Cover crops for the management of saline seeps in areas of high flooding risk

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INTRODUCTION

Cover crops (CCs) contribute to mitigate the salinization of soil's surface and manage shallow water table in areas of high flooding risk. They should be used to confine the movement of salts from saline seeps and groundwater to higher portions of the landscape. This is important during the long bare winter fallows that are usual in Argentinean cash crop production.

CCs are recommended in semiarid and sub-humid (700-900 mm/year) temperate plains of poor drainage with a high risk of flooding and salinization due to a saline shallow water table (Fig. 1). They have been successfully employed in the lowlands of the Western Argentinean Pampas, where the rise in groundwater level due to land cover change is threatening millions of hectares of productive land. These sandy-loam textured soils are being degraded due to groundwater salinity and the flooding risk.

Fig 1. Shallow saline water table.

METHODOLOGY

For a successful germination and establishment, CC must be sowed when soil moisture is high enough to reduce surface salinity and salts have been leached further down in the soil profile. However, analysis of soil and natural vegetation of the site are very helpful. In the Argentinean Pampas *Sporobolus sp.* indicates flooding while in saline soils *Distichlis sp.* and *Salicornia sp.* are common. *Conyza sp.* and *Salsola sp.* appear in improved conditions.

Generally, a mixture of winter CCs is the best option under multiple threats (salinity, sodicity, waterlogging, etc.). While barley demonstrates to be the best CC for saline soils, triticale (Fig. 2) has a good behaviour in waterlogged conditions. Well adapted legumes are *Lotus tenuis* and *Melilotus albus*, while vetch has low salt tolerance.

Fig 2. Triticale sowed over natural saline vegetation.

RESULTS

An example of the results that can be achieved with this practice is resumed in Fig. 3. A cover crop of 70% triticale and 30% vetch was planted at a density of 80 kg/ha in a 92-ha field in early fall.

Salinity at the soil surface was reduced in the entire area, especially in the lowest portion of the landscape. The water table also receded considerably, reducing flooding risk, despite high rainfall (207 mm) during the CC growing season. Thus, 45 ha could be recovered for crop production, representing almost half of the field with only one CC season. Currently the field is managed with a rotation of winter CCs and summer cash crops.

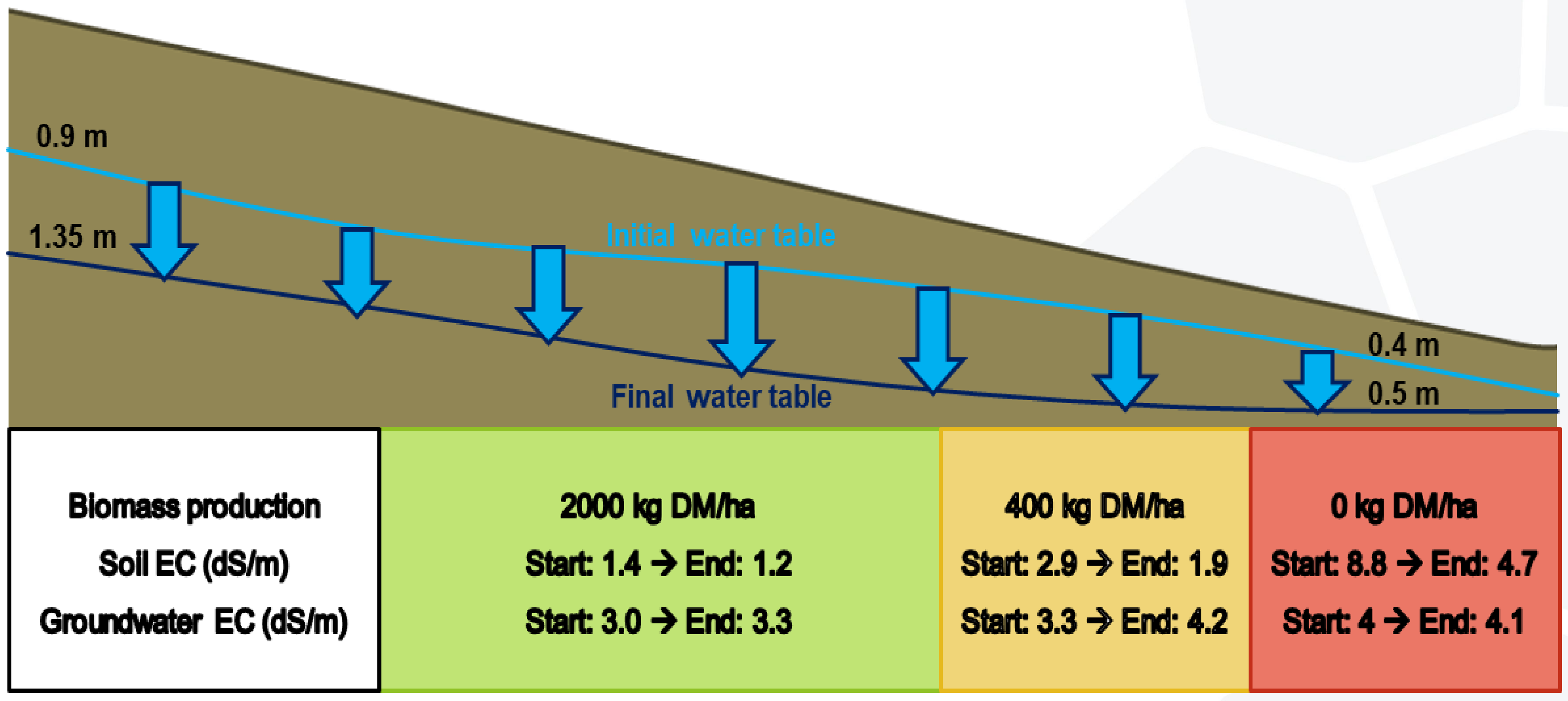

Fig 3. Cover crops reduce soil's surface salinity and contribute to the lowering of a shallow water table.

Apart from reducing the capillary flow of salt water to the soil surface and lowering the water table, CCs added carbon to the soil thus improving soil structure and pore system, which in turn favours the leaching of salts and sodium (Fig. 4).

Fig 4. CCs improve soil structure, water infiltration and salts leaching.

Legumes can also provide nitrogen for following cash crops (Fig. 5).

Fig 5. Legumes in mixed CCs contribute to soil fertility

CONCLUSIONS

CCs can contribute to mitigate the salinization of the soil's surface and to lower the shallow water table in areas with a high risk of flooding. Thus, with recurrent use of this practice salinity is confined to the lower portions of the soil profile, allowing successful planting of crops and pastures (Fig. 6).

At a basin level, the use of CCs is not enough to manage the excess of water and to reduce shallow water tables during flooding events. This practice should be implemented with a systemic approach, including pastures and trees in recharge areas and salt tolerant crops in discharge areas.

Fig 6. Sorghum is an excellent cash crop after winter CCs.

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