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October 23, 1991

Mr. Johnny Pappas
Soldier Creek Coal Co.
P.O. Box I
Price UT 84501

RE: Draft Test Plot Design, Banning Load Out, Soldier Creek Coal Co., ACT/007/034, Folder #2, Carbon County, Utah

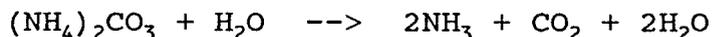
Dear Mr. Pappas:

Although urea is the specified fertilizer in your Mining and Reclamation Plan, the use of urea fertilizer on the Banning soils is of concern. These soils are characterized by extremely basic conditions (pH > 9.0) and high SAR values (37 to 78) in the top 3 feet.

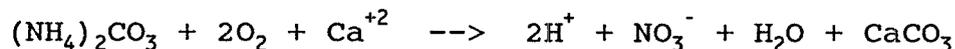
Urea fertilizer is readily available for absorption by plant roots. The reaction of urea fertilizer in soil has the **immediate effect of increasing alkalinity.**



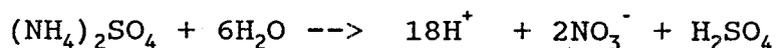
This reaction is followed by the production of volatile ammonium.



Therefore, to gain maximum benefit from the application of this type of fertilizer, plants should be established at the time of fertilization. Otherwise, the urea may be lost to the environment in the form of ammonium. The sulfur coating on the urea compound will slow down the dissolution of the fertilizer, and, in the presence of available bases such as calcium, nitrification will take place.



A better choice of nitrogen fertilizer would be ammonium sulfate, because of the **residual acidifying effect.**



Sulfuric acid or the free sulfate anion will react with sodium to

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produce leachable sodium sulfate thereby reducing the sodicity of the soil. The effects of sulfuric acid on the reduction of sodicity are well known. With the high SAR values shown from the test pit sampling at the Banning site, this seems to be a valid reason for using ammonium sulfate fertilizer rather than urea.

The results of sampling of the test plot soils prior to the previous test plot implementation could not be found. In light of the present failure and to provide baseline information on the soils in the test plot, soil sampling of the control or blank treatment must include:

pH, EC, available water capacity (see guidelines for methodology)

available nitrogen (NO_3^-) (see guidelines)

available phosphorus (see guidelines)

available potassium (see guidelines)

Exchangeable Sodium Percentage (Agriculture Handbook No. 60, USDA, 1954, Methods 18 and 19, p. 100-101.)

Because of the extremely alkaline conditions, available iron, manganese, copper and zinc (Soil Science Soc of Am Proceeding, Vol. 35, No. 4, 1971, p 600 - 602).

Because of the presence of elevated boron levels in previous samples, hot water soluble boron (see guidelines for methodology).

After two years, soil sampling must again be performed on one replication of each treatment including the blank or control. So that, the treatment effect on the change in the soil can be related to plant growth.

Initial sampling of the manure and wood chips must include bulk density to provide a conversion between volume and weight when application rates are discussed. Also, nitrate and ammonium nitrogen levels must be measured in the manure.

The following treatment for the improvement of sodic, saline, aridic soils is strongly recommended and based on several scholarly articles which can be made available to you, at your request.

60 tons/acre of wood chips with 100 lb. nitrogen/acre [476

lbs $(\text{NH}_4)_2\text{SO}_4$ /acre] and 80 lbs/ac of phosphorus [243 lbs of treble superphosphate $\text{Ca}(\text{H}_2\text{PO}_4)_2$ per acre]

We offer the following additional comments concerning your draft description of the Banning test plots.

- 1) The test plot design would be simpler if gouging was not a treatment but was utilized throughout the plots.
- 2) To eliminate treatment effects associated with the different seeding and mulching methods proposed, the following methodology should be adhered to:
 - a) All plots should be ripped to a depth of 18 inches and gouged.
 - b) All seeding should be accomplished by broadcasting.
 - c) All seed should be raked and 2 tons of hay per acre will be tacked to the surface either with tackifier or netting.
- 3) If the supplemental seed mix is to be used in conjunction with the main seed mix, the rates can be as Bob Thompson originally suggested them, i.e., 1/4 of what is now shown. If this mix is to be used independently, then the rates now shown should be used.
- 4) Supplemental seed treatments need not be replicated but must be separate from the main treatments.
- 5) Vegetation monitoring information must be described in more detail. The evaluation procedures should include the following:
 - a) Annually, a list of all species present in each plot whether or not encountered in quantitative sampling.
 - b) A measurement of production by life form or species after the fifth year.
 - c) Annually, each replicate of each treatment should have at least five evaluations, i.e., quadrats, transects, etc. Reports should be submitted with the Annual Report and should include either statistical analysis of the data or data sheets that are clear enough that statistical analysis can be performed.

In conclusion, our conception of the treatments is as follows:

- a) 7" of manure.
- b) 60 T/ac of wood chips with 100 lb nitrogen/acre [476 lb $(\text{NH}_4)_2\text{SO}_4$ /acre] and 80 lbs/ac of phosphorus [243 lbs of treble superphosphate $\text{Ca}(\text{H}_2\text{PO}_4)_2$ per acre].
- c) - 18 lbs nitrogen/acre (as 86 lbs of ammonium sulfate/ac) and 80 lbs of phosphorus/acre (as 44 lbs of treble superphosphate).
- d) control (no treatment other than physical ripping and gouging and seeding).
- e) blank (no treatment other than physical ripping and gouging to determine the success of reclamation without seeding).

All soil amendment treatments (a through e) are replicated twice, using the main seed mix. Therefore, there will be eight 100 sq. ft treatments and two blank treatments for a total of 1000 sq feet (ten plots). Additional space would be needed for the supplemental seed treatments and for the buffer zones.

Our conception of the chronology for establishing the plots is as follows:

- 1) The area should be staked.
- 2) Manure, wood chips, and fertilizer should be broadcast on the appropriate plots.
- 3) The entire area should be ripped to 18".
- 4) Appropriate seed mixes should be broadcast and raked in.
- 5) Mulch should be applied and tacked either with a tackifier contained in the mulch or with netting, but be consistent.
- 6) The entire area should be fenced.

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Finally, it is important to choose a site for the test plots that will not be disturbed for five years or more. The site you have chosen is suitable and representative of the conditions that might exist upon reclamation.

Thank you for giving us the opportunity to comment on your draft proposal. Please don't hesitate to call if you have any questions about these suggestions.

Sincerely,



Paul Baker
Reclamation Biologist



Priscilla Burton
Reclamation Soils Specialist

xc: DHaddock