Sydney Environmental & Soil Laboratory

Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Dredged Material for Revegetation

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by Simon Leake BScAgr(HonsI).

Simon is principal soil scientist with Sydney Environmental and Soil Laboratory, a firm of urban soil scientists and agronomists specialising in services to urban horticulture. Simon is well known in NSW for trouble shooting landscape problems, and in providing site analysis which form the basis for job specifications. He has been involved in nearly all major jobs in Sydney including Darling Harbour, Homebush Bay, Sydney Park, Badgerys Creek Airport and Lakeside and Riverside Oaks Golf Courses. He has also provided services for Crib Point Melbourne, Bond University, and Yulara Resort Uluru as well as many others. It is hoped that this new column can provide the open forum for exchange of knowledge on all aspects of soil technology.

Questions on soil problems should be addressed to Simon Leake, "Down to Earth"

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Question.

We have a saline, alkaline dredged material to revegetate for open space parkland. Can this be done or should we allow for importation of topsoil?

Answer.

Material dredged or reclaimed from marine environments can be of two kinds:- saline, pyritic and acid generating, or saline, sodic and alkaline . The pyritic material is usually black in colour and weathers to form highly acidic soil needing special treatment. The second class of material is common in reclaimed urban environments and has been successfully reclaimed for landscape use. The saline, sodic and alkaline condition is usually but not always associated with marine influence.

During the desalination of marine materials a reaction sets in called sodification which results in alkaline pHs, high exchangeable sodium levels, and gross nutrient imbalance. Further weathering and the establishment of salt tolerant terrestrial plants will slowly result in improved chemistry as limiting nutrients are accumulated and desodification occurs. These natural processes can be enhanced and hastened by Man.

Table 1 shows test results before, during, and after amelioration of a sandy dredged material. This is from a large open space park in Sydney comprising a mixture of sandy dredged material and recycled waste soil.

Table 1.0 Before, During, and After analysis of a saline, sodic reclamation.

Test Result	Before Treatment	During Treatment	Ready to plant
pH in Water	8.3	7.2	7.0
pH in CaCl2	8.2	7.1	6.9
EC dS/m 1:2	0.80	1.60	0.50
% Exchangeable			
Sodium	18.9	9.5	4.8
Potassium	2.8	2.4	3.2
Calcium	60.4	81.0	90.5
Magnesium	17.9	7.1	1.6
Ca/Mg ratio	3.4	11.3	57.0
Sulphate mg/kg	146	903	273

The first test result showed an alkaline pH, moderate to high salinity, and high exchangeable sodium levels. The calcium level is not actually very deficient and marine materials may or may not be deficient in calcium depending on how much shell grit (calcium carbonate) they contain. In this case the calcium is probably a result of the inclusion of cement and lime in the waste soil component. Cement and lime contamination is common in recycled urban soils.

It was decided that the Before Treatment condition was hostile to tree and shrub planting and although turf grasses could probably cope with the level of salinity, they would suffer continual iron deficiency at such a high pH and not give the desired green appearance. A program of amelioration was started which involved-

1. Application of Agricultural sulphur to bring pH down, and application of gypsum to improve drainage rates. These have to be worked in and in sterile soils an application of organic matter can be beneficial as the action of Ag sulphur is biologically mediated.

2. Heavy and repeated watering to remove the saline products.

3. Retest at 4 weeks to check progress.

The soil was retested one week after the application and the result is shown as During Treatment. Note that pH and sodium have come down quickly but a temporary rise in overall salinity is apparent. This is to be expected since we are adding salts as gypsum. It is very important to realise that gypsum and other ameliorant applications can increase salinity in the short term and planting must be delayed until the reaction products have been leached out.

By the time of the 4 week test, and after heavy watering several times salinity has dropped to acceptable levels for most plantings, pH is down, and exchangeable sodium is well below the definition of a sodic soil. The soil is essentially ready for planting but note that other nutrients, potassium and magnesium, have been greatly reduced also. This is an unavoidable since gypsum displaces all other cations, not just sodium, and leaching then removes them from the soil. The resulting nutrient deficiency must be made up in the fertiliser program. An application of NPK fertiliser containing magnesium was made and the grassed areas gave excellent results. Some isolated areas of poor drainage gave a few problems with shrub plantings but no severe salt effects were seen.

Amelioration of these soils is certainly possible. It requires careful analysis, some time allowance for amelioration, and budgetary considerations for machinery operations. The more hostile the soil, the greater time allowance should be made. The material above was reasonably permeable so leaching was effective. We have another job involving heavy sodic, alkaline clay which is taking up to a year to get results from the desired species. As a compromise, the architects can allow for the use of more salt tolerant species if the planning and site analysis gives pre-warning of difficult soil conditions. The above amelioration resulted in considerable savings on the overall budget, as no topsoil was imported.

Further Reading

Craul P.J. 1992. *Urban Soil in Landscape Design*. John Wiley & Sons New York . pg 59 and pp 165...166.

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