

A Biodynamic Approach to Dryland Salinity and its Potential to Ameliorate Degraded Landscapes – Hyden Western Australia

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INTRODUCTION

This article is a companion to an earlier article published in the last issue of Biodynamic Growing (Issue No. 4) where, in case study one, definitive comparative field measurements of soil physical, chemical and biological properties complemented the farming observations of John Cashmore, a biodynamic farmer at “Nyonger” near Hyden, Western Australia.

This second article presents a summary of case study two and is *not* a definitive study of the amelioration of dryland salinity landscapes, but an interim report of the ongoing investigations at “Nyonger”.

The claims of John Cashmore can be appreciated and understood from his observations and a comparison of the government aerial photographs (DOLA 1994 and 1999, refer Biodynamic Growing issue No. 3, pages 21-24) but could not be confirmed on site by the authors due to an extensive, three months flooding of the areas in question in 2000: the flooding masked the improvements evident in the photographs. (Experimental work was conducted in October 2002, a drought year).

However, what evidence remained confirmed that there had been a recovery of the least salt-scalded areas prior to the flooding. This evidence, together with the findings of case study one, provided the basis of a hypothesis for how the expression of biodynamics can be physically, chemically and biologically experienced in the dryland salinity areas. Further experimental work is planned for October 2006.

Following is an abridged version of the relevant results of case study two: a 325 metre longitudinal section taken west through the landscape shown in figure 1.

2 HISTORY OF LAND USE

Figure 1 shows Site 3. In the foreground is an agricultural area treated with biodynamic preparations and in the distance is the virgin bush, which was also part of the study. Many years ago this area was cleared of natural vegetation, cropped and now occasionally grazed. This land was lightly seeded in 1997 with tall wheat grass and billencia clover.

The January 2000 flood collapsed the soil, raised the water table and destroyed the areas reclaimed from salt

scald shown in the aerial photographs. In October 2002 the remnants of very small ‘ice plants’ (previously succulents but now with the appearance of a miniature petrified forest) on the slopes leading up to the sandy rise were discovered and recorded. The top line of the ‘ice plants’ clearly defined the upper contour of the flood level. There had been no re-growth since the January 2000 flood, possibly due to successive droughts, although other succulents were starting to reappear in opportunistic niches over the saltpan.



Figure 1 General picture of Site 3 looking west shows the salt scalding. This landscape was once a stable Bioregion which was cleared for agricultural land. On the sandy rise in the distance is ‘improved’ pasture.

3 RESULTS AND DISCUSSION

Soil aggregates are a sign of soil structure, and as expected, the lack of soil aggregates seems indicative of the salty collapsed soils found on this site. The slaking (a measure of the amount of sodium in the soil chemistry) results varied quite considerably and generally there were few aggregates except in some small areas shown in Figure 2, which showed a hard crust millimetres thick covering the saltpan.

A deep pit dug near chainage 225m showed a heavy clay profile interconnected with shoe-string sands down to at least 2m deep with the ground water table 1 m from the clay surface of the salt pan. Groundwater salinity & pH readings were 65,587 parts per million (ppm) and 3.67 respectively. Similar values were measured in recently dug new surface drains (engineering solutions) about 1.5 km downstream of the test site.

Soil salinity profiles at sample points along the longitudinal section clearly showed reduced salinity



Figure 2 Shows a close up of the soil and scald at chainage 225m. In January 2000 this soil was underwater for 3 months.

from the groundwater 'surface' to the surface of the land. This was particularly so where there was sand over clay on the sandy rises. The deeper the sand cover over the clay the lesser the salinity in the surface soil. This finding was supported by the 'improved' pasture on the higher ground and the noticeable increase in soil moisture with depth. Such soil moisture was indicative of the capillary fringe extending from the water-table.

Prolonged flooding not only drowns the soil, killing off most of the aerobic soil biota but also raises the water-table. The higher the water table, the higher the capillary fringe can reach with its salt laden solution, and if the capillary fringe reaches to the surface, the salt-laden solution can be evaporated off leaving its salt on the surface as a salt scald. As the biota dies and the soil chemistry changes, due to the increases in salt, most soil structure is lost, causing the bulk density of the soil to increase. Less pore space, more mass. It is not surprising to note that John Cashmore consistently observed that salt affected soil collapsed about 100mm.

There is no doubt in the author's experience that whilst there are high saline water tables and capillary fringes reaching to the surface of the land, salt scalds and salty soil profiles will persist. However, there are at least two factors that significantly influence the remediation of a salt affected landscape. The first factor is farm management. If the farm management practices result in the build-up of soil biota then much more water is retained in the soil 'humus' and is available for crop growth, which results in a reduction of recharge water to the groundwater, minimising downstream problems. The second factor is that if farm management practice adds salts, (artificial soluble fertilizers), not only is the amount of salt in the top 100 millimetres increased but more importantly the development of soil biota is severely inhibited.

Reclamation of a saline landscape is a most delicate incremental process, which starts with the absence of saline capillary fringe at the surface and the reintroduction of soil biota, which in turn, at the microscopic level, commences the process of soil enlivenment. This vital process includes the leaching away of surface salt and the commencement of the development of soil profile. Such a soil starts to exhibit

an increase in its soil porosity, soil aggregation and a drop in soil acidity.

The hypothesis is:

Biodynamic preparations (in particular BD 500) are an important substance in the establishment and enhancement of soil biodiversity. This includes micro-organisms like fungi which increase both the organic carbon content of the soil and soil porosity. A 'puffing-up' of the soil takes place, allowing the soil to respire. This then starts a chain reaction in the further development of soil structure, which becomes the beginning of reversing dryland salinity and other land degradation problems. It is the author's intention to further test the above hypothesis in October 2006 at 'Nyonger', Hyden, W.A.

4 CONCLUSIONS

It is concluded that;

1. Farm management practices are directly related to the extent, duration and severity of local dryland salinity.
2. Farm management practices which increase soil biota (raised organic carbon levels) stores additional water in the humus for plant production and reduces recharge to the groundwater.
3. Farm management practices which increase soil biota also promote soil structure and increased soil porosity, which in-turn enables salt leaching and the commencement of soil profile respiration.
4. The remediation of damaged saline landscapes is a most delicate process commencing at the microscopic level and is possible only if the capillary fringe is inhibited, through one means or another, from being present at the surface of the soil.
5. Engineering solutions such as subsurface drainage lowers local groundwater and is a way to remove excessive recharge to the groundwater and lower the water table in upstream localities, hence lowering the capillary fringe from the soil surface.
6. Farm management practices which add salts to the soil severely inhibit the establishment of biologically active soils and retards the natural process of soil improvement.
7. Further study is required to understand the observations of John Cashmore.
8. Alex Podolinsky's article on 'Salinity' in Biodynamic Growing No. 3 is recommended reading.

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