2 times a day and average 54 lbs per animal. Mature cows and heifers graze on farm April through October. The facility uses a dry scrape system and scrapes the manures to a covered 64,512 cubic foot solid manure storage barn. Owner Fred Wismer states that the solids will then be stored until they can be spread on crop ground. There is no export of manure off farm. The facilities liquids drain to a 48' x 10' below ground liquid tank (BGLT). The liquids are stored there until they can be applied to crop ground. Wismer Dairy has access to 88 owned acres to distribute manures to. Bedding materials consist of loose straw. The acreage is broken up into eight different fields. Fields one through 4 are used as pasture/hay ground, fields five, one third of six, seven and eight are utilized for grass silage. The remaining third of field six is planted to sudan grass for haylage. Fields one and half of fields five and six are tiled. The Tualatin River runs southwest to northeast of the property. A buffer of 12' is maintained for solid manure application, 100' for liquid sprinkler application, and 50' for liquid honey wagon application. A buffer of 100' will be maintained for any manure spread in the winter months.

Manure Storage and Application

All manures are dry scraped to the east side of the facility into a 144' x 56' x 8' covered solid storage facility. From there manures are stored until they can be applied. ORAWM recommend for at least a years worth of solid storage. All liquids from the facility drain into a 48' x 10' below ground liquid tank. The liquids are stored in the tank until they can be applied to the crops. ORAWM recommends for at least 40 days of liquid storage and a years worth of solid storage. All haylage is stored under cover. All contaminated water from the barns and yard area will be directed to the BGLT. All barns will be guttered to divert clean water away from manure storage facilities. The operator will contain all wastewater within the facilities while diverting clean water out of the system.

Manure is applied to the acreage via the use of a solid spreader wagon, liquid stationary gun, and honey wagon. Manure will be applied to the acreage via calibrated equipment to meet the expected nutrient uptake of the crop system. The average elevation is approximately 170 feet and the property has no noticeable change in elevation. Application of manure will be done at appropriate times of the year as to utilize nutrients for maximal forage production.

SPECIFIC DESCRIPTIONS AND CALCULATIONS

Land Application Areas

The operation manages 87.6 acres of its own land on site, which it applies liquid and solid waste to and 22 acres of land in Tillamook not used for manure application. All of the manure is utilized on the facility's local property.

Throughout the growing season milkers, dry cows and heifers are grazed 80% of the time.

Manure and Waste Volumes

Calculated volumes of all manure, bedding, have been completed using the Oregon Animal Waste Management worksheet based from the NRCS Agricultural Waste Field Handbook. The worksheet is included in this Animal Waste Management Plan.

Nutrient Content of Manure, Litter and Process Waste Water

The same worksheet was used to estimate nutrient content of manure. Annual on farm manure test results are available for customers.

Wismer's D[illegible]y MA # 63628

New land
103 AC total
45 available now
(farmable)

Washington Co.

AGCT = 100 x 16 Aug 2012?

A to 199 m & d & max out

& 45 AC ↗

Farm Nutrient Balance

Nutrient balances for manure application on the farm is also included in the Oregon Animal Waste Management worksheet.

Application Schedule and Limitations

All of the manure is applied at a time of year in which the nutrients will best be utilized. It is the dairies goal to have solid and liquid storage available at the end of fall for winter storage and to start applying in the spring. If emergency application is necessary the operation takes care not to spread on saturated or frozen ground and leaves at least a 100' buffer beside surface waters.

Animal Mortality Management

One hundred percent of animal mortalities are hauled off site to a rendering plant.

Record Keeping

a) Applications of manure, litter and process waste will be kept, including the date and the amount of N and P applied during each application.
b) Records of exporting manure, litter and process waste will also be kept.

Reporting to the Oregon Department of Agriculture (ODA)

a) Any discharge will be reported orally to ODA within 24 hours. Within 5 days, a written statement describing this discharge will also be submitted to ODA.
b) The amount of manure, litter and process waste applied will be reported annually.
c) The amount of manure, litter and process waste exported will be reported annually.

Protocol for Sampling Manure

Solid manure compost will be sampled and tested prior to manure exports in the spring. Approximately 20 small grab samples from the manure pile will be taken to make on composite sample. After collection, the grab samples will be thoroughly mixed. About one quart of manure will be removed for nutrient analysis. The sample will be preserved for shipping to an analytical laboratory to be tested for Total Nitrogen (TKN), Ammonium Nitrogen (NH4-N), Phosphorus (P), Potassium (K) and moisture content (or dry matter).

ANIMAL WASTE MANAGEMENT WORKSHEET

Version 2.4

CLIENT: Wismer
ASSISTED BY: Oregon Department of Agriculture
CHECKED BY:

ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

ANIMAL INVENTORY

Type of Animal	Number of Animals	Average Weight (lbs.)	Animal Units (1,000 lb.)	Milk Production in Pounds/Cow/Day=					54	Manure CF/D/AU	Annual	
				Nutrient Production								
				(lbs./day/1000 lb. Animal Unit)			(lbs./day)				Days Confined	Days Grazed
				N	P	K	N	P	K			
MILKER	125	1,200	150.0	0.51	0.09	0.29	76.01	13.18	43.57	1.41	194	171
MILKER (DRY)	25	1,200	30.0	0.36	0.05	0.23	10.80	1.50	6.90	1.10	194	171
HEIFERS (12-24 Months)	75	750	56.3	0.31	0.04	0.24	17.44	2.25	13.50	1.30	194	171
CALVES (1-12 Months)	75	100	7.5	0.31	0.04	0.24	2.33	0.30	1.80	1.30	365	0
Totals/Averages-	300	813	243.8	0.44	0.07	0.27	106.6	17.2	65.8	1.3		

GRAZING PERIOD

Type of Animal	Percent of Month and Number of Animals Grazing												
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AU-YR.
MILKER	80%	0%	0%	0%	0%	0%	80%	80%	80%	80%	80%	80%	
	125	125	125	125	125	125	125	125	125	125	125	125	840
MILKER (DRY)	80%	0%	0%	0%	0%	0%	80%	80%	80%	80%	80%	80%	
	25	25	25	25	25	25	25	25	25	25	25	25	168
HEIFERS (12-24 Months)	80%	0%	0%	0%	0%	0%	80%	80%	80%	80%	80%	80%	
	75	75	75	75	75	75	75	75	75	75	75	75	315
CALVES (1-12 Months)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
	75	75	75	75	75	75	75	75	75	75	75	75	[illegible]
													0
													0
													0
													0
													0
													0
Total AUM's Available>	99						102	102	102	101	101	101	708
Total AUM's Needed>>>	189	0	0	0	0	0	189	189	189	189	189	189	1,323
Total AUM's>>>>>>>>>>	-90	0	0	0	0	0	-87	-87	-87	-88	-88	-88	-615

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ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

WEATHER STATION FOREST GROVE

	25Yr-24Hr	4.00	Lot Runoff Factors as a Percent of Monthly Precipitation	
	Monthly Average in Inches			
Month	Precipitation	Evaporation	Paved	Unpaved
October	3.54	1.66	100%	15%
November	6.75	0.74	100%	20%
December	9.18	0.42	100%	20%
January	7.18	0.47	100%	20%
February	5.47	0.79	100%	20%
March	5.00	1.52	100%	15%
April	2.52	2.32	100%	15%
May	1.76	3.63	100%	10%
June	1.35	4.21	100%	10%
July	0.43	5.24	100%	0%
August	0.69	4.78	100%	10%
September	1.55	3.26	100%	15%
Annual	45.42	29.04		

AREAS CONTRIBUTING RUNOFF TO LIQUID STORAGE FACILITY

Description of Runoff Area	Area in SF
Paved Lot Area >>> Is paved lot scraped daily? (Y/N) YES	8,156
Unpaved Lot Area >>>	0
Roof Area >>>	0
Surface Area of Silage Storage Facility>>>>>>>>>>>>>>>>>>>>>>>>>>>>> Does Silage Seepage Drain to Storage Facility? (Y/N) NO	0
Total Runoff Area Contributing to Liquid Storage Facility>>>>>>>>>>>>>>>	8,156

WATER USE THAT ENTERS LIQUID STORAGE FACILITY

Type of Water Use	Number of Animals	Number of Washes per Day	Gallons of Water Used per Wash-Day	Total Water Use per Day, Gallons	Total Water Use per Day, Cubic Feet
Animal Washwater	0.0	2	0.00	0	0.0
Equipment Wash		2	71.25	143	19.1
Flushwater		2	0.00	0	0.0
Miscellaneous		2	0.00	0	0.0
Total>>>				143	19.1

CROP DATA

						Nutrients Removed in Pounds per Acre		
Field Number	Acres	Crop	Condition	Yield Units	Target Yield	Nitrogen N	Phosphorous P_2O_5	Potassium K_2O
1-4	47.0	Ryegrass Hay/Pasture	DHM	Ton	6.00	200	74	205
5,6(1/3),7,8	30.7	Ryegrass Haylage	As Harvested	Ton	18.00	450	165	462
6(2/3)	9.9	Sorghum-Sudan Haylage	DHM	Ton	7.00	190	51	245
Off-Farm								

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ANIMAL WASTE MANAGEMENT SYSTEM INVENTORY

BEDDING VOLUME

Type of Animal	Type of Bedding Facility	Bedding Material	Unit Weight Lbs/CF	Amount Needed Lbs/Day/AU	Volume CF/Day/AU	Total Volume CF/Day	Total Weight Lbs/Day
MILKER	Free Stall	Loose Straw	**2.50**	**2.60**	**0.82**	123	390
MILKER (DRY)	Loose Housing	Loose Straw	**2.50**	**9.30**	**0.50**	15	279
HEIFERS (12-24 Months)	Loose Housing	Loose Straw	**2.50**	**9.30**	**0.48**	27	523
CALVES (1-12 Months)	Loose Housing	Loose Straw	**2.50**	**9.30**	**0.25**	2	70

SOLIDS SEPARATION FACTOR

Type of Animal	Type of Separator	Separation Factor %	Volume of Solids Separated CF/Day	Volume of Solids in Liquids CF/Day	Volume of Manure in Liquids CF/Day	Volume of Manure in Solids CF/Day	Accumulated Sludge in Storage CF/Day	Density of Separated Solids Lbs/CF	Weight of Separated Solids Lbs/Day
MILKER	Dry Scrape System	**90%**	301	33	21	190	14	**36**	10,820
MILKER (DRY)	Dry Scrape System	**90%**	43	5	3	30	2	**36**	1,555
HEIFERS (12-24 Months)	Dry Scrape System	**90%**	90	10	7	66	3	**36**	3,244
CALVES (1-12 Months)	Dry Scrape System	**90%**	10	1	1	9	0	**36**	377
Total Solids>>			444	49	33	294	19		15,996

ANIMAL WASTE MANAGEMENT WORKSHEET
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ANIMAL WASTE MANAGEMENT SYSTEM PRODUCTION

MONTHLY VOLUMES

	Runoff in Cubic Feet					Manure									
Month	Roof Area Square Feet 0	Paved Slab Area Square Feet 8,156	Unpaved Lot Area Square Feet 0	Silage Pit Surface Area, SF 0	Facility Water Use Cubic Feet	Solids Cubic Feet	Liquids Cubic Feet	Bedding Cubic Feet	Bedding Pounds	Solids Separated Cubic Feet	Solids Separated Pounds	Solids in Liquids Cubic Feet	Solids in Liquids Pounds	Total Solids Cubic Feet	Total Liquids Cubic Feet
October	0	2,406	0	0	591	268	2,000	1,081	9,553	3,014	108,518	335	12,058	3,014	3,558
November	0	4,588	0	0	572	1,172	8,633	5,006	37,856	13,330	479,891	1,481	53,321	13,330	7,654
December	0	6,239	0	0	591	1,211	8,921	5,173	39,118	13,775	495,887	1,531	55,099	13,775	9,374
January	0	4,880	0	0	591	1,211	8,921	5,173	39,118	13,775	495,887	1,531	55,099	13,775	8,014
February	0	3,718	0	0	533	1,094	8,058	4,673	35,333	12,442	447,898	1,382	49,766	12,442	6,647
March	0	3,398	0	0	591	1,211	8,921	5,173	39,118	13,775	495,887	1,531	55,099	13,775	6,533
April	0	1,713	0	0	572	259	1,936	1,046	9,245	2,917	105,018	324	11,669	2,917	2,835
May	0	1,196	0	0	591	268	2,000	1,081	9,553	3,014	108,518	335	12,058	3,014	2,349
June	0	918	0	0	572	259	1,936	1,046	9,245	2,917	105,018	324	11,669	2,917	2,040
July	0	292	0	0	591	268	2,000	1,081	9,553	3,014	108,518	335	12,058	3,014	1,445
August	0	469	0	0	591	268	2,000	1,081	9,553	3,014	108,518	335	12,058	3,014	1,621
September	0	1,053	0	0	572	259	1,936	1,046	9,245	2,917	105,018	324	11,669	2,917	2,176
Annual	0	30,870	0	0	6,954	7,750	57,261	32,661	256,493	87,905	3,164,577	9,767	351,620	87,905	54,245

DAILY NUTRIENT PRODUCTION

	Pounds/Day of Nutrients from LIQUIDS			Pounds/Day of Nutrients from SOLIDS			Pounds/Day of Nutrients from GRAZING		
Type of Animal	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
MILKER	7.60	3.02	5.25	68.41	27.18	47.25	76.01	30.20	52.50
MILKER (DRY)	1.08	0.34	0.83	9.72	3.09	7.48	10.80	3.44	8.31
HEIFERS (12-24 Months)	1.74	0.52	1.63	15.69	4.64	14.64	17.44	5.15	16.27
CALVES (1-12 Months)	0.23	0.07	0.22	2.09	0.62	1.95	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

CLIENT: **Wismer**
ASSISTED BY: **Oregon Department of Agriculture** CHECKED BY:

ANIMAL WASTE MANAGEMENT SYSTEM PRODUCTION

MONTHLY NUTRIENT PRODUCTION

	Pounds of Nutrients from LIQUIDS			Pounds of Nutrients from SOLIDS			Pounds of Nutrients from GRAZING			Pounds of Nutrients going OFF-FARM			Total Pounds of Nutrients from ALL SOURCES		
Month	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
October	72	26	55	647	236	491	2,585	962	1,912	0	0	0	3,304	1,224	2,457
November	320	118	238	2,877	1,066	2,140	0	0	0	0	0	0	3,197	1,184	2,378
December	330	122	246	2,973	1,102	2,211	0	0	0	0	0	0	3,304	1,224	2,457
January	330	122	246	2,973	1,102	2,211	0	0	0	0	0	0	3,304	1,224	2,457
February	298	111	222	2,686	995	1,997	0	0	0	0	0	0	2,984	1,106	2,219
March	330	122	246	2,973	1,102	2,211	0	0	0	0	0	0	3,304	1,224	2,457
April	70	25	53	626	228	475	2,502	931	1,850	0	0	0	3,197	1,184	2,378
May	72	26	55	647	236	491	2,585	962	1,912	0	0	0	3,304	1,224	2,457
June	70	25	53	626	228	475	2,502	931	1,850	0	0	0	3,197	1,184	2,378
July	72	26	55	647	236	491	2,585	962	1,912	0	0	0	3,304	1,224	2,457
August	72	26	55	647	236	491	2,585	962	1,912	0	0	0	3,304	1,224	2,457
September	70	25	53	626	228	475	2,502	931	1,850	0	0	0	3,197	1,184	2,378
Annual	**2,105**	**777**	**1,573**	**18,946**	**6,992**	**14,157**	**17,847**	**6,642**	**13,197**	**0**	**0**	**0**	**38,898**	**14,411**	**28,927**

ANIMAL WASTE MANAGEMENT WORKSHEET

Version 2.4

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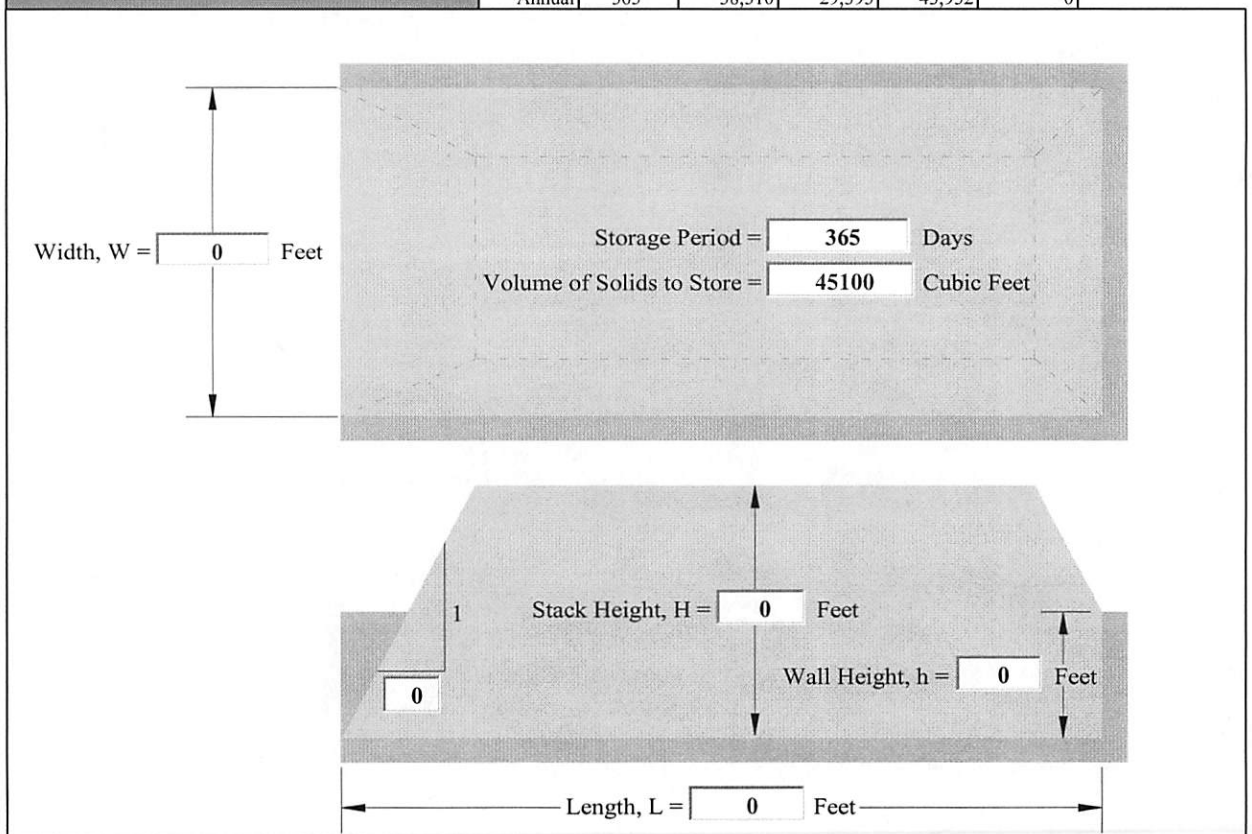
ANIMAL WASTE MANAGEMENT SYSTEM STORAGE

SOLIDS STACKING FACILITY

Solids Storage Facility Parameters	Value
Storage Period, Days=	365
Stacking Width, W in Feet=	0
Stacking Height, H in Feet=	0.00
Wall Height, h in Feet=	0.00
Stack Side Slope (X:1)=	0.00
Existing Storage, Cubic Feet=	64,512
Surface Area of Existing Storage, SF=	0
25 Year-24 Hour Storm Runoff, CF=	0
Volume Needed, Cubic Feet=	45,100
Design Volume, Cubic Feet=	0
Is Facility Covered?	YES

MONTHLY SOLIDS VOLUME STACKED IN FACILITY

Month	Number of Days	Manure CF	Bedding CF	Solids to Store CF	Normal Runoff CF
October	31	2041	973	1,507	0
November	30	8825	4,506	6,665	0
December	31	9119	4,656	6,887	0
January	31	9119	4,656	6,887	0
February	28	8236	4,205	6,221	0
March	31	9119	4,656	6,887	0
April	30	1976	942	1,459	0
May	31	2041	973	1,507	0
June	30	1976	942	1,459	0
July	31	2041	973	1,507	0
August	31	2041	973	1,507	0
September	30	1976	942	1,459	0
Annual	365	58,510	29,395	43,952	0



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ANIMAL WASTE MANAGEMENT SYSTEM STORAGE

TANK

Tank Parameters	Value
Storage Period, Days=	**41**
Tank Diameter, Feet=	**0**
Existing Storage, Cubic Feet=	**17,410.00**
Surface Area of Existing Storage, SF=	**1,808**
25 Year-24 Hour Storm Runoff, CF=	**2,718**
Volume Needed, Cubic Feet=	**17,323**
Design Volume, Cubic Feet=	**0**
Is Tank Covered?	NO
Tank Dimensions?	Circular

MONTHLY INFLOWS INTO TANK

Month	Number of days	Rain-Evap on Tank CF	Rain-Evap on Existing Storage, CF	Normal Runoff CF	Washwater CF	Manure CF
October	31	0	283	2,406	591	227
November	30	0	906	4,588	572	981
December	31	0	1,320	6,239	591	1,013
January	31	0	1,011	4,880	591	1,013
February	28	0	705	3,718	533	915
March	31	0	524	3,398	591	1,013
April	30	0	30	1,713	572	220
May	31	0	-282	1,196	591	227
June	30	0	-431	918	572	220
July	31	0	-725	292	591	227
August	31	0	-616	469	591	227
September	30	0	-258	1,053	572	220
Annual	365	0	2,468	30,870	6,954	6,501

1.0 Feet

Minimum Freeboard = 1.0 Feet

25Yr-24Hr Storm Precipitation = **4** Inches

25Yr-24Hr Storm Runoff = **2718** Cubic Feet

41 Day Precip - Evap = **11.220333333** Inches

Runoff from Normal Precipitation = **8028** Cubic Feet

Depth = **0** Feet

Washwater = **807** Cubic Feet

Manure = **1384** Cubic Feet

Diameter = **0** Feet

ANIMAL WASTE MANAGEMENT WORKSHEET

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CHECKED BY:

ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

NUTRIENTS AVAILABLE AFTER STORAGE

Nutrient Source	Type of Operation: Dairy / Type of Storage Facility	Pounds of Nutrients Available N	P2O5	K2O	Percent Nutrients Retained After Storage N	P2O5	K2O	Pounds of Nutrients Retained After Storage N	P2O5	K2O
Liquids	Tank (Uncovered)	2,105	777	1,573	**70%**	**85%**	**85%**	1,474	660	1,337
Solids	Solids Storage Facility (Roofed)	18,946	6,992	14,157	**75%**	**90%**	**90%**	14,210	6,293	12,742
Grazing	NONE	17,847	6,642	13,197	**100%**	**100%**	**100%**	17,847	6,642	13,1

NUTRIENTS AVAILABLE AFTER APPLICATION

Nutrient Source	Type of Application System	Pounds of Nutrients Available N	P2O5	K2O	Percent Nutrients Retained After Application N	P2O5	K2O	Pounds of Nutrients Retained After Application N	P2O5	K2O
Liquids	Sprinkling	1,474	660	1,337	**75%**	**100%**	**100%**	1,105	660	1,337
Solids	Broadcast (Incorporated 7 or more days after application)	14,210	6,293	12,742	**70%**	**100%**	**100%**	9,947	6,293	12,742
Grazing	Grazing	17,847	6,642	13,197	**90%**	**100%**	**100%**	16,062	6,642	13,197

NUTRIENTS AVAILABLE AFTER DENITRIFICATION

Nutrient Source	Location: Between Coastal and Cascade Mountains / Soil Drainage Class	Pounds of Nutrients Available N	P2O5	K2O	Percent Nutrients Retained After Denitrification N	P2O5	K2O	Pounds of Nutrients Retained After Denitrification N	P2O5	K2O
Liquids	Somewhat Poorly Drained	1,105	660	1,337	**83%**	**100%**	**100%**	917	660	1,33
Solids	Somewhat Poorly Drained	9,947	6,293	12,742	**83%**	**100%**	**100%**	8,256	6,293	12,74
Grazing	Somewhat Poorly Drained	16,062	6,642	13,197	**83%**	**100%**	**100%**	13,331	6,642	13,1

CLIENT: Wismer
ASSISTED BY: Oregon Department of Agriculture

CHECKED BY:

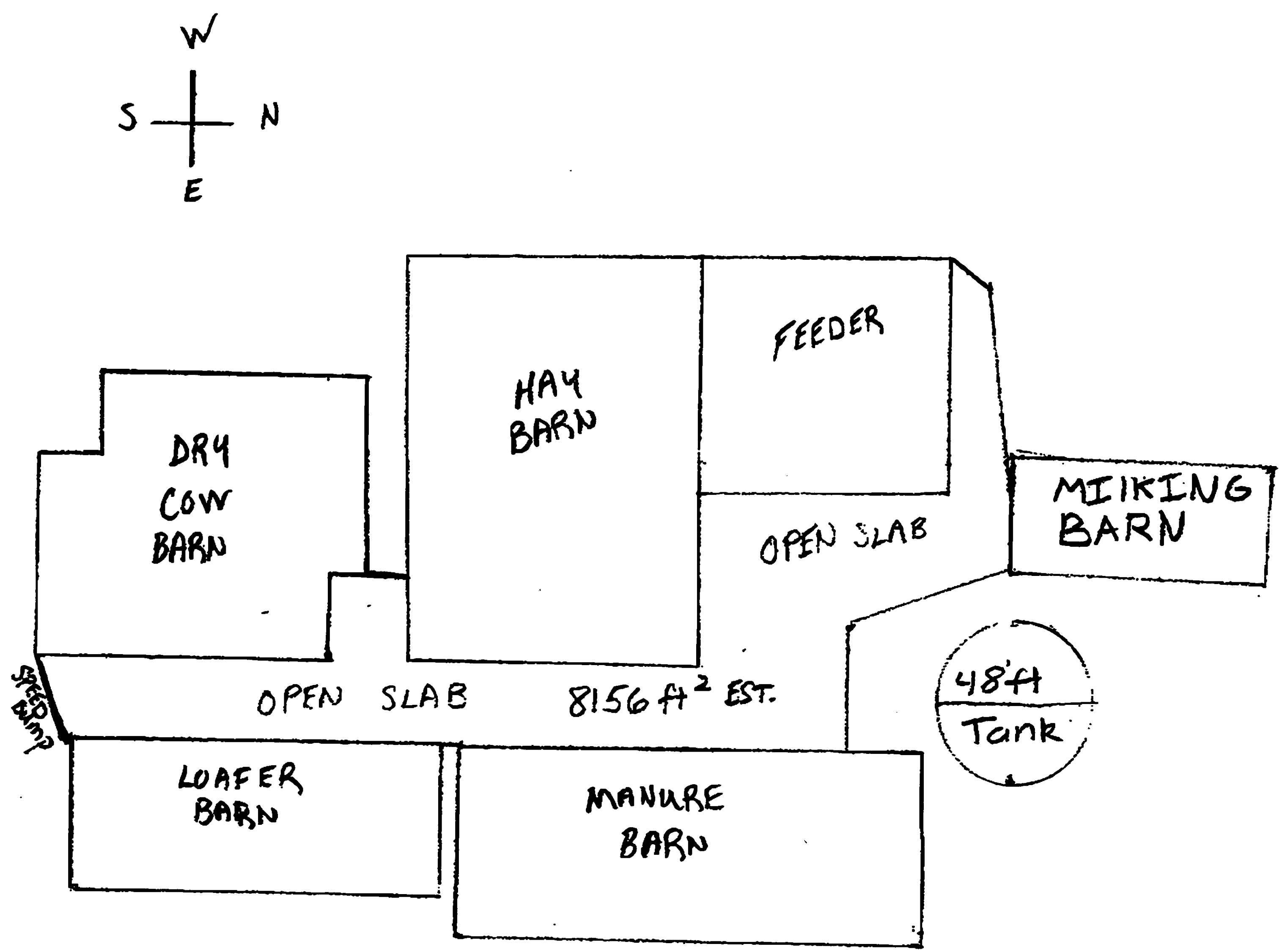
ANIMAL WASTE MANAGEMENT SYSTEM UTILIZATION

PERCENT OF MANURE TO BE APPLIED TO FIELD AND UTILIZATION ACRES NEEDED BASED ON NITROGEN, N

Field Number	Acres	Crop	LIQUIDS Percent to be Applied	LIQUIDS Pounds of Nutrients to be Applied	LIQUIDS Acres Needed for Utilization of Nutrients	SOLIDS Percent to be Applied	SOLIDS Pounds of Nutrients to be Applied	SOLIDS Acres Needed for Utilization of Nutrients	GRAZING Percent to be Applied	GRAZING Pounds of Nutrients to be Applied	GRAZING Acres Needed for Utilization of Nutrients
1-4	47.0	Ryegrass Hay/Pasture	0%	0	0	0%	0	0	70%	9,332	47
5,6(1/3),7,8	30.7	Ryegrass Haylage	0%	0	0	100%	8,256	18	30%	3,999	9
6(2/3)	9.9	Sorghum-Sudan Haylage	100%	917	5	0%	0	0	0%	0	0
0											
0											
0											
0											
0											
0											
Off-Farm			0%	0		0%	0		0%	0	
		TOTALS-	100%	917	5	100%	8,256	18	100%	13,331	55

NUTRIENT BALANCE BASED ON AVAILABLE ACRES

Field Number	Acres	Crop	NUTRIENTS APPLIED Nitrogen, N Lbs/Acre	NUTRIENTS APPLIED Phosphorous, P_2O_5 Lbs/Acre	NUTRIENTS APPLIED Potassium, K_2O Lbs/Acre	- NUTRIENTS REMOVED Nitrogen, N Lbs/Acre	NUTRIENTS REMOVED Phosphorous, P_2O_5 Lbs/Acre	NUTRIENTS REMOVED Potassium, K_2O Lbs/Acre	= NUTRIENT BALANCE Nitrogen, N Lbs/Acre	NUTRIENT BALANCE Phosphorous, P_2O_5 Lbs/Acre	NUTRIENT BALANCE Potassium, K_2O Lbs/Acre
1-4	47.0	Ryegrass Hay/Pasture	199	99	197	200	74	205	-2	25	-9
5,6(1/3),7,8	30.7	Ryegrass Haylage	399	270	544	450	165	462	-51	105	82
6(2/3)	9.9	Sorghum-Sudan Haylage	93	67	135	190	51	245	-98	15	-110
0											
0											
0											
0											
0											
0											
Off-Farm											


W
S
N
E
DRY
COW
BARN
HAY
BARN
FEEDER
OPEN SLAB
MIIKING
BARN
48'ft
Tank
OPEN SLAB
8156 ft² EST.
SPEED
BUMP
LOAFER
BARN
MANURE
BARN

Tract 19375

Legend

clu_a_or067

2,400 1,200 0 2,400 Feet

N

Washington County
Farm 1784
Tract 19375

400 0 400 800 1200 Feet

Legend
Tract/Field Boundary
Wetland

N

Apr 01, 2005
T1S R4W SEC35
SW¼,NE¼

This acreage is for FSA program purposes only
No warranty is made for any other use.

Washington County
Farm 1784
Tract 19375

400 0 400 800 1200 Feet

Legend
Tract/Field Boundary
Wetland

N

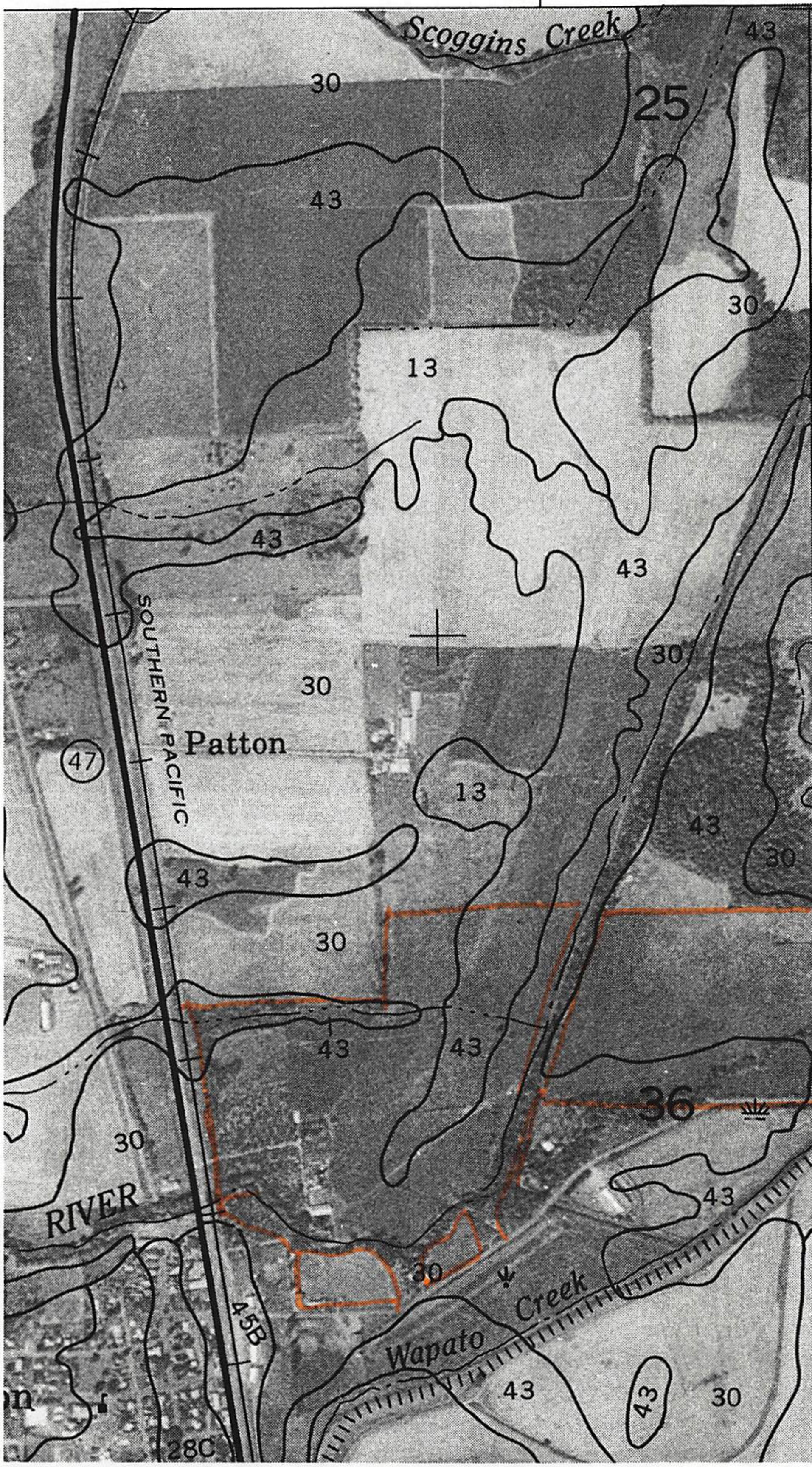
Apr 01, 2005
T1S R4W SEC36
~SW¼,NW¼

This acreage is for FSA program purposes only.
No warranty is made for any other use.

Wismer Soils

41

N



(Joins sheet 42)

Non-Technical Descriptions

Soil Survey Area: Washington County, Oregon
Survey Status: Maintenance needed
Correlation Date: 07/07/1975
Distribution Date: 04/27/2004

Map Unit: 27 Labish mucky clay
Description Category: SOI
The Labish soil is over 60 inches deep to bedrock. It is clayey, high in organic matter, poorly drained and occurs on floodplains. Permeability is slow. This soil is subject to flooding. A water table is present during winter and spring. This is a hydric soil.

Map Unit: 30 McBee silty clay loam
Description Category: SOI
The McBee soil is over 60 inches deep to bedrock. It is silty, moderately well drained and occurs on floodplains. This soil is subject to flooding. A water table is present during late fall, winter and spring.

Map Unit: 37B Quatama loam, 3 to 7 percent slopes
Description Category: SOI
The Quatama soil is over 60 inches deep to bedrock. It is loamy, moderately well drained and occurs on terraces. Water erosion is a potential hazard.

Map Unit: 43 Wapato silty clay loam
Description Category: SOI
The Wapato soil is over 60 inches deep to bedrock. It is silty, poorly drained and occurs on floodplains. This soil is subject to flooding. A water table is present during the late fall, winter and spring. This is a hydric soil.

Map Unit: 45B Woodburn silt loam, 3 to 7 percent slopes
Description Category: SOI
The Woodburn soil is over 60 inches deep to bedrock. It is silty, moderately well drained and occurs on terraces. Permeability is slow. A water table is present during winter and spring. Water erosion is a potential hazard.

USDA United States Department of Agriculture

Natural Resources Conservation Service

Soils Report

Hydrologic Group - Dominant Condition

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are placed into four groups A, B, C, and D, and three dual classes, A/D, B/D, and C/D. Definitions of the classes are as follows:

A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Dual hydrologic groups, A/D, B/D, and C/D, are given for certain wet soils that can be adequately drained. The first letter applies to the drained condition, the second to the undrained. Only soils that are rated D in their natural condition are assigned to dual classes.

Soil Survey: Washington County, Oregon
Survey Status: Maintenance needed
Correlation Date: 07/07/1975
Distribution Date: 04/27/2004

Map Symbol	Soil Name	Rating
27	Labish mucky clay	D
30	McBee silty clay loam	C
37B	Quatama loam, 3 to 7 percent slopes	C
43	Wapato silty clay loam	D
45B	Woodburn silt loam, 3 to 7 percent slopes	C

Soils Report

Manure and Food Processing Wastes - Dominant Condition

Manure is the excrement of livestock and poultry. The consistency of manure is labile. It changes in storage or treatment, and it depends upon the bedding used and upon whether the manure is diluted or allowed to dry. Food processing wastes consist of damaged fruit and vegetables and the peelings, stems, leaves, pits, and soil particles removed in food preparation. Most wastes produced in the processing of milk, cheese, and meat are liquids. Paunch manure is an exception.

Manure and food processing wastes have a variable nitrogen content. The material is either solid, slurry, or liquid. A high nitrogen content limits the application rate. Toxic or otherwise dangerous wastes, such as those mixed with lye used in food processing, are outside the meaning of manure and food processing wastes.

The limitations are considered not limiting if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome. A somewhat limiting limitation indicates soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations. A very limiting limitation indicates soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are very limiting.

Soil Survey: Washington County, Oregon
Survey Status: Maintenance needed
Correlation Date: 07/07/1975
Distribution Date: 04/27/2004

Map Symbol	Soil Name	Rating
27	Labish mucky clay	Very limited
30	McBee silty clay loam	Very limited
37B	Quatama loam, 3 to 7 percent slopes	Somewhat limited
43	Wapato silty clay loam	Very limited
45B	Woodburn silt loam, 3 to 7 percent slopes	Very limited

AD-1026A (Supplemental to AD-1026)

1. STATE:OREGON 41 2. COUNTY:WASHINGTON 067 3. CROP YEAR: 2005 4. ID NO. 20-0485015

5. PRODUCER NAME & ADDRESS TELEPHONE
WISMER'S DAIRY INC
PO BOX 69
GASTON, OR 971190069

6. COUNTY OFFICE NAME & ADDRESS TELEPHONE
WASHINGTON COUNTY FSA OFFICE (503) 648-3174
1080 SW BASELINE SUITE B-3
HILLSBORO OR 97123-3823

FARMING INTEREST (Completed by producer)

7. Circle each tract for which a "YES" answer applies to the tract for Items 8, 9, OR 10 on AD-1026. (OP = Operator, OW = Owner, OO = Owner-Operator).

FARM NO	OP/ OW/ OO	TRACT NO	CROPLAND	OWNER	PHOTO/GRID	8. HEL	9. 027	10. A027	11. Wetland
1784	OP	19375	89.1	JANET L WISMER	J73 2B T1		N	N	

12. You are recorded as a tenant or sharecropper on the farm numbers listed below. Please specify the tracts that apply to you by completing items (a) and (b).

(a) Circle "YES" or "NO" in the "FARMING INTEREST" column beside each tract number below to indicate whether you have a farming interest in the tract. The HELC and WC provisions will apply to all land in which you have a farming interest.

(b) If any "YES" answer to questions 8, 9, or 10 on AD-1026 applies to your land listed below, circle the applicable tract in the "Tract No" column.

FARM NO	TRACT NO	FARMING INTEREST	CROPLAND	OWNER	PHOTO/GRID	8. HEL	9. 027	10. A027	11. Wetland

NONE FOUND

13. MULTIPLE COUNTY INTEREST: (CONTROL COUNTY: NONE .)
OTHER COUNTIES & STATES :
NONE

Need: Soil Map
Topography

FINAL PAGE

PHOSPHORUS INDEX WORKSHEET – WESTERN OREGON

Producer: Wismer County: WA Tract No. ______ Field No(s). 1 Date: 5/20/2005

Soil Map Unit(s): 30-McBee S,C,L Soil Test P: 31 ppm Lab. Method: Weak Bray Sample Depth: 6"

Crop Rotation: Perennial Pasture Nutrient Application Method(s) ______

Planner: S. Haushalter Notes: ______

TRANSPORT FACTORS	Factor Weight	PHOSPHORUS LOSS RATING: None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Weighted Rating Value: Current	Planned
Soil Erosion – tons/ac/yr (RUSLE)	1.50	< 1 (0)	1 – 3 (1.5)	4 – 6 (3.0)	7 – 15 (6.0)	> 15 (12.0)	1.5	
Soil Erosion from Sprinkler Irrigation	0.75	No sprinkler irrigation (0)	Application rate < infiltration rate OR No visible runoff at field borders (0.75)	Application rate = infiltration rate OR Little to no visible runoff at field borders (1.5)	Application rate > infiltration rate OR Visible runoff at field borders (3.0)	Application rate > infiltration rate OR Excessive runoff visible at field borders. Rills and gullies present. (6.0)	.75	
Runoff Class	1.00	Negligible (0)	Very low or low (1.0)	Medium (2.0)	High (4.0)	Very High (8.0)	2	
Flooding Frequency Class	0.75	None or very rare (0)	Rare (0.75)	Occasional (1.5)	Frequent (3.0)	Very Frequent (6.0)	3	
Distance to Perennial Surface Waters / Buffer Widths	0.75	> 500 feet OR buffer > 30 ft. wide (or meets NRCS standards) next to surface waters (0)	300 – 500 feet OR buffer 20 - 30 ft. wide next to surface waters (0.75)	200 – 299 feet OR buffer 10 -19 ft. wide next to surface waters (1.5)	100 – 199 feet AND buffer < 10 ft. wide next to surface waters (3.0)	< 100 feet AND No buffer next to surface waters (6.0)	1.5	
Subsurface Drainage	0.50	No Tile Drains (0)	Tile drains present Soil Test P (Bray P1) < 60 ppm (0.5)	Tile drains present Soil Test P (Bray P1) 61 - 140 ppm (1.0)	Tile drains present Soil Test P (Bray P1) 141- 190 ppm (2.0)	Tile drains present Soil Test P (Bray P1) > 190 ppm (4.0)	.5	
						Transport Factors Subtotal (TFS)	9.25	

PHOSPHORUS INDEX WORKSHEET – **WESTERN** OREGON

Tract ______ Fields ________

SOURCE FACTORS	Factor Weight	PHOSPHORUS LOSS RATING: None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Weighted Rating Value: Current	Planned
Soil Test P – ppm (Bray P1)	1.00	(Soil Test P – 40) x 0.10	(31 - 40) x 0.10 = ______ (Soil Test P)			Assign 0 points if Soil Test P < 40 ppm	0	___
Commercial P Fertilizer Application Rate	1.00	lbs/ac P_2O_5 x 0.02	0 x 0.02 = 0 (lbs/ac P_2O_5)				0	___
Commercial P Fertilizer Application Method	1.00	None Applied (0)	Injected / banded deeper than 2 inches OR Incorporated within 5 days of application from March through September (1.0)	Incorporated within 5 days of application from October through February OR Surface applied March through August (2.0)	Incorporated more than 5 days after application OR Surface applied September through October (4.0)	Surface applied November through February (8.0)	0	___
Organic P Source Application Rate	1.00	lbs/ac P_2O_5 x 0.02	______ x 0.02 = ______ (lbs/ac P_2O_5)				0	___
Organic P Source Application Method	1.00	None Applied (0)	Injected deeper than 2 inches OR Incorporated within 5 days of application from March through September (1.0)	Incorporated within 5 days of application from October through February OR Surface applied March through August (2.0)	Incorporated more than 5 days after application OR Surface applied September through October (4.0)	Surface applied November through February (8.0)	2	___

Total Rating Value TFS + SFS	Site Vulnerability Class
< 13.0	**Low**
13.0 – 25.0	**Medium**
25.1 – 50.0	**High**
> 50.0	**Very High**

	Current	Planned
Transport Factors Subtotal (TFS)	9.25	
Source Factors Subtotal (SFS)	2	
Total Rating Value (TFS + SFS)	11.25	
Site Vulnerability Class	Low	

ANIMAL WASTE MANAGEMENT PLAN
MINIMUM REQUIRED ELEMENT

OPERATION AND MAINTANENCE

☐ Above and/or Below Ground Liquid Tank

The tank serves as a collection point for effluent to drain to or be scraped from the animal feeding areas. If the tank will provide storage capacity to the waste management system it shall be completely emptied at the beginning of the storage period and the contents applied to cropland as weather and crop conditions permit. A 1-foot free board will be maintained to prevent spillage. Continually maintain all pumps, agitators, piping valves and all other electrical and mechanical equipment in good operating condition by following manufacturer's recommendations. Float valves will be maintained in good working order. Perform daily inspections of waterlines including drinking water or cooling water lines. Repair leaking lines immediately to prevent excess water from entering the waste storage system. Depth markers are installed to assure maximum volume will be maintained and checked weekly. At least once every 5 years, the tank shall be emptied and inspected for structural damage and leakage. Any damage found shall be corrected before putting the tank back in service. Remove all foreign debris within the structure that may cause damage to pumps and agitator. If below ground, the tank lid will not be subjected to more than two, 8,000 pound wheel loads. Before entering a tank, for any reason whatever, proper ventilation shall be provided, and self-contained breathing apparatus shall be used, if required, when entering a covered tank. No one shall enter the tank unless safety ropes are used and someone else capable of providing assistance is outside of the tank. Warning: Entering Unventilated Tanks Is Extremely Dangerous.

☐ Animal Access Lanes or Walkways

Damaged components will be repaired or replaced as needed. Debris and excess manure will be removed from roadway surfaces, road ditch and drainage areas. Maintain drainage area capacities. Maintain good vegetative cover on all slopes and watercourses.

☐ Agitator

Preventative maintenance will be in accordance with the manufacturer's recommendations. Periodically examine the agitator for proper operation. Clean debris from the propeller and promptly replace any defective or damaged parts. Remove the agitator from the manure tank or pond and periodically clean and oil as needed to increase the life expectancy of the agitator. Immediately repair any vandalism or livestock damage. Do not allow livestock near the equipment during operation.

☐ Concrete Gutters

Floor gutters and grates will be inspected periodically. All foreign material restricting flow will be removed. Damage will be repaired as needed.

☐ Curbs

Curbs, gutters and slabs that are used to convey effluent will be inspected periodically. Broken sections will be repaired or replaced. Manure or other solids will be prevented from building up next to curbs or flowing over them. If over flow is a consistent problem the curb height should be increased.

- [ ] <u>Culverts</u>

Inspect annually or after large rainfall event. All foreign objects restricting water flow will be removed. Damaged sections will be repaired or replaced. Erosion around inlet or outlet will be corrected.

- [ ] <u>Dry Stack Storage Facility</u>

Solid manure storage facility will be inspected annually. Broken slabs and curbs will be repaired. Repair or replace rusted or damaged areas on roof structure. Broken gutters and/or downspouts will be repaired or replaced. Check for adequacy and function of drain away from downspouts. Check side and back walls for soundness. Manure solids and leachate will not escape through cracks in the facility.

- [ ] <u>Fencing</u>

Fences will be inspected periodically. Broken or decayed posts will be replaced. Sagging wire will be tightened. Broken wire will be spliced or replaced. Broken or missing insulators for electric fencing will be replaced. Vegetation will be controlled under the fences. Electric fencing will be sufficiently charged to detour animals.

- [ ] <u>Filter Strips</u>

Maintain vigorous growth of vegetative covering. This includes reseeding, fertilization and application of herbicides when necessary. Periodic mowing, harvesting or grazing may also be needed to control height. Remove all foreign debris that hinders system operation. Limit the traffic from filter strip area. Limit livestock usage to vegetative growth periods when the animals will not damage vegetative root system or compact the soil. Eradicate or otherwise remove all rodents or burrowing animals. Immediately repair any damage.

- [ ] <u>Gutters and Downspouts</u>

Gutters will be inspected annually to ensure all gutters are free of foreign materials. Broken gutters or downspouts will be replaced or repaired. Gutters will be connected to downspouts. Leaky gutters and downspouts will be repaired. Weeds and sediment will be removed from downspout outlets. All downspouts will be connected to outlets, which are kept free flowing. Outlets will be inspected for rodent guards and repaired or replaced as needed.

- [ ] <u>Irrigation Water Management</u>

Irrigation water application will be at rates that minimize transport of sediment, nutrients, and chemicals to surface water and ground water. Equipment modifications and/or soil amendments such as polyacrylamides and mulches should be considered to reduce erosion if needed.

- [ ] <u>Manure Application Equipment</u>

All manure application equipment (including but not limited to sprinklers, big gun irrigators, spreaders and/or tank wagons) will be operated and maintained according to the manufacturer's manual. Equipment found to be broken or worn will be replaced. Equipment will be calibrated to ensure recommended rates are applied. Liquids will be drained from sprinklers or big guns prior to freezing weather. When system is flushed, rinse water is used following waste, and liquid and sediment is applied agronomically. Nozzles will be checked periodically and if worn, nozzles will be replaced. Minimize exposure to animal and organic waters and manure gasses. Wear protective clothing when appropriate. When cleaning equipment after nutrient application, remove and save wastes in an appropriate manner. Avoid applying manure near surface water by establishing buffer strips and set backs, and use extreme care to avoid contaminating ground water.

❑ Manure Effluent and Irrigation Transfer Lines.

Manure, effluent and irrigation lines shall be flushed with clean water periodically to prevent particle buildup and plugging. Manure flushed from the lines will be applied agronomically so that surface and groundwater will be protected. Manure, effluent and irrigation lines shall be inspected periodically for leaks or worn out nozzles, and repairs or replacements made as needed. Special inspection shall be done to pressure relief valves, risers and control valves. Shut off valves will be inspected annually. Avoid unnecessary travel over pipelines that will damage their integrity. Equipment found to be broken or worn will be replaced. Water will be drained during cold weather to prevent frozen or broken lines. These lines can explode if not properly maintained and may cause human injury.

❑ Pumps

Pumps will be maintained in accordance with manufacturer's operation and maintenance manual. Effluent will be drained from pumps prior to freezing weather. Pumps will be inspected periodically to identify and remove debris wrapped around impeller or worn parts. Appropriate action will be taken to repair any worn parts. Liquids will be drained from pump prior to freezing weather to prevent breakage. It is recommended to have a spare pump or back up system in case a pump must be removed for an extended time for repair.

❑ Roofs

Roofs will be inspected annually. Rusted sections will be replaced or repaired if needed. Loose sections will be secured. All broken trusses, beams, poles, gutters and downspouts will be repaired or replaced.

❑ Subsurface Drainage System

Subsurface drainage will be inspected annually. Fields will be checked for breaks or suck holes. Outlets will be kept free of vegetation and sediment. Erosion at outlets will be corrected with riprap or other means. Damage or broken lines will be repaired. Outlets from fields on which animal waste is being applied will be monitored daily. Animal waste applications will cease if the tile outflow contains any indication of animal waste.

❑ Trough or Tank

Watering facility will be inspected periodically. Damaged tank/trough will be repaired or replaced. Float valves will be maintained in good working order. Area immediately surrounding the trough/tank will be maintained in a stable condition. Watering facility will be inspected periodically. Damaged tank/trough will be repaired or replaced. Float valves will be maintained in good working order. Area immediately surrounding the trough/tank will be maintained in a stable condition. Watering facilities will not be allowed to overflow if additional liquid will affect waste storage capacities.

Maintain all pumps, agitators, pipeline, valves, and electrical and mechanical equipment in good operating condition following the manufacturer's recommendations. Immediately repair any vandalism, vehicular, or livestock damage to any earth fill. Immediately remove any obstructions or blockage of spillways, trash racks or pipe inlets. Settlement or cracks in earthen sections should be investigated to determine cause and immediately repaired. Maintain vigorous growth of vegetative coverings on the dikes to eliminate soil erosion. Eradicate or otherwise remove all rodents or burrowing animals and repair any damage caused by their activity. Fences and/or warning signs should be maintained as necessary to unauthorized human or livestock entry. Operate systems in a manner that minimizes odor and drift.

☐ ____

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____

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EM 8832-E
May 2003
$2.00

Post-harvest Soil Nitrate Testing
for Manured Cropping Systems West of the Cascades

D.M. Sullivan and C.G. Cogger

Contents

OREGON STATE UNIVERSITY
EXTENSION SERVICE

What's in this publication?

This publication describes the use of post-harvest soil nitrate testing as a tool for assessment of nitrogen (N) management in manured cropping systems west of the Cascade Mountains in Oregon, Washington, and south coastal British Columbia.

The first section of this publication gives general information on the test and is designed for use by growers and dairy operators. This section gives a brief introduction to soil sampling, but does not provide all of the technical details. The focus is on how to use the post-harvest test to improve nutrient management. This section describes:

- ◆ What the post-harvest test measures
- ◆ How to collect soil samples
- ◆ Units used in soil nitrate testing
- ◆ How to interpret soil nitrate test results for grass and silage corn crops

In addition, background information explains the rationale for the test:

- ◆ How to use the post-harvest test as a management tool (page 3)
- ◆ Crop and soil response to excess plant-available N (page 4)

Dan M. Sullivan, Extension soil scientist, Oregon State University, and Craig G. Cogger, Extension soil scientist, Washington State University.

The second section of this publication is designed primarily for use by conservation planners and other agricultural professionals working with farmers to implement nutrient management plans. This section is also designed for dairy operators who do their own soil sampling. This section includes detailed suggestions for the following:

- Collecting, preserving, and analyzing the soil sample
- Developing a long-term soil sampling plan

The post-harvest test and how to use it

What the post-harvest test measures

The post-harvest soil nitrate test measures the quantity of plant-available nitrogen present in the nitrate form in the surface foot of soil in the late summer or early fall. The test measures nitrate-N not utilized by the recently harvested crop. Because crops differ in their ability to remove nitrate-N from the soil, test interpretation is crop-specific.

The test looks backward in time. It evaluates the balance between N supply and crop uptake for the crops produced during the summer. Nitrate-N accumulates in the soil when more plant-available N is supplied than can be utilized by the summer crop (see "Crop and soil response to excess plant-available N," page 4).

Use the post-harvest test to:

- Get a general idea of balance between N supply from manure and other sources and crop N demand
- Identify imbalances in N supply among fields on a farm
- Identify fields that may respond to changes in timing or amount of manure application or other agronomic practices

Soil sampling protocols

Sampling depth

Sample the 0- to 12-inch depth for the post-harvest test. This shallow sampling depth is a good predictor of nitrate in the rest of the soil profile when (1) in-season irrigation is not excessive, and (2) samples are taken prior to heavy rains in the fall.

Composite soil sample

Collect a composite soil sample consisting of a mixture of 15 to 30 soil cores from each field or management unit. See "Collecting, preserving, and analyzing the soil sample" (page 9) for detailed sampling instructions and suggestions for special situations.

What fields to sample

In general, it is not necessary to sample every field on a farm every year. Consult with your farm advisor to determine any regulatory requirements for sampling frequency. We recommend that you sample selected fields that represent typical manure and crop management practices each year to track long-term trends in post-harvest soil nitrate values. See "Developing a sampling plan" (page 11) for more information.

When to sample

In general, samples for the post-harvest test should be collected as soon as possible after a crop harvest. Avoid sampling a field that has had manure application within the past 30 days.

Samples must be taken before heavy fall rains move nitrate below the 12-inch depth. Because the timing of fall rainfall is unpredictable, the best strategy is to sample fields before October 1 whenever possible.

Collect samples from medium- to fine-textured soils (loams, clay loams, and clays) prior to 5 inches of cumulative fall rainfall. Sandy soils (sand, loamy sand, or sandy loam soil texture) have lower water-holding capacities and should be sampled prior to

continues on page 5

How to use the post-harvest test as a management tool

Sampling depth and timing are critical. Interpretation tables for this test apply only to samples taken to a 12-inch depth. Surface soil (0 to 12 inches) typically contains the highest nitrate-N levels and requires the least time and effort for sample collection. Samples must be taken before heavy fall rains move nitrate below the 12-inch depth. The target sampling period generally is August 15 to October 15.

To get the most value from this test, it is important to understand:

- ◆ How the test fits into an overall nutrient management program
- ◆ Limitations to interpretation of test results
- ◆ How *not* to use the test

Using the test as part of a nutrient management program

The post-harvest test is but one measure of success in nutrient management. Post-harvest nitrate test data should be assessed in the context of the current N management plan and records of manure application. Successful N management involves a number of components, including:

- ◆ Assessing crop N needs
- ◆ Planning manure application to meet crop N needs
- ◆ Applying manure according to the plan
- ◆ Recording manure application amount and estimated plant-available N amount
- ◆ Measuring crop yield and N content
- ◆ Monitoring success of the plan

All components of the nutrient management system should be evaluated together.

Limitations to test results

Interpretive values for post-harvest soil nitrate are:

- ◆ Calibrated only for high-rainfall portions of the Pacific Northwest (west of the Cascades). Extrapolation to other environments is not recommended.
- ◆ Provided only for corn silage and grass hay/silage crops. Field research has been used as the basis for interpretive levels for these crops. Applicable research data are not available for other crops to determine post-harvest nitrate-N levels associated with good crop and nutrient management practices. However, the test may be used for relative comparisons among fields planted to another crop (e.g., comparisons among grass pasture fields).
- ◆ Based on the assumption that summer irrigation is less than, or close to, evapotranspiration to ensure that significant nitrate leaching does not occur before the fall test.
- ◆ Designed for fields with a history of applied manure (more than 3 consecutive years of regular manure application). Lower post-harvest soil nitrate test values are attainable where only fertilizer N is used, or where manure is applied infrequently.
- ◆ Based on good management of the crop and normal yields. Crop moisture stress, insect damage, or plant disease will reduce crop yield and crop uptake of nitrogen, thus increasing post-harvest soil nitrate test levels.

How *not* to use the post-harvest test

The test will *not*:

- ◆ Detect a shortage of plant-available nitrogen for crop production. Continual mineralization of nitrogen (conversion of organic N forms to plant-available N forms in the soil) can provide enough plant-available nitrogen for a crop without accumulation of nitrate-N in soil.
- ◆ Determine the source(s) of excess plant-available N. Sources of N may include manure slurry, lagoon water, fertilizer, soil organic matter, or previous crop residues.
- ◆ Predict crop response to fall manure or N fertilizer applications. The test does not predict the amount of plant-available N that will be mineralized from soil organic matter or crop residues in the fall.

Crop and soil response to excess plant-available N

Crop response to applied N. Crop N uptake is controlled by the environment, crop N uptake potential, and management. Crops respond to plant-available nitrogen supply (ammonium + nitrate-N) by the law of diminishing returns (Figure 1). Without added N, some crop yield is produced from N supplied by soil organic matter, residual plant-available N, and other non-fertilizer sources (e.g., mineralization of crop residues). Additional N supplied from manure or fertilizer increases crop yield until site yield potential is reached.

The application rate of manure or N fertilizer needed to reach near-maximum yield is termed the *agronomic rate*. Rather than a single agronomic rate, the crop response to N is best described as an agronomic rate range (Figure 1). The agronomic rate range concept allows for variability in crop performance among years and for crop uptake of N beyond the yield maximum (increased protein).

Post-harvest soil nitrate test measures nitrate-N not used by the crop. At excessive plant-available N supply levels, crop yield and crop N uptake do not respond to further N additions. The extra soil N not used by the crop accumulates as nitrate-N.

Elevated post-harvest soil nitrate-N concentrations are an indicator of one or more of the following: (1) excess plant-available N, (2) N supplied too late in the season for crop utilization, or (3) poor crop growing conditions due to insect infestation, moisture/heat stress, plant disease, or other cultural problems. If crop yields are acceptable and crop protein is at typical levels, then the most likely explanation is that plant-available N was supplied in excess of crop needs.

Because grass is more efficient than corn at N uptake, target post-harvest soil nitrate levels given in this publication are lower for grass than for corn. There are two key reasons that grass is more efficient than corn in N removal.

- Grass has a greater capacity to take up N supplied in excess of that needed for maximum yield. After enough N has been supplied for maximum yield, grass protein content increases in response to increased N supply. With grass, soil nitrate increases only when the available N supply exceeds that required to produce near-maximum protein. Corn does not take up additional N after the maximum yield is reached. Corn silage protein does not increase much in response to excess N supply.
- Grass utilizes N mineralized late in the growing season more efficiently. Grass managed for silage or hay continues to take up N until harvest. Corn grown for silage completes its N uptake approximately 4 weeks before harvest. Some of the soil nitrate measured after corn harvest is produced by mineralization of soil organic N to available forms during the final weeks of the growing season.

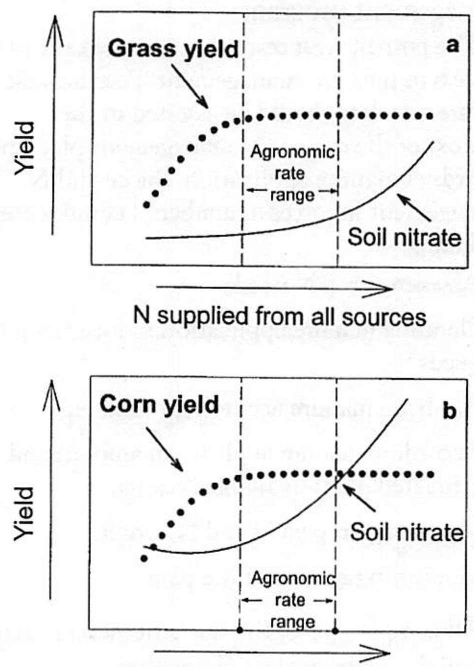

Figure 1.—Crop yield and soil nitrate response to increased N supply. Agronomic rate range = range of N supplied from all sources that results in near-maximum crop yield with acceptable post-harvest nitrate accumulation. Above the agronomic rate range, excess N accumulates as nitrate in soil. More nitrate accumulates in the agronomic rate range with corn (b) than with grass (a).

Table 1.—Average calendar date when cumulative rainfall (after September 1) reaches 5 inches west of the Cascades.[a]

Cumulative rainfall after Sept. 1	Calendar date to reach specified cumulative rainfall							
	Medford (OR)	Salem (OR)	Tillamook (OR)	Coupeville (WA)	Centralia (WA)	Lynden (WA) Abbotsford (BC)	Agassiz (BC)	Comox (BC)
(inches)								
3	10 Nov	20 Oct	26 Sep	31 Oct	8 Oct	1 Oct	26 Sep	10 Oct
5	29 Nov	1 Nov	8 Oct	24 Nov	23 Oct	15 Oct	9 Oct	25 Oct
7	16 Dec	13 Nov	18 Oct	15 Dec	4 Nov	27 Oct	19 Oct	6 Nov

[a]Average daily precipitation data for many other locations is available at: Western Regional Climate Center (http://wrcc.dri.edu) or Environment Canada (http://www.msc-smc.ec.gc.ca/climate/climate_normals/index_e.cfm).

3 inches of cumulative fall rainfall. The starting date for calculating cumulative fall rainfall is September 1. Include inches of irrigation water applied after September 1 in your estimate of cumulative rainfall.

Table 1 shows the average calendar date when cumulative fall rainfall (after September 1) reaches 5 inches at a variety of locations. For most locations, sampling prior to October 15 is acceptable in an average year. In high rainfall areas (coastal areas and the Cascade foothills), plan to sample earlier. A late October sampling date usually is acceptable in lower rainfall areas of southern Oregon, the Puget Sound islands, Olympic Peninsula, or Vancouver Island.

Units used in soil nitrate testing

In this publication, interpretation of a post-harvest soil nitrate test (Tables 3 and 4) is based on units of parts per million (ppm). Some labs report soil test nitrate-N in units of lb/acre by assuming a standard value for soil bulk density. If the lab reports nitrate-N results in pounds per acre, ask them to provide a conversion factor to express data in units of ppm. The conversion factor assumed by laboratories usually is between 3 and 4, because 1 acre-foot of dry soil usually weighs about 3.5 million pounds (3.5 lb per acre-foot = 1 ppm).

Table 2.—Units used to report soil nitrate analyses.

Name	Interpretation	Equivalent units
nitrate-N or NO_3-N	N present in the nitrate form, soil dry weight basis	mg/kg or ppm (dry weight basis)

Interpreting soil nitrate test results

Data quality and variability

The first step in evaluating your soil nitrate data is to verify data quality. Determine whether the sample collection method, timing of sample collection, sample preservation, and laboratory analysis methods are acceptable. Reject data that did not result from reasonable protocols. For example, Tables 3 and 4 should not be used for soil samples collected in November after heavy fall rains.

Make sure that you understand the units used to report test results. See Table 2 for an explanation of units found in soil test reports.

Response of post-harvest soil test N to changes in management

Success in N management is indicated by long-term trends in post-harvest soil nitrate (at least 3 to 5 years). **Because of the large pool of readily mineralizable N in manured soils, fall soil nitrate values may not decline for 3 to 5 years in response to improved management.** For multiyear comparisons, sampling methods and timing must be consistent.

Some portions of a crop rotation will have higher fall nitrate values because of rapid N mineralization stimulated by tillage or incorporation of crop residues. For example, soil nitrate concentrations typically are high, regardless of overall N management, after a perennial grass sod is plowed down and reseeded.

Reductions in fall soil N are most likely to be measured when (1) commercial N fertilizer amounts are reduced or eliminated, (2) cropping systems that maximize N removal in late summer and fall (August to October) are used, and (3) manure or N application is eliminated after August 1. It is more difficult to attain post-harvest soil nitrate-N values of less than 20 ppm for corn than for grass (see "Crop and soil response to excess plant-available N," page 4).

Interpretation for individual fields

Interpretations of soil test nitrate-N should be made first at the field level. You may be able to discover a probable cause for differences in test values among fields. Questions to ask include:

- Are relationships present between known management factors (e.g., manure application rate or timing, crop yield and quality, irrigation frequency, distance to the barn) and soil test values?
- Is a large amount of variation present between fields? Is there a logical explanation for unusual values?
- Are values for grass and corn fields similar?

Annual averages across grass and corn crops

After looking at test values for individual fields, it may be useful to look at averages across all grass or corn fields. You may want to calculate averages only for fields under similar management.

Average nitrate-N test values are most useful for consideration of changes in whole farm nutrient management. Tables 3 and 4 present interpretive information separately for grass and corn fields.

If a few fields have unusual test values, you may be justified in excluding those fields from an average. Although you may want to exclude unusually high test values from the farm average, you definitely should evaluate those fields further to determine the probable cause of the high soil test values. The unusually high test values may reflect the need for management changes or may reflect a soil sampling or analytical error.

Using the interpretive tables (Tables 3 and 4)

Interpretations and management suggestions given in Tables 3 and 4 (pages 7–8) are general in nature and should serve as only one portion of a nutrient management plan evaluation. Some of the management suggestions can be implemented for individual fields, while others need to be implemented on a whole farm basis.

Remember not to focus solely on post-harvest nitrate-N in evaluating N management. Include other important aspects of N management in your evaluation, such as success in following a plan for manure application, calibration of manure application equipment, maintaining good manure application records, and effective irrigation management.

Table 3.—Silage corn. Suggested interpretation for post-harvest soil nitrate-N (0- to 12-inch depth).[a]

If post-harvest nitrate-N is less than 20 ppm (less than approximately 70 lb N per acre)

- ◆ Continue present N management.

If post-harvest nitrate-N is 20 to 45 ppm (approximately 70 to 160 lb N per acre)

- ◆ Reduce or eliminate sidedress N fertilizer application. Use the pre-sidedress nitrate test (PSNT). Apply sidedress N only when PSNT indicates a need.
- ◆ Reduce lagoon water application after August 1.
- ◆ Keep records to document crop yield, dry matter, and crop N removal. Total applied manure-N + fertilizer-N should be less than 125 percent of documented crop N removal.
- ◆ Reduce manure application on fields where corn follows grass sod plow-down.
- ◆ Plan to reduce manure-N application by 10 to 25 percent.
- ◆ Improve whole farm N balance.

If post-harvest nitrate-N is greater than 45 ppm (greater than approximately 160 lb N per acre)

- ◆ Apply only starter N (20 to 40 lb N/acre at planting).
- ◆ Plan not to sidedress N fertilizer in June. Apply sidedress N only when PSNT indicates a need.
- ◆ Eliminate lagoon water application after August 1.
- ◆ Keep records to document crop yield, dry matter, and crop N removal. Apply manure N at a rate less than or equal to crop N removal (approximately 200 lb total N per acre).
- ◆ Eliminate manure application on a few fields or a few strips within a field next year to determine the contribution of mineralized N vs. current-season application of manure.
- ◆ Plan to reduce manure-N application by 25 to 40 percent.
- ◆ Consult experts to improve whole farm nutrient balance.

[a]The post-harvest test values listed above are for the *end* of a growing season. Management changes (if needed) should be implemented in future years. Interpretive values assume near-optimum crop yields. If yield is below average, improve agronomic practices to increase crop yield and crop N uptake.

Table 4.—Grass for hay or silage. Suggested interpretation for post-harvest soil nitrate-N (0- to 12-inch depth).[a]

If post-harvest nitrate-N is less than 15 ppm (less than approximately 55 lb N per acre)

◆ Continue present N management.

If post-harvest nitrate-N is 15 to 30 ppm (approximately 55 to 105 lb N/acre)

◆ Apply manure earlier in the growing season.

◆ Keep records to document crop yield, dry matter, and crop N removal. Total applied manure-N + fertilizer-N should be less than 125 percent of documented crop N removal.

◆ Check protein levels in forage. Grass crude protein greater than 21 percent is associated with increased potential for nitrate toxicity to cows.

◆ Plan to reduce manure-N application by 10 to 25 percent.

◆ Improve whole farm nutrient balance.

If post-harvest nitrate-N is greater than 30 ppm N (greater than approximately 105 lb N/acre)

◆ Apply manure earlier in the growing season. Reduce manure application after August 1.

◆ Keep records to document crop yield, dry matter, and crop N removal. Total manure-N + fertilizer-N should be less than or equal to crop N removal. Even if calculated crop removal exceeds 400 lb N per acre, apply manure-N + fertilizer-N not to exceed 400 lb N per acre per year.

◆ Consider reseeding or interseeding if grass yield is limited by poor stand or undesirable species.

◆ Check protein levels in forage. Grass crude protein greater than 21 percent is associated with increased potential for nitrate toxicity to cows.

◆ Plan to reduce manure-N application by 25 to 40 percent.

◆ Consult experts to improve whole farm nutrient balance and reduce danger of nitrate toxicity to cows.

[a] The post-harvest test values listed above are for the *end* of a growing season. Management changes (if needed) should be implemented in future years. Interpretive values assume near-optimum crop yields. If yield is below average, improve agronomic practices to increase crop yield and crop N uptake.

Detailed suggestions for soil sampling and planning

Collecting, preserving, and analyzing the soil sample

Tools for field sampling

Collect a sample that is representative of the entire sampling depth. For example, a representative sample for a 0- to 12-inch depth has the same amount of soil from the soil surface (0 to 6 inches) and from the bottom of the sampling depth (6 to 12 inches).

Always use a tool specifically designed for soil sampling. Don't use a shovel, because the samples won't be uniform with depth. Tools for soil sampling often are called soil probes or augers. There are several kinds available.

Push probes are tubes that you push into the soil. They have a T-shaped handle attached to a cylindrical tube (about 1 inch diameter) with a beveled tip. The tube collects a cylinder, or "core," of soil. Push probes work well in soft, uncompacted soils.

Hammer probes are designed for hard or compacted soils. They have a sliding weight (hammer) instead of a T-handle to drive the probe into soil.

Soil test consultants often use hydraulic probes mounted on a tractor or pickup to sample soils. These reduce the time and effort of sampling in hard soils. Gravelly and rocky soils are difficult to sample. A hydraulic probe with a rotating auger can sample some gravelly soils.

A mud auger or bucket auger is the best tool for hand-sampling at sites that are difficult to sample with push probes. Use an auger for compacted, muddy, rocky, or dry soils. Augers can be purchased from several manufacturers. A 2- to 4-inch diameter mud auger (open-sided) works best for most situations because it is easy to remove the sample from the bucket. Use a larger diameter auger for soils with large rocks. Augers sample a 4- to 6-inch depth. You will need to take several bites from the same hole to sample to 12-inch depth. You will collect a larger sample volume, about 5 to 10 times that collected with a push tube. Because of the extra effort required for auger sampling, use this method only if other sampling methods are difficult or impossible.

Field sampling protocol

Plan ahead. Use field maps and soil maps to divide the farm into different management units. A management unit is usually a field, but you may want to subdivide a large field if sections can be managed separately for nutrient application. The simplest approach is to collect a composite sample from the entire management unit. You may choose to restrict sampling to the dominant soil type if the management unit has soils that differ markedly in visual appearance (soil color, texture, organic matter).

Alternatively, you can restrict your sampling to a representative area (usually about an acre in size) within the management unit. Choosing a representative area within the field where manure application rate, timing, and uniformity are well documented is essential. If you use the "representative area" sampling approach, record the sampling location using a GPS receiver or record the distance from a fixed location (e.g., fenceline).

Avoid large buffer zones that are sometimes present adjacent to water bodies or roads, especially with big gun manure applicators. Avoid small atypical areas such as:

- ◆ Swales
- ◆ Very rocky or shallow soil (less than 12 inches deep)
- ◆ Site of an old manure pile or a feeding, watering, or resting area for livestock
- ◆ Abandoned field roads
- ◆ Field edges

Collect 15 to 30 soil cores from each management unit or representative sampling area with a push probe or similar tool. If you use an auger, 10 holes per management unit or zone is sufficient.

Choose sampling locations in a zigzag pattern across the field. Your general route of travel should be across rows, rather than down one row in the field. Make sure you sample within the part of the field where manure is routinely applied. For grazed pastures, choose sampling locations that have average crop growth and productive forage species.

Scrape away loose crop residues or manure present on the soil surface. Sample only the soil. Including the accumulated organic debris from the soil surface in the soil sample will increase variability in test results.

Once you are satisfied with a sampling strategy, repeat the same procedure each year. This will increase the validity of year-to-year comparisons of results.

Obtaining a representative sample from fields where manure has been injected into soil or placed in bands on the soil surface is difficult. The depth of manure injection, the width of injection zone, and the spacing between bands depend on equipment, soil, and the applicator. Some injection equipment can place manure below the 12-inch sampling depth used for the post-harvest nitrate test. Manure may be injected or banded more than one time per year, with several orientations in a field (e.g., north–south or east–west). Because of the added variability associated with manure injection or banding, plan to collect a larger number of soil cores to obtain a representative composite sample.

Sample handling

Mixing. If it is not too hard to break up the soil cores, break them, mix them all together, and homogenize thoroughly. Take a 1-cup subsample for shipment to the lab. If the soil cores are too hard to break apart, send the entire sample to the lab, where they can pass the sample through a mechanical grinder. Check with the lab to make sure they will grind and mix the *entire* sample before subsampling.

Preservation. Soils kept moist and warm continue to accumulate nitrate via biological activity after sampling. The simplest way to limit biological activity is to cool the soil after collection. Put the samples in plastic bags and place them in a cooler on ice while still in the field. Refrigerate them when you return from the field. Freeze the samples if they will be held longer than 48 hours before analysis.

Shipment. Keep the samples refrigerated or frozen until you deliver them to the lab. Contact the lab before you sample, so they will be prepared to receive the samples. Use a shipping method that will get the samples to the lab within 48 hours. You may want to freeze the samples before shipping to make sure they remain cool in transit.

Working with an analytical laboratory

Choose a laboratory that has experience with agricultural samples. Ask if they participate in the North American Proficiency Testing Program or a similar quality assurance program for agricultural testing labs. Find out what extraction and analytical procedures they use. Procedures should be consistent with those recommended for the western states (Gavlak et al., 1994).

Labs may use one of several colorimetric (color-based) lab procedures or they may use an electrode method to measure nitrate. Sample comparisons have shown that the colorimetric procedures usually are more precise than the electrode method.

Some testing labs also have sampling and consulting services. This can be convenient for people who have little experience in sampling or need help with sampling.

Find out how the lab reports soil test data. Standard units for soil nitrate-N are parts per million (ppm, Table 2). If you aren't familiar with the lab, it's a good idea to obtain a copy of a sample laboratory report.

Because you will use sample results to compare post-harvest soil nitrate across years, laboratory consistency over time is a major issue. A standard reference sample (soil sample with known concentration of nitrate) can help you assess laboratory variability. Consider submitting a standard reference sample (approximately 50 to 100 g dry weight) with a nitrate-N concentration of 20 to 45 ppm with each batch of soil samples. Keep track of test results for the standard reference sample over time. If you note a major error in the nitrate concentration reported for the standard reference sample, then the test data is questionable.

Standard reference samples are available from the North American Proficiency Testing Program (see "For more information," page 15). Standard reference samples must be dried, ground, and thoroughly mixed.

We do not recommend that you split a field sample to check laboratory consistency. The one-time nature of such comparisons, the uncertainty of obtaining a homogeneous sample, and the uncertainty of sample preservation in-transit to the lab limit the interpretation of split-sample data.

Developing a sampling plan

Nutrient management plans can be voluntary, required by regulatory agencies, or a part of an agreement with a conservation planning agency (e.g., Natural Resources Conservation Service or conservation district). If your nutrient management plan is not voluntary, consult the agency that supervises your nutrient management plan to determine whether they have specific requirements for how often fields must/should be sampled. Suggestions given here for sampling frequency are general in nature and are not intended to serve as policy for any agency.

Representative fields for long-term monitoring

Representative fields are fields that you sample every year to track trends in sample values over time. Select fields that represent typical management practices. Criteria that can be used to choose representative fields include: (1) records or estimates of annual manure application rate, (2) number of years of continuous manure application, (3) soil test values for P and K. On dairies where P and K fertilizers are not routinely applied, soil test values above 75 ppm P (Bray P1 method) and 400 ppm K (ammonium acetate method) usually reflect substantial manure application in the past.

Sample the representative fields every year to assess trends over time. If you grow corn silage and perennial grass forage, plan to sample at least four grass fields and four corn fields each year. At a small dairy (fewer than four fields), sample all fields each year.

Other fields

Periodically, you will need to evaluate the fields not designated as "representative" fields. Consider sampling all fields every 3 years. Compare whole farm soil data to representative field data.

If you have only a few fields with elevated soil test N, then focus management on those fields. If all fields on the farm give similar test data, then focus your N management efforts at the whole farm level. If representative fields consistently have test values of less than 15 ppm (grass) or less than 20 ppm (corn) over a 3-year period, and all other fields sampled have similar test values, consider reducing the number of post-harvest soil nitrate tests.

Sampling priority

Prioritize fields for fall sampling ahead of time so that you get high-priority fields sampled at an appropriate time. Highest priority should be given to representative fields used to track long-term trends. Fields with high manure application rates or elevated soil test N the previous year should also have a high priority.

Corn fields can be sampled for soil nitrate in June (PSNT, pre-sidedress nitrate test) or in the fall (post-harvest test described in this publication). You will get the most management information by sampling your high-priority representative corn fields both in June (PSNT) and after harvest. You also may want to sample fields with PSNT values greater than 45 ppm nitrate-N again in the fall.

For other corn fields where only one soil test per year is planned, we recommend using the PSNT in preference to the post-harvest soil nitrate test. The PSNT is preferred because test results are applicable to in-season N management. Growers can save money and reduce post-harvest nitrate by omitting sidedress N fertilizer application on fields where sufficient soil nitrate-N is present in June.

Sampling corn fields at PSNT time also will reduce the number of post-harvest samples that need to be collected during the short interval between harvest and the end of the fall sampling window (approximately October 15). If you miss a planned fall sampling on a corn field, consider sampling next year using the PSNT.

Grass fields are best sampled in the fall, using the protocols described in this publication. Think carefully about the best way to achieve consistent timing of sample collection for your fields. The timing of manure application and the timing of grass harvest are key variables to consider.

Samples collected shortly after manure application are not a good indicator of the balance between N supply and crop N demand over the entire growing season. If manure is applied late in the year, postpone soil sampling until after a fall grass harvest. Wait at least 30 days after a late-season manure application before sampling. Sampling need *not* be postponed until after the last manure application or until after the last grass harvest in the fall.

Questions and answers

Why is it difficult to achieve post-harvest nitrate-N less than 15 to 20 ppm with organic sources such as manure?

First, the timing and rate of application for organic sources is less flexible than for fertilizer N. Second, environmental processes that control the quantity and timing of N availability from organic sources are difficult to manage. The biggest factors controlling N availability are soil temperature and moisture. The timing of crop N uptake usually does not match the timing of N supplied from manure and other organic sources. Soil temperature and moisture often support continued release of available N after crop N uptake is complete.

Is there a relationship between soil organic matter content and potential N mineralization?

Research west of the Cascades has demonstrated a lack of correlation between soil organic matter content and N mineralization potential for soils having 3 to 8 percent organic matter. The active fraction of soil organic matter that controls annual N mineralization rates is a small proportion of total organic matter (usually less than 10 percent of total). Recent site management affects soil N mineralization potential; it does not have much effect on soil organic matter content. Because most soil total N is contained in soil organic matter, soil total N is also an unreliable indicator of mineralization potential.

What other soil tests can be used to provide information to guide N management for corn?

Soil nitrate testing in spring and early summer can assist with N management for silage corn. Test soil ammonium + nitrate-N several weeks after a spring manure application to track early-season N availability. Test soil nitrate when corn is at the four- to six-leaf stage (pre-sidedress nitrate test, PSNT) to determine the need for sidedress N application to corn.

How much variability should I expect in post-harvest nitrate-N test values for the same grass field sampled between August 15 and October 15?

It all depends on weather, soil biology, and crop management. A good stand of actively growing grass can maintain nitrate-N concentrations of less than 15 ppm throughout the post-harvest sampling period. Where soil is dry in late summer, increased N availability may occur for 2 or 3 weeks following the first heavy rain. It may be useful to take several soil nitrate tests from the same field in the fall to document changes in nitrate concentration with time. Soil nitrate values given in the interpretive table in this publication are for typical precipitation and sampling date.

Ammonium-N is plant-available. Why doesn't the post-harvest test include ammonium-N analysis?

Post-harvest ammonium-N analyses cost money, and they do not yield reliable interpretive information. Ammonium-N does not accumulate in soils supplied with an excess of plant-available N. It is rapidly converted to nitrate. Soil samples taken at least 30 days after manure application usually have negligible ammonium-N concentrations unless soil has remained dry.

Drying of soils after sampling releases ammonium-N from microbial biomass. Most dried soils have 2 to 20 ppm ammonium-N that is caused by the soil drying process. Dry soil ammonium-N concentrations are poorly correlated with other indices of N availability in controlled experiments.

Should post-harvest nitrate tests be used for fields with organic soils?

Other methods should be used to assess the success of nutrient management plans on organic soils. Goals for post-harvest nitrate-N of less than 20 ppm are difficult if not impossible to attain on organic soils, which contain more than 20 percent organic matter. These soils formed as organic matter accumulated under natural poorly drained conditions. Soil organic matter decomposition and N mineralization processes are greatly accelerated under typical farming practices such as artificial drainage and tillage.

Should I measure or estimate soil bulk density to estimate post-harvest nitrate-N in units of pounds per acre?

The variation in bulk densities among soils typically is less than the variation associated with soil nitrate sampling and testing. Interpretive information in this publication is based on units of parts per million (ppm; mg per kg dry soil). You can approximate soil nitrate-N in the surface foot of soil by assuming typical bulk density (ppm x 3.5 = lb/acre). This conversion factor is based on the weight of 1 acre-foot of soil at a bulk density of 1.3 g cm^3 (1 acre-foot = 3.5 million lb). Organic soils (more than 20 percent organic matter) have lower bulk density (0.6 to 0.8 g cm^3).

What is whole farm nutrient management?

The goals of whole farm management are: (1) to move toward a balance of nutrient imports and exports, and (2) to utilize nutrients on the farm at agronomic rates that minimize nutrient losses to the environment. Managing nutrients at the whole farm level requires knowledge of the major nutrient imports, major nutrient exports, crop utilization of nutrients on the farm, and nutrient losses to air and water.

The Livestock and Poultry Environmental Stewardship (LPES) Curriculum, available through the Midwest Plan Service, includes a Web presentation of whole farm nutrient management principles and a worksheet for evaluating whole farm nutrient balance. See "For more information" (page 15) for details.

What is the role of post-harvest nitrate testing in connection with Comprehensive Nutrient Management Plans (CNMPs)?

CNMPs, developed by the Natural Resources Conservation Service (NRCS) or other nutrient management professionals under NRCS supervision, are broader than just nutrient management. Other components of a CNMP are: (1) manure and wastewater handling and storage, (2) land treatment practices, (3) record-keeping, (4) feed management, and (5) other waste utilization options.

Post-harvest nitrate test values may be used as part of a process to develop a new CNMP or to update an existing CNMP. The CNMP typically includes a plan for regular soil testing. Appropriate timing of the post-harvest nitrate test is critical (see "When to sample," page 2), while soil samples for P and K analysis may be collected any time of the year. Soil samples collected for the post-harvest nitrate test can be analyzed by routine agronomic soil testing procedures and used in developing plans for P and K utilization in a CNMP.

What are the implications of high nitrate concentrations in forages?

Nitrate in ensiled forages can interfere with normal fermentation processes, resulting in poor-quality forage. Forage nitrate affects the distribution of nitrogen compounds in silage. It is difficult to use the silage to formulate rations that meet cow needs for specific protein fractions. Enough nitrate is sometimes present in the silage itself to create a health risk to the animal. Grass silage that is greater than 21 percent crude protein should be tested for the level of nitrate-N. See Johnson et al. (2002) for interpretation of forage nitrate concentrations.

For more information

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Marx, E.S., J. Hart, and R.G. Stevens. 1996. Soil Test Interpretation Guide, EC 1478.

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Sullivan, D.M., C.G. Cogger, and A.I. Bary. 1997. Which Test Is Best? Customizing Dairy Manure Nutrient Testing, PNW 505.

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Many OSU Extension Service publications, as well as additional gardening information, may be viewed or downloaded from the Web (http://eesc.oregonstate.edu).

Copies of many of our publications and videos also are available from OSU Extension and Experiment Station Communications. For prices and ordering information, visit our online catalog (http://eesc.oregonstate.edu) or contact us by fax (541-737-0817), e-mail (puborders@oregonstate.edu), or phone (541-737-2513).

WSU Cooperative Extension publications

Bary, A.I., C.G. Cogger, and D.M. Sullivan. 2000. Fertilizing with Manure, PNW 533.

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Visit the WSU Cooperative Extension publications Web site at http://pubs.wsu.edu

Other resources

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The authors acknowledge the involvement of the following individuals in development of portions of the publication:

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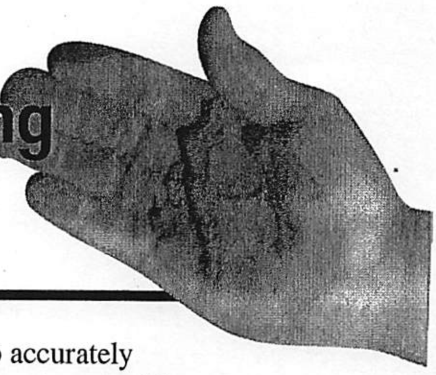
Simple irrigation scheduling



Using the "look and feel" method

F. Niederholzer and L. Long

Why schedule irrigation?

Accurate irrigation scheduling maximizes the benefits of irrigation while minimizing potential negative impacts of over-irrigation or under-irrigation.

Over-irrigation **(too much water):**

- Drowns roots, thus stressing plants
- Encourages root diseases
- Reduces nutrient uptake
- Cools soil, thus reducing root growth
- Leaches nutrients and pesticides from the root zone to groundwater
- Reduces crop quality
- Wastes money

Under-irrigation **(too little water):**

- Reduces crop yield
- Reduces crop quality (fruit and vegetable size)
- Reduces plant growth
- Weakens plants

Many people schedule irrigation by the calendar rather than by plant need. Calendar-based scheduling can be very inaccurate since plant water needs and the amount of soil water available to plants are affected by factors such as climate, plant size, soil type, and rooting depth.

The goal of accurate irrigation scheduling is to replace soil water lost by evaporation and plant use as precisely as possible. To accomplish this goal, you need to accurately assess soil moisture content. Then you can determine the need for irrigation and how much water to deliver.

Irrigation scheduling can seem complicated. It doesn't have to be. Anyone can use a simple, effective method known as the "look and feel" (or "soil appearance and feel") method to determine when to irrigate.

How does it work?

This method is based on three simple ideas:

- Soil is at "field capacity" when it is holding as much water as possible after the excess has drained away. (A wet sponge is at "field capacity" when it holds all the water it can without any dripping away.)
- It's best to irrigate when half of this water is depleted.
- Your goal when irrigating is to return the soil to field capacity.

So, all you need to know to schedule irrigation is:

- How much water will the soil hold within the plants' rooting zone when it's at field capacity?
- What does the soil look like when half of that water is gone?
- How much water should be applied to return the soil to field capacity?

Franz Niederholzer, Extension horticulture agent, Hood River County; and Lynn Long, Extension horticulture agent, Wasco County; Oregon State University. *Photos are from* Estimating Soil Moisture by Feel and Appearance, *and are reproduced courtesy of USDA/NRCS. Special thanks to Mr. Diego León for his excellent work with English/Spanish translation.*

OREGON STATE UNIVERSITY
EXTENSION SERVICE

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ACCOUNT NO.	12754	COPY TO	

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WISMER DAIRY

PACIFIC HARVEST SUPPLY CO
JEFF DUYCK
PO BOX 309
CORNELIUS OR
97113-

SOIL ANALYSIS REPORT

LAB NUMBER	SAMPLE IDENTIFICATION	ORGANIC MATTER WALKLEY BLACK		PHOSPHORUS P_1 WEAK BRAY		PHOSPHORUS P_2 STRONG BRAY		PHOSPHORUS BICARBONATE P OLSEN		POTASSIUM K (NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE))		MAGNESIUM Mg		CALCIUM Ca		SODIUM Na		pH SOIL pH 1:1	pH BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
		PERCENT	RATE	ppm	RATE	ppm	RATE	ppm	RATE	ppm	RATE	ppm	RATE	ppm	RATE	ppm	RATE								
5569426	1	4.8	VH	31	VH	34	M			1040	VH	873	VH	2634	L			6.0	6.6	27.2	9.8	26.7	48.4	15.1	
5569427	2	4.3	H	8	L	10	L			267	H	869	VH	2647	M			5.9	6.5	25.5	2.7	28.4	51.9	17.0	

7.5

Sample ID	NITRATE-N (FIA) Surface ppm	Surface lbs/A	Surface depth IN	Sub 1 ppm	Sub 1 lbs/A	Sub 1 depth IN	Sub 2 ppm	Sub 2 lbs/A	Sub 2 depth IN	Total lbs/A	SULFUR S ICAP ppm	SULFUR RATE	ZINC Zn ppm	ZINC RATE	MANGANESE Mn ppm	MANGANESE RATE	IRON Fe ppm	IRON RATE	COPPER Cu ppm	COPPER RATE	BORON B ppm	BORON RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	SOLUBLE SALTS RATE
1																									
2																									

(Zinc through Boron: DTPA Extraction)

80 - 40 - 0 - 8 - 6 - 80 N. 125165

2 → 40 - 8 - - 8 - 6.

REPORT NUMBER	4-057-0033	PAGE	1/1
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SOIL ANALYSIS REPORT

LAB NUMBER	SAMPLE IDENTIFICATION	ORGANIC MATTER (WALKLEY BLACK) PERCENT	RATE	PHOSPHORUS P1 WEAK BRAY ppm	RATE	P2 STRONG BRAY ppm	RATE	BICARBONATE P OLSEN ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	% K	% Mg	% Ca	% H	% Na
5878915	FIELD 2	2.3	L	8	L	10	L			423	VH	654	VH	2296	M	35		6.3	6.7	20.3	5.3	26.8	56.6	10.6	0.7
5878916	FIELD 4	3.4	M	6	VL	7	VL			431	VH	771	VH	2531	M	61		6.2	6.6	23.3	4.7	27.6	54.3	12.3	1.1
5878917	FIELD 5	3.3	M	4	VL	5	VL			252	H	777	VH	2823	M	51		6.1	6.6	25.0	2.6	25.9	56.5	14.1	0.9
5878918	FIELD 7	2.7	M	5	VL	7	VL			143	L	839	VH	2623	M	57		6.1	6.6	24.1	1.5	29.0	54.4	14.1	1.0

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE): Potassium, Magnesium, Calcium, Sodium. PERCENT BASE SATURATION (COMPUTED).

7.5 15 70.

Sample ID	NITRATE-N (FIA) Surface ppm	Surface lbs/A	Surface depth IN	Sub 1 ppm	Sub 1 lbs/A	Sub 1 depth IN	Sub 2 ppm	Sub 2 lbs/A	Sub 2 depth IN	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn ppm	RATE	MANGANESE Mn ppm	RATE	IRON Fe ppm	RATE	COPPER Cu ppm	RATE	BORON B ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE
FIELD 2	8	14	0-6							14	7	L	1.3	M	5	L	88	VH	5.5	VH	0.3	VL	L	0.1	L
FIELD 4	11	20	0-6							20	19	H	3.0	M	11	M	179	VH	8.0	VH	0.4	VL	L	0.2	L
FIELD 5	10	18	0-6							18	13	M	2.1	M	7	L	124	VH	6.2	VH	0.4	VL	L	0.2	L
FIELD 7	9	16	0-6							16	11	L	1.5	M	5	L	129	VH	4.8	VH	0.3	VL	L	0.2	L

DTPA Extraction: Zinc, Manganese, Iron, Copper, Boron.

Dolomite Lime Ag lime only

N	P	K	S	Mg	CA	B
2 60 100.	~~100~~ - 50	282	20	252	2730 - 2296 434 = 2604	2
4 60-100	~~100~~ - 50	309 60P	20	288	3120 2531 = 589 3534	2
5 60-100	~~100~~ - 50	254 - 325	20	312	3380 2823 = 557 - 3342	2
7 60-101	100 - 50	317 - 244 100	20	300	3250 2623 = 627 = 3762	2

REPORT NUMBER 5-073-0267
ANALYSIS DATE MAR 14, 2005
ACCOUNT NO. 12754

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985-7489

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JEFF DUYCK
PO BOX 309
CORNELIUS OR
97113-

SOIL ANALYSIS REPORT

LAB NUMBER	SAMPLE IDENTIFICATION	ORGANIC MATTER WALKLEY BLACK PERCENT	RATE	PHOSPHORUS P1 WEAK BRAY ppm	RATE	P2 STRONG BRAY ppm	RATE	BICARBONATE P OLSEN ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	% K	% Mg	% Ca	% H	% Na
6377870	F2	2.8	M	17	M	20	M			428	VH	603	VH	2272	M	34		6.3	6.7	19.7	5.6	25.5	57.7	10.4	0.8
6377871	F3	3.1	M	4	VL	8	L			290	VH	740	VH	2552	M	50		5.9	6.6	24.0	3.1	25.7	53.2	17.1	0.9
6377872	F5	2.7	M	8	L	9	L			242	VH	626	VH	2487	M	39		6.0	6.6	21.7	2.9	24.0	57.3	15.0	0.8

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE): POTASSIUM, MAGNESIUM, CALCIUM, SODIUM. PERCENT BASE SATURATION (COMPUTED).

Sample ID	NITRATE-N (FIA) Surface ppm	Surface lbs/A	Surface depth IN	Sub 1 ppm	Sub 1 lbs/A	Sub 1 depth IN	Sub 2 ppm	Sub 2 lbs/A	Sub 2 depth IN	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn ppm	RATE	MANGANESE Mn ppm	RATE	IRON Fe ppm	RATE	COPPER Cu ppm	RATE	BORON B ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE
F2	5	9	0-6							9	10	L	1.9	M	7	L	86	VH	5.3	VH	0.6	L	L	0.2	L
F3	4	7	0-6							7	17	M	1.4	M	9	M	133	VH	7.1	VH	0.7	L	L	0.2	L
F5	9	16	0-6							16	14	M	1.6	M	4	VL	92	VH	5.2	VH	0.6	L	L	0.2	L

DTPA Extraction: ZINC, MANGANESE, IRON, COPPER, BORON.

F2

k	Mg	Ca
273	238	2955
428	603	2272
X	X	683
		x 2
		1366
		x 3
		4098

F3

k	Mg	Ca
309	288	3600
290	740	2552
19	X	1048
x 2		x2
38		2096
		x3
		6,288

F5

k	Mg	Ca
292	263	3300
242	626	2487
50	X	813
x2		x2
100		1626
		x3
		4878

Field 5~~44~~

Pacific Harvest Supply Co.
PO Box 309
Cornelius, OR 97113 / 503-359-4289

Blend Ticket **105**
Not Loaded

Wismers Dairy

PO Box 69
Gaston, OR 97119
503-985-7489

Field ID: WisDai/All
Description:
County:
Township:
Range:
Section:

Date: 03/15/2004
Time: 12:19 PM
Crop:
Acre: 1
Placement:
Set: PHFERT

Comments:

Product	Rate/Acre	Blending Units	RPM
46-0-0 Granular Bulk	90.301 Lbs	90 Lbs	**250**
21-0-0-24 Granular Bulk	250.000 Lbs	250 Lbs	**1000**
11-52-0 Granular Bulk	76.923 Lbs	75 Lbs	**266**
0-0-50-17 Granular Bulk 0-0-60	150.000 Lbs	150 Lbs	**498**
Boron 15% Bulk	6.667 Lbs	5 Lbs	**64**

Lbs	N	P	K	S	UD	Ca	Mg	Zn	Fe	Mn	Cu	B
Order.	100	40	75	10.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000	1.000
Blend.	100	40	75	88.538								1.000
Analys.	17.42	6.97	13.07	15.428								.174

Lbs/Acre: 574 **Lbs/Cu Ft: 58.99** **Cu Ft/Acre: 9.728** **Lbs/Batch: 574** **Acre/Batch: 1.000**

1 full Batches: ☐

per Acre cost $79.00 296. per ton.

40-0-0-6 — 175 lbs per AC

Total Units/Min: **1266.7 lbs/min**
Total Weight: **570 lbs**
Blending Time: **.45 minutes**

Blend Ticket **105**

REPORT NUMBER 4-057-0033
ANALYSIS DATE FEB 26, 2004
ACCOUNT NO. 12754

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GROWER
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SOIL ANALYSIS REPORT

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5878915	FIELD 2	2.3	L	8	L	10	L			423	VH	654	VH	2296	M	35		6.3	6.7	20.3	5.3	26.8	56.6	10.6	0.7
5878916	FIELD 4	3.4	M	6	VL	7	VL			431	VH	771	VH	2531	M	61		6.2	6.6	23.3	4.7	27.6	54.3	12.3	1.1
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5878918	FIELD 7	2.7	M	5	VL	7	VL			143	L	839	VH	2623	M	57		6.1	6.6	24.1	1.5	29.0	54.4	14.1	1.0

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FIELD 2	8	14	0-6							14	7	L	1.3	M	5	L	88	VH	5.5	VH	0.3	VL	L	0.1	L
FIELD 4	11	20	0-6							20	19	H	3.0	M	11	M	179	VH	8.0	VH	0.4	VL	L	0.2	L
FIELD 5	10	18	0-6							18	13	M	2.1	M	7	L	124	VH	6.2	VH	0.4	VL	L	0.2	L
FIELD 7	9	16	0-6							16	11	L	1.5	M	5	L	129	VH	4.8	VH	0.3	VL	L	0.2	L

DTPA Extraction: Zinc, Manganese, Iron, Copper, Boron.

AG. Lime ONLY

1
2 4 } 22 -

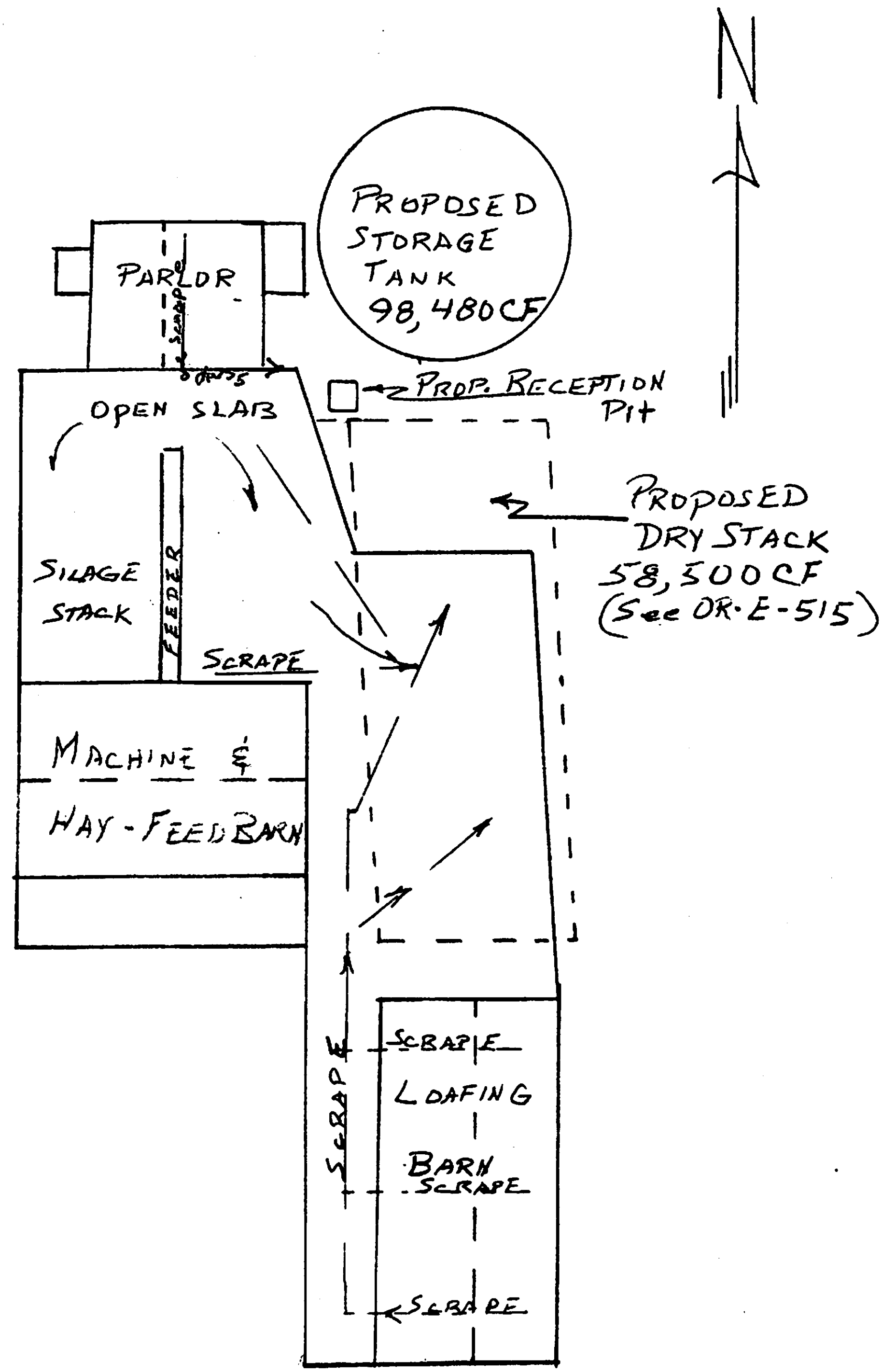
5
7 } 17 -

2604 AC
3534 AC.
3342 AC
3762 AB

SCS-ENG-523 Rev. 8-

SOIL CONSERVATION SERVICE

STATE		PROJECT		
OREGON		ROBERT WISMER ANIMAL WASTE FACILITY		
BY	DATE	CHECKED BY	DATE	JOB NO.
E R Evans	10-26-93			
SUBJECT				SHEET ____ OF ____
Floor plan & Flow Diagram				



Soils Map

Date: 3/3/2005

Customer(s): WISMER'S DAIRY INC
District: TUALATIN SOIL & WATER CONSERVATION DISTRICT
Approximate Acres: 104
Legal Description: T1SR4W
Section 36

Field Office: HILLSBORO SERVICE CENTER
Agency: USDA NRCS
Assisted By: Robert App
State and County: OR, WASHINGTON

Recopy Soils Map from Survey

Legend

soil_a_or067

Consplan3

Image: ortho_E1-1_or067_1994.sid

300 0 300 600 900 1,200 Feet

N