Salt Tolerance Test for Ozbreed Plants by Todd Layt

Introduction

Landscapes and gardens are often required for areas adjacent to the coast. These areas can be subject to salt laden winds, or even salt spray on occasions when the weather is rough enough to cause such events. More and more developments are occurring near the coast in these types of situations. Designers, home owners, landscape Architects, and Landscapers need to know which plants can tolerate high levels of salt from winds and spray. This investigation is concerned with the effects of salt on the leaves and roots of the plants, and the experiment tried to mimic the effects of salt spray. The aerial drift of salt-laden water droplets that are deposited on plants causes salt spray damage. When droplets evaporate, they can penetrate plant tissue, causing direct damage. Salt spray damage to plants is most frequently seen on seaside plants. Additional stresses in these areas, including wind, sun, heat, exposure, heavy traffic and saline soils, increase the likelihood of damage. This investigation tests which Ozbreed plants cope best with Salt damage.

Materials and methods.

Double replicated pots of 16 different Ozbreed plants were grown in 140mm pots. These pots were split into 4 groups. All plants would be irrigated with fresh water as per normal in the nursery. In addition each of the 4 groups of 32 pots would be watered 18 times over a 4 month period with 15 litres of water with a different salt to water concentration. The first group (0) concentration was basically Sydney tap water, which was the control, effectively having Zero Salt, although it is well known that even tap water has very small amounts of salt in it. The next group (10) was watered with 10000 parts per million of salt in the water. To make this 10 grams of salt was added to each litre of water. This mixture is approximately 30% of ocean salt water strength. The next group (20) was watered with 20000 parts per million of salt in the water. To make this 20 grams of salt was added to each litre of water. This mixture is approximately 60% of ocean salt water strength. The final and fourth group (30) was watered with 30000 parts per million of salt in the water. To make this 30 grams of salt was added to each litre of water. This mixture is approximately 90% of ocean salt water strength, or equivalent of salt water found in many bays and lakes.

Testing

On 18 separate occasions spread over a 4 month period in spring and summer 2006/2007 15 litres of these salt water mixtures were poured evenly over 32 plants. The Salt water was always left for at least 4 hours, and generally for at least 16 hours before any fresh water irrigation was applied. This allowed the salt to dry on the plants, mimicking salt spray. The plants with the higher concentrations were often left with a white salt residue after the sun dried the application, and often even after irrigation the residue could be seen. After 12 applications, the plants were evaluated, and then again two months after the 18th application. The lapse in time was to let the full effects of the salt happen. On these occasions, each pot was rated for loss of quality. This was done by giving the best sample pots a 0% loss in quality. Then the other samples were rated compared to the best samples, giving them a figure in percent, how much quality was lost. EG; King Alfred at 30000 ppm had lost 15% quality after the 18 applications and 6 months in total time, whilst the Anigazanthos flavidus had lost 70% in quality.

During this time a trip to ocean side vegetation showed that the salt residue was far more on the test pots of 20000 ppm and 30000 ppm, then at the actual beach side area. However it must be noted this trial showed the effects of higher quantities of salt over a shorter period, rather than the moderate salt laden winds over a longer period. It also involved salty water saturating the plant, and roots, which allowed for evaluation of how the plants coped with salty water in general. This research is clear evidence of which plants from the Ozbreed plant range can handle higher salt levels compared to others. This can then be compared to real world data, and plants such as Little Jess, a Dianella caerulea 'DCMP01' which has been used in coastal situations on many occasions, as to have Breeze, and Little Rev. This test was more harsh on the plants than a typical salt laden wind would be.

Results

The results of this research clearly show that at the higher rates of 20000 ppm and 30000 ppm all plants are adversely effected. However some plants perform better than others, and some did not tolerate these salt applications at all, or at least very badly. All plants were dwarfed, or made more compact by the high saturation salt applications, which is typical of what happens to plants that are adjacent to the ocean, and bombarded with salt laden winds. Some plants, like King Alfred, a Dianella caerulea had relatively clean more compact foliage as a result of the salt. It performed the best, only rating a 15 percent loss with 30000 ppm salt applications, and only a 2 percent loss of quality at the 20000 ppm rate. It averaged only an 8.5% loss in quality over the 2 tests.

Lomandra Nyalla was the second best, and this is not surprising, as the Parent plant of Nyalla, namely Cassica, came from a coastal sand dune variety. Nyalla had a loss of only 15 percent at the 30000 ppm and 4 percent at the 20000 ppm. Other plants to do well in the trial were Wingarra, Little Jess, Katrinus Deluxe, Breeze, Nafray, Little Rev, Eskdale, Tasred, Tanika, Katie Belles, and Cassa Blue. Interestingly, the Lomandra longifolias all did better than the Lomandra hystrix, however, Katie Belles a Lomandra Hystrix still had good results. Tropic Belle, another Lomandra hystrix had a poor result, showing it is not suitable for high salt conditions. This shows that just because one cultivar from a species does well, does not mean all from that species will. This suggests it is necessary to test all varieties before using them in a salty situation, and it makes it more risky to use a common form, with unknown salt tolerance.

	Names		Average % loss in Quality after 12 aplications water/Salt				Average % loss in Quality after 18 aplications water/Salt **				
	Trade Name Rank In salt Tolerance 1. Best	Botanical Name	0 salt	10000 parts per million 1/3 Bay salt * water strength	20000 parts per million 2/3 Bay salt * water strength	30000 parts per million Full Bay salt * water strength	0 salt	10000 parts per million 1/3 Bay salt * water strength	20000 parts per million 2/3 Bay salt * water strength	30000 parts per million Full Bay salt * water strength	Average 20000 & 30000 PPM 18 Applics.
1	King Alfred	Dianella caerulea 'John 316'	3	0	3	5	3	0	2	15	8.5
2	Nyalla	Lomandra longifolia 'LM400'	0	2	4	5	0	2	4	15	9.5
3	Wingarra	Lomandra confertifolia 'Sir 5'	2	0	3	7	0	2	5	20	12.5
4	Little Jess	Dianella caerulea 'DCMP01'	0	2	3	7	0	3	10	20	15
4	Katrinus Deluxe	Lomandra long. 'Katrinus Deluxe'	0	0	3	8	0	0	10	20	15
4	Breeze	Dianella caerulea 'DCNC0'	2	0	2	8	3	0	10	20	15
7	Nafray	Pennisetum alopecuroides'Nafray'	7	0	3	5	7	0	8	24.5	16.25
8	Little Rev	Dianella revoluta DR'5000'	10	2	8	0	0	8.5	20	14.5	17.25
9	Eskdale	Poa labilardieri 'Eskdale'	0	4	2	4	0	10	5	30	17.5
10	Tasred	Dianella tasmanica 'TR20'	5	0	3	5	3	0	10	30	20
10	Tanika	Lomandra longifolia 'LM300'	0	5	2	10	0	8	5	35	20
10	Katie Belles	Lomandra hystrix 'LHBYF'	0	0	1	3	0	5	15	25	20
13	Cassa Blue	Dianella caerulea 'DBB03'	2	0	3	5	0	5	20.5	25	22.75
14	Gold Velvet	Anigazanthos flavidus	0	5	3	20	0	5	20	70	45
15	TropicBelle	Lomandra hystrix 'LHCOM'	0	5	7	15	0	5	60	80	70
16	Savannah Blue	Lomandra filiformis 'LMF500'	0	0	5	10	0	0	100	100	100

Based on this research all plants are suitable for coastal salt spray, except for perhaps the three plants in the shaded areas.
Even those in the shaded are could tolerate indirect coastal salt ladden winds, just not direct coastal salt spray drift on front line winds.

* Bay salt water strenght based on brackish water strenght of inlets, such as lakes, bays etc.
Ocean salt water is approximatly 34000 parts per million.
** This reading was taken 4 months after application of salt stopped to give time for full damage.

Conclusion

This investigation provides evidence that many Ozbreed plants can cope with relatively high salt laden winds, or reasonable amounts of salty water. It does not quantify how much salt water in parts per million each plant can tolerate over a long period, but it does indicate which plants would tolerate higher levels of salt water in general. For example, if someone was using a salty bore, or grey water with high salt content, it would be safer to use one of the plants that scored better in this test. If a coastal site needed to be revegetated, it would also be safer to use one of the plants that scored better in this test.

Photographs from the 2006/2007 salt trail on Ozbreed Plants.

Tasred did well in the salt trials. As with all plants, the 30000 parts per million salt water had an effect of making the plant more compact. (Far Right). Left to right; 0 salt, 10000ppm, 20000ppm, 30000 ppm.

All photos are from left to right; 0 salt, 10000 ppm salt, 20000 ppm, and 30000 ppm. When evaluating quality, the fact that the plant was more compact was not used in rating. These King Alfred were rated on health, and tissue damage

Katie Belles, a Lomandra hystrix did well but not as well as the Lomandra longifolia species. It was much better than the TropicBelle at the high salt levels.

This is a picture of the Velvet Kangaroo paws. They did OK at the lower salt levels, but all the Lomandra longifolias, and Dianellas did better at higher salt levels.

Little Jess although more compact at the higher salt levels, was still healthy, showing it would be good for salt laden wind areas.

It must be noted in general high salt tolerant plants were tested in this experiment. Savannah Blue coped well with the 10000ppm, but not the higher salt rates.