ST. JOHNS LANDFILL

COVER VEGETATION PLAN

DEMONSTRATION PLOTS: PRELIMINARY REPORT

Prepared for

METRO SOLID WASTE DEPARTMENT

Submitted by

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ST.JOHNS LANDFILL COVER VEGETATION: SUBAREA 1 AND 2 NATIVE GRASS DEMONSTRATION PLOTS PRELIMINARY REPORT - December 1994

Background

The establishment of a permanent vegetative cover at the St. Johns Landfill is currently envisioned as a two year process. In the fall of the first year, a temporary (non persistent) cover crop is to be seeded on each subarea as it is closed. Starting the following spring, site preparation activities are to be carried out on the areas seeded to temporary cover crop in order to prepare for the fall seeding of a permanent cover of native vegetation. Monitoring results from the demonstration plots will give the envisioned two year establishment process a "reality check".

In May of the 1994 growing season work to determine how best prepare areas for seeding native grasses began. Six native grass establishment plots, two fallowing plots, and two control plots were established on Subarea 1 and 2. These plots are identified as follows:

NATIVE GRASS ESTABLISHMENT PLOTS

PLOT NUMBER 1A - HERBICIDE/TILL
Plot Location: Subarea 1

PLOT NUMBER 1B - HERBICIDE/NO TILL
Plot Location: Subarea 1

PLOT NUMBER 2 - SOLARIZATION AND TILLAGE ONLY
Plot Location: Subarea 1

PLOT NUMBER 3A - TILLAGE ONLY
Plot Location: Subarea 1

PLOT NUMBER 3B - ACID pH
Plot Location: Subarea 1

PLOT NUMBER 4 - CLOSURE WITH NATIVE GRASS VEGETATION
Plot Location: Subarea 2

FALLOWING DEMONSTRATION PLOTS

PLOT NUMBER 5A - SWATHING TO CONTROL RYEGRASS
Plot Location: Subarea 2

PLOT NUMBER 5B - FLAIL MOWING TO CONTROL RYEGRASS
Plot Location: Subarea 2

CONTROL PLOTS

PLOT NUMBER 6 - CONTROL (No manipulation)

Plot Locations: Subarea 1 and 2

See the **Appendix** for a description of the location of each of these plots.

Establishment Plots: Seed Selection, Site Preparation and No-Till Drilling

Two native bunchgrasses, **California Brome-grass** (Bromus carinatus) and **Idaho Fescue** (Festuca idahoensis) were selected for seeding on the demonstration plots on the basis of previous trials on Subarea 1 and advise given by the SJL Cover Vegetation Technical Advisory Committee. The Brome is a fast growing two to four foot high pioneer grass; the Fescue is a slow growing one and a half to two foot high long lived grass.

The goal of site preparation activities implemented on Plots 1A through 4 was to determine the best means of establishing the two native bunchgrasses on soils contaminated with a large amount of undesirable weeds. The extent of contamination was revealed in soil seedbank testing done on Plots 1A through 4 in early May 1994. Copies of those testing results can be found in the **Appendix**.

Weed and seedbank control activities implemented on the plots ranged from chemical application to tillage by repeated discing from May through early September, 1994. **PART II** of this report describes the specific site preparation work carried out on each of the establishment plots.

The seeding of the two grasses was done on September 20 and 21, 1994 using a no-till grass seed drill. This drill is a complex implement that tills a 1" wide furrow into crop stubble and then hydraulically injects and covers the seed and fertilizer mix in that furrow in one pass over the field. Although the drill is specifically designed for use on fields that have not been prepared by plowing or discing, it can also be adapted to seed prepared ground. The particular no-till drill used was operated by it's fabricator and was leased from Oregon State University. It is the only known equipment of it's kind in western Oregon.

Fallowing Plots

Before the fall of 1994 no native grasses had been seeded on the landfill since the fall of 1991. Currently most of Subarea 1 and all of Subarea 2 vegetation is now dominated by undesirable grasses and weeds. The fallowing plots were established to determine the best means of minimizing the seed set of the existing vegetation on these previously closed subareas. As both grazing and field flaming were not viable options for removal of biomass and seed, mowing was identified as a control strategy. Flail mowing and swathing plots have been established to determine the best control method.

PART 1- DESCRIPTION OF 1994 WORK

NATIVE GRASS ESTABLISHMENT PLOTS

PLOT NUMBER 1A - HERBICIDE/TILL

Plot Location: Subarea 1

Acreage Prepared: .50 Acres

Summary of preparation:

May 6, 1994 - soil/seedbank test
May 9, 1994 - herbicide application
May 26, 1994 - tillage (disc/cross disc)
July 13, 1994 - tillage (disc/cross disc)
August 15, 1994 - tillage (disc/cross disc)
September 19, 1994 - tillage and cultipacking

Acreage Seeded: .30 Acres

Summary of Seeding:

Seeding date - September 20, 1994
Species seeded - Bromus carinatus (BRca)
Festuca idahoensis (FEid)
Application rate -
Seed- applied @ 8.5 pounds/Acre
1.25 pounds BRca/plot
1.25 pounds FEid/plot
Fertilizer- applied @ 64 pounds/Acre
19 pounds 10-20-20

PLOT NUMBER 1B - HERBICIDE/NO TILL

Plot Location: Subarea 1

Acreage Prepared: .60 Acres

Summary of preparation:

May 6, 1994 - soil/seedbank test
May 9, 1994 - herbicide application

Acreage Seeded: .30 Acres

Summary of Seeding:

Seeding date - September 20, 1994
Species seeded - Bromus carinatus (BRca)
Festuca idahoensis (FEid)
Application rate -
Seed- applied @ 8.5 pounds/Acre
2.5 pounds BRca/plot
2.5 pounds FEid/plot
Fertilizer- applied @ 64 pounds/Acre
40 pounds 10-20-20

PLOT NUMBER 2 - SOLARIZATION AND TILLAGE ONLY

Plot Location: Subarea 1

Acreage Prepared: .35 Acres total

Solarization subplot - .10 Acres

Tillage only subplot - .25 Acres

Summary of preparation:

May 6, 1994 - soil/seedbank test
[both subplots]

May 26, 1994 - tillage (disc/cross disc)
[both subplots]

May 26, 1994 - covering with plastic film
[solar subplot only]

July 13, 1994 - tillage (disc/cross disc)
[tillage subplot only]

August 15, 1994 - tillage (disc/cross disc)
[tillage subplot only]

September 18, 1994 - removal of plastic
[solar subplot only]

September 19, 1994 - tillage [till subplot only]
cultipacking [both subplots]

Acreage Seeded: .33 Acres

Summary of Seeding:

Seeding date - September 20, 1994

Species seeded - Bromus carinatus (BRca)
Festuca idahoensis (FEid)

Application rate -

Seed- applied @ 8.5 pounds/Acre
1.5 pounds BRca/plot
1.5 pounds FEid/plot

Fertilizer- applied @ 64 pounds/Acre
21 pounds 10-20-20

PLOT NUMBER 3A - TILLAGE ONLY

Plot Location: Subarea 1

Acreage Prepared: .60 Acres

Summary of preparation;

May 6, 1994 - soil/seedbank test

May 26, 1994 - tillage (disc/cross disc)

July 13, 1994 - tillage (disc/cross disc)

August 15, 1994 - tillage (disc/cross disc)

September 19, 1994 - tillage and cultipacking

Acreage Seeded: .30 Acres

Summary of Seeding:

Seeding date - September 21, 1994

Species seeded - Bromus carinatus (BRca)
Festuca idahoensis (FEid)

Application rate -
Seed- applied @ 16.3 pounds/Acre
2.5 pounds BRca/plot
2.5 pounds FEid/plot
Fertilizer- applied @ 69.5 pounds/Acre
21 pounds 10-20-20

PLOT NUMBER 3B - ACID pH

Plot Location: Subarea 1

Acreage Prepared: .55 Acres

Summary of preparation:
May 6, 1994 - soil/seedbank test
May 26, 1994 - tillage (disc/cross disc)
July 13, 1994 - application of 1000 pounds of popcorn sulphur
July 13, 1994 - tillage (disc/cross disc)
August 15, 1994 - tillage (disc/cross disc)
September 19, 1994 - tillage and cultipacking

Acreage Seeded: .50 Acres

Summary of Seeding:
Seeding date - September 21, 1994
Species seeded - Bromus carinatus (BRca)
Festuca idahoensis (FEid)
Application rate -
Seed- applied @ 16.3 pounds/Acre
4 pounds BRca/plot
4 pounds FEid/plot
Fertilizer- applied @ 69.5 pounds/Acre
35 pounds 10-20-20

PLOT NUMBER 4 - CLOSURE WITH NATIVE GRASS VEGETATION

Plot Location: Subarea 2

Acreage Prepared: 1.50 Acres

Summary of preparation:
August 20, 1994 - sand and topsoil placement
September 19, 1994 - tillage and cultipacking

Acreage Seeded: 1.50 Acres

Summary of Seeding:
Seeding date - September 21, 1994
Species seeded - Bromus carinatus (BRca)
Festuca idahoensis (FEid)
Application rate -
Seed- applied @ 16.3 pounds/Acre
12.25 pounds BRca/plot
12.25 pounds FEid/plot
Fertilizer- applied @ 69.5 pounds/Acre
104 pounds 10-20-20

FALLOWING DEMONSTRATION PLOTS

PLOT NUMBER 5A - SWATHING TO CONTROL RYEGRASS

Plot Location: Subarea 2
Plot Size: 1 Acre
Method of Preparation: Plot was seeded to Regreen in the fall of 1993. During the 1994 growing season, plots were cut monthly from May through July with a tractor drawn sickle bar (sidecutter). Cut hay was left on the stubble in an attempt to reduce ryegrass seedbank by smothering. Plots will be monitored in the spring of 1995 to determine degree of success.

PLOT NUMBER 5B - FLAIL MOWING TO CONTROL RYEGRASS

Plot Location: Subarea 2
Plot Size: 1 Acre
Method of Preparation: Plot was seeded to Regreen in the fall of 1993. During the 1994 growing season, plots were cut monthly from May through July with a tractor drawn flail mower and chopped residue was left on stubble. Plot will be monitored in the spring of 1995 and results compared to those from Plot 5C to determine best means of reducing ryegrass prior to seeding native grasses.

CONTROL PLOTS

PLOT NUMBER 6 - CONTROL

Plot Locations: Subarea 1 and 2
Plot Size: 1 Acre each subarea
Method of Preparation: Two plots in each subarea, have been selected for monitoring during the spring of 1995. Both plots were seeded with Regreen during closure. The Subarea 1 plot was seeded in the fall of 1992; the Subarea 2 plot during the fall of 1993. Mowing has not been possible on either plot because of gas pipe and/or steep slopes and no other manipulations have or will be carried out on either plot prior to monitoring. Monitoring results will be analyzed to gain a better understanding of the natural succession of the vegetative plant community since soil placement. Populations of invasive pest plants found within the plots will also be inventoried.

PART II- PRELIMINARY MONITORING

FALL 1994 MONITORING OF PLOTS SEEDED WITH NATIVE GRASSES

The drilling method of seeding creates a small ridge and furrow topography of the surface of a field. Each seed is injected into the soil in a straight line slightly below the ground surface at the bottom of each furrow. Preliminary monitoring focused on identifying if there was a sprout of native seed on the bottom of the furrow and if there was a sprout of other seed spread irregularly throughout the plot. Two site visits were conducted during the fall of 1994. On September 28th and again on November 29th Plot 1A, 1B, 2, 3A, 3B, and 4 were checked to determine: 1. The rate of germination and subsequent growth of the drilled native grasses, and 2. The initial success of the pest plant control strategies. A summary of field notes for each of the site visits follows.

SEPTEMBER 28, 1994 SITE VISIT (1 week after seeding)

PLOT NUMBER 1A - HERBICIDE/TILL

No sprout of native grasses in furrows or of pest plants on ridges. Estimated percent cover of all vegetation = 0. Soil dry.

PLOT NUMBER 1B - HERBICIDE/NO TILL

No sprout of native grasses in furrows. Slight sprout of pest plants within herbicide killed crop residue primarily in moist soil area at southeast corner of plot. Estimated percent cover of native grasses in furrows = 0; estimated percent cover of pest vegetation in moist areas = <2%.

PLOT NUMBER 2 - SOLARIZATION AND TILLAGE ONLY

Soil in furrows within most of solarized subplot slightly moist except for edges [due to greenhouse affect of solarizing plastic?]. Sprout of BRca fairly consistent in moist furrows; no evidence of pest plant sprout elsewhere. Percent cover of native grasses in moist furrows = 5-10%. Soil in till only subplot dry. Estimated percent cover of all vegetation = 0.

PLOT NUMBER 3A - TILLAGE ONLY

No sprout of native grasses in furrows or of pest plants on ridges. Estimated percent cover of all vegetation = 0. Soil dry.

PLOT NUMBER 3B - ACID pH

Sprout of BRca in moist furrows on south boundary of plot and also in moist soil areas along east boundary. Sprout of pest grasses and weeds throughout same areas. Soil in the remainder of the plot is dry; no evidence of sprout. Estimated percent cover of native grasses in moist furrows = 5-10%; estimated percent cover pest plants in moist soil areas = 2-5%.

PLOT NUMBER 4 - CLOSURE WITH NATIVE GRASS VEGETATION

No sprout of native grasses in furrows or of pest plants on ridges. Estimated percent cover of all vegetation = 0. Soil dry.

On September 28th the SA3 areas seeded to cereal wheat exhibited an estimated percent cover of approximately 10-20%. When the growth of the native grass Bromus carinatus (California Brome-grass) was compared to the growth of the cereal wheat in Subarea 3 the performance was only slightly different, even though seeding techniques and rates were very different. Bromus seed had a slightly slower rate of seed germination [8 days versus 5 days] but developed tillers (branches) immediately. The high seeding rate of the wheat resulted in the crowding of seedlings, perhaps preventing tillering.

NOVEMBER 29, 1994 SITE VISIT (2 months after seeding)

PLOT NUMBER 1A - HERBICIDE/TILL

Sprout of BRca throughout plot; small 3-10 foot spots of BRca beginning to tiller and cover approximately 50% of ground. Southwest corner of plot is under 1-2" of water- dead BRca seedlings. BRca that survives exhibiting signs of nitrogen deficiency and/or drowning (?). Southwest corner and middle of plot have greatest concentration of pest plants [Ryegrass (?) and Mustard (?)].

PLOT NUMBER 1B - HERBICIDE/NO TILL

Sprout of BRca throughout plot; in center of plot 5-10 foot spots of BRca beginning to tiller and cover approximately 50% of ground. BRca growing under 1-2" of surface water in southeast corner exhibiting signs of nitrogen deficiency and/or drowning (?). North boundary of plot has very dense (30-50% coverage) sprout of a weedy dicot [Mustard (?)]; no pest grasses observed anywhere in plot. Small sprout of FEid in dryer soil in middle and on west boundary of plot.

PLOT NUMBER 2 - SOLARIZATION AND TILLAGE ONLY

Solar subplot is driest and most free of pest plants. Sprout of BRca uniform but showing very different growth stages [some plants in first leaf others 4-5" wide and tillering] FEid in first leaf throughout the solar plot. Percent cover of native grasses in furrows = 10-25%. Estimated percent cover of pest plant vegetation = <2% within solar subplot/> 2% in till plot.

PLOT NUMBER 3A - TILLAGE ONLY

BRca and other grass [Ryegrass?] sprout throughout plot; uniform sized seedlings most approximately 2" wide. Plot exceptionally dry especially east boundary [very sandy soil]. Percent cover of native grasses in furrows = 5-10%. Estimated percent cover of pest plant vegetation 5-10%.

PLOT NUMBER 3B - ACID pH

BRca has sprouted throughout plot; sprout of BRca uniform but showing very different growth stages [some plants in first leaf others 4-5" wide and tillering]

FEid in first leaf in middle and north boundary. Plot mostly free of pest plants except in very wet southwest corner sprout of grasses (Ryegrass?). Percent cover of native grasses in furrows = 10-25%. Estimated percent cover of pest plant vegetation = 5-10%.

PLOT NUMBER 4 - CLOSURE WITH NATIVE GRASS VEGETATION

Good growth of BRca throughout plot especially with wheat seedlings on southern boundary. West boundary very wet due to compaction of scrapers; small erosion rills in this area. Estimated percent cover of BRca = 10-20%; pest plant vegetation = 5-20%.

Again, when comparing native grass plots with areas seeded to cereal wheat within Subarea 3, the growth of the native grasses has not caught up with the more vigorously growing wheat. Wheat also seems more tolerant of periodic inundation. On November 28th the SA3 areas seeded to wheat exhibited an estimated percent cover of approximately 10-50%.

SUMMARY

Due to the late start of site prep work in May of 1994, only one application of Roundup herbicide, rather than the specified two, was able to be made to the Herbicide/No till and the Herbicide/Till Plots (Number 1A and 1B). The consequence is not yet evident. It is generally recommended that the first application of Roundup be made in March or April and another application by early May before the cessation of warm spring rains. In this way two crops of weeds could be killed prior to the onset of summer drought induced dormancy; consequently, a weed dominated seedbank could be depleted more quickly.

The no-till drilling of Bromus carinatus (BRca) grass has produced a reasonably good stand on areas of well drained soils two months after seeding. The results of seeding BRca on areas of seasonally saturated soils has been very poor. Surface erosion within the boundaries of the demonstration plots has been very slight, in Plot 4 on Subarea 2 the erosion seems to have been caused by the compaction of heavy equipment which used the west boundary of the plot as a haul road. Most of the Festuca idahoensis (FEid) grass seed has not germinated at this time due to its need for a greater amount of chilling time. To date, native grass germination and growth has been the most greatest on the Solarized plot (Number 2). The Solarized plot (Number 2), the Herbicide only plot (Number 1B) and the Acid pH plot (Number 3B) are the most weed free; the Till only plot (Number 3A) contains the most amount of weeds.

PART III- RECOMMENDATIONS

RECOMMENDATIONS

At this time, any predictions of the success of native grass drilling are premature as most of the plants and the weed seeds are dormant and the success of site preparation strategies implemented during the summer of 1994 can not be fully determined. The soil seedbank of all the demonstration plots does, without doubt, still contain undesirable weed seed and most of these seeds will not germinate until the soil warms in the spring. Thus the success of native grass establishment will depend on early spring plot monitoring followed immediately by the implementation of timely plot maintenance prescriptions such as high mowing and/or herbicide wicking of the faster growing undesirable grasses and weeds. Plot monitoring should begin as early as late January, weather dependent.

Most of the Festuca idahoensis (FEid) seed has not germinated yet but the growth to date of BRca is significant. Thusfar the Bromus has germinated quickly and is out competing the weeds on most of the plots. If weed control techniques are at least partially successful, and the BRca and FEid grow to their potential heights of 2.5 feet and 1.5 feet respectively, the native grasses will have a competitive establishment advantage over the undesirable vegetation.

Additional areas of the St. Johns Landfill can be seeded with native grasses in the fall of 1995. The numbers of acres seeded and the site preparation techniques and seeding methods used will be contingent on funding and the acquisition of more complete monitoring data from the demonstration plots. Preliminary planning for contract work and staffing support for that seeding work should begin by the first of the year. Early spring 1995 monitoring results will be completed by mid to late February 1995; site prep work should begin by 1 March 1995.

APPENDIX

-demonstration plot location maps

-seedbank test results

-popcorn sulphur specs

-photos

OREGON STATE UNIVERSITY
SEED LABORATORY
CORVALLIS, OREGON 97331 U.S.A.
Phone: (503) 737-4464 FAX: 737-2126

EXAMINATION REPORT

Test No. 124347 Date Recv'd 06-02-94

Laboratory Identification:

Seedbank

Commercial Sample

Mark G Wilson
723 SE Thirty-third Avenue
PORTLAND, OR 97214

Sender's Identification:

NAME: Landfill # 4
LOT NO.:
AMOUNT:
FIELD NO.:

ex-36.00

Plot Number 1A°
+Herbicide/Till

This sample has been examined for:

CROP AND WEED SEEDS

Found:

Species	# Found in 20.70 grams	#/lb.
CROP SEED		
Ryegrass	1	22
WEED SEED		
None found		

Date Completed: 06-08-94

COST CODE

p = purity
g = germination
fl = fluorescence
tz = tetrazolium
d = pest and disease
c = crop
w = weed
cw = crop and weed
r = rush
cc = copies

Rodger Danielson
Rodger Danielson, Manager

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SEED LABORATORY
CORVALLIS, OREGON 97331 U.S.A.
Phone: (503) 737-4464 FAX: 737-2126

EXAMINATION REPORT

Test No. 124348 Date Recv'd 06-02-94

Laboratory Identification:

Seedbank

Commercial Sample

Mark G Wilson
723 SE Thirty-third Avenue
PORTLAND, OR 97214

Sender's Identification:

NAME: Landfill # 5
LOT NO.:
AMOUNT:
FIELD NO.:

ex-36.00

This sample has been examined for:

CROP AND WEED SEEDS

Found:

Species	# Found in 20.72 grams	#/lb.
CROP SEED		
Ryegrass	5	109
WEED SEED		
Speedwell	2	44
Common chickweed	1	22

Plot Number 1B:
Herbicide/No Till

Date Completed: 06-08-94

COST CODE

p = purity
g = germination
fl = fluorescence
tz = tetrazolium
d = pest and disease
c = crop
w = weed
cw = crop and weed
r = rush
cc = copies

Rodger Danielson
Rodger Danielson, Manager

OREGON STATE UNIVERSITY
SEED LABORATORY
CORVALLIS, OREGON 97331 U.S.A.
Phone: (503) 737-4464 FAX: 737-2126

EXAMINATION REPORT

Test No. 124344 Date Recv'd 06-02-94

Laboratory Identification:

Seedbank

Commercial Sample

Mark G Wilson
723 SE Thirty-third Avenue
PORTLAND, OR 97214

Sender's Identification:

NAME: Landfill # 1
LOT NO.:
AMOUNT:
FIELD NO.:

ex-36.00

This sample has been examined for:

CROP AND WEED SEEDS

Found:

Species	# Found in 20.20 grams	#/lb.
CROP SEED		
Ryegrass	3	67
WEED SEED		
Common chickweed	4	90
Foxtail	3	67
Rattail fescue	3	67

Plot Number 2°
Solarization

Date Completed: 06-08-94

COST CODE

p = purity
g = germination
fl = fluorescence
tz = tetrazolium
d = pest and disease
c = crop
w = weed
cw = crop and weed
r = rush
cc = copies

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Rodger Danielson, Manager

OREGON STATE UNIVERSITY
SEED LABORATORY
CORVALLIS, OREGON 97331 U.S.A.
Phone: (503) 737-4464 FAX: 737-2126

EXAMINATION REPORT

Test No. 124349 Date Recv'd 06-02-94

Laboratory Identification:

Seedbank

Commercial Sample

Mark G Wilson
723 SE Thirty-third Avenue
PORTLAND, OR 97214

Sender's Identification:

NAME: Landfill # 6
LOT NO.:
AMOUNT:
FIELD NO.:

ex-36.00

Plot Number 3A:
Tillage only

This sample has been examined for:

CROP AND WEED SEEDS

Found:

Species	# Found in 20.88 grams	#/lb.
CROP SEED		
Ryegrass	2	45
WEED SEED		
Bittercress	3	68
Common chickweed	3	68
Sticky chickweed	2	45

Date Completed: 06-08-94

COST CODE

p = purity
g = germination
fl = fluorescence
tz = tetrazolium
d = pest and disease
c = crop
w = weed
cw = crop and weed
r = rush
cc = copies

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OREGON STATE UNIVERSITY
SEED LABORATORY
CORVALLIS, OREGON 97331 U.S.A.
Phone: (503) 737-4464 FAX: 737-2126

EXAMINATION REPORT

Test No. 124346 Date Recv'd 06-02-94

Laboratory Identification:

Seedbank

Commercial Sample

Mark G Wilson
723 SE Thirty-third Avenue
PORTLAND, OR 97214

Sender's Identification:

NAME:
LOT NO.: Landfill # 3
AMOUNT:
FIELD NO.:

ex-36.00

Plot Number 38
Acid pH

This sample has been examined for:

CROP AND WEED SEEDS

Found:

Species	# Found in 20.48 grams	#/lb.
CROP SEED		
None found		
WEED SEED		
Common chickweed	2	44

Date Completed:
06-13-94

COST CODE

p = purity
g = germination
fl = fluorescence
tz = tetrazolium
d = pest and disease
c = crop
w = weed
cw = crop and weed
r = rush
cc = copies

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AGRICULTURAL PRODUCT INFORMATION

UNOCAL CHEMICALS DIVISION

SULFUR / "POPCORN" ® ROP

CHEMICAL PROPERTIES	Guarantee (Wt.%)
SULFUR CONTENT (Dry Basis)	99.5
MOISTURE (Equilibrium, Air Dried)	0.5
(Typical, From Pile)	2.0 - 7.8
SULFUR CONTENT (As Shipped)	95.0

PHYSICAL PROPERTIES	
Bulk Density, lb./cu. ft., a.i.	73.3
Specific Volume, cu. ft./short ton, a.i.	27.3
Melting Point	239°F
Angle of Repose	36°-38°

Screen Analysis, % retained on stacked screens (Tyler)

Mesh	+1"	+1/4"	+4	+6	+8	+20	+60	+100	-100
Wt.%	0	1	4	18	28	36	9	3	1

GENERAL

Sulfur is all in the elemental form. Depending on temperature, moisture, soil condition and soil bacteria, elemental sulfur converts to the oxidized form which acidifys the soil and provides nutrient sulfur. Porous texture of particles assures maximum active surface area.

Dry Unocal ROP POPCORN ® Sulfur can be applied with most conventional dry bulk spinner spreaders. Because of the small amount of residual moisture and a special manufacturing process Unocal POPCORN ® Sulfur contains little dust, making it a safer and cleaner to use than conventional soil sulfur.

Storage is as a bulk dry, but because sulfur is not water soluble, POPCORN ® Sulfur may be stored outside without covering, unless it must remain dry for bulk blending.

POPCORN ® Sulfur is not classified as a hazardous product. Refer to Safety and Handling section for further information.

SHIPPING POINT: Santa Maria, California

8/86

UCD SPEC 343 6/86