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UNIVERSITY OF NEW ZEALAND

兰州大学,草地农业科技学院

International Symposium on Forage Disease & Grassland Management

Observations on the role of endophyte in field performance of ryegrass and tall fescue in New Zealand

Cory Matthew

新西兰，梅西大学

THE ENGINE OF THE NEW NEW ZEALAND

alk outline

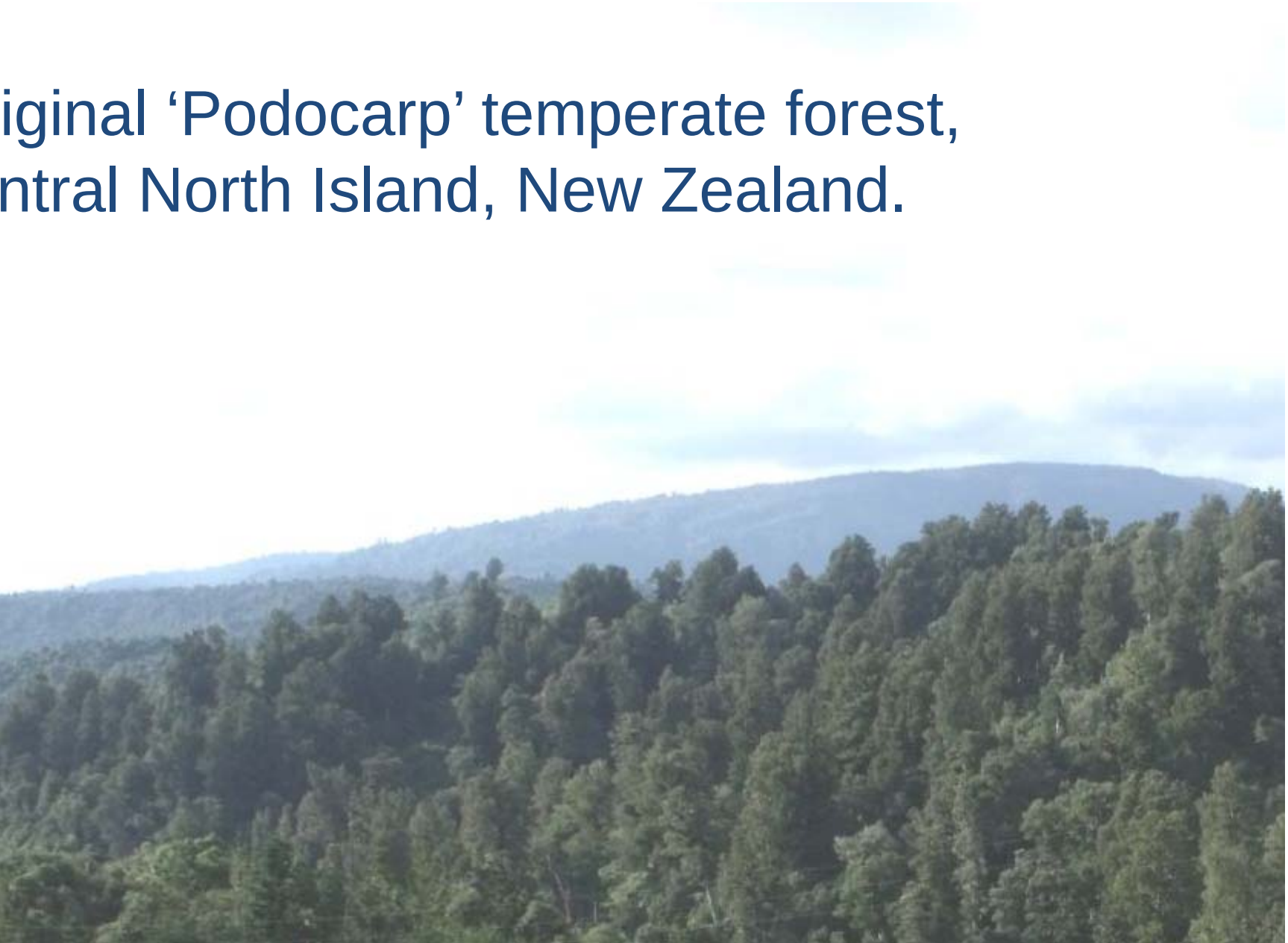
New Zealand: Forest to farm;
Changing climate;
50 years ago with endophyte;
Animal health disorders;
Metabolic cost to the host;
Insect protection to the host;
Water balance benefits to the host;
Transmission;
What benefit to a farmer?

ndophyte distribution in the meristem

Confocal laser microscope image.

Photo courtesy M Christensen, AgResearch

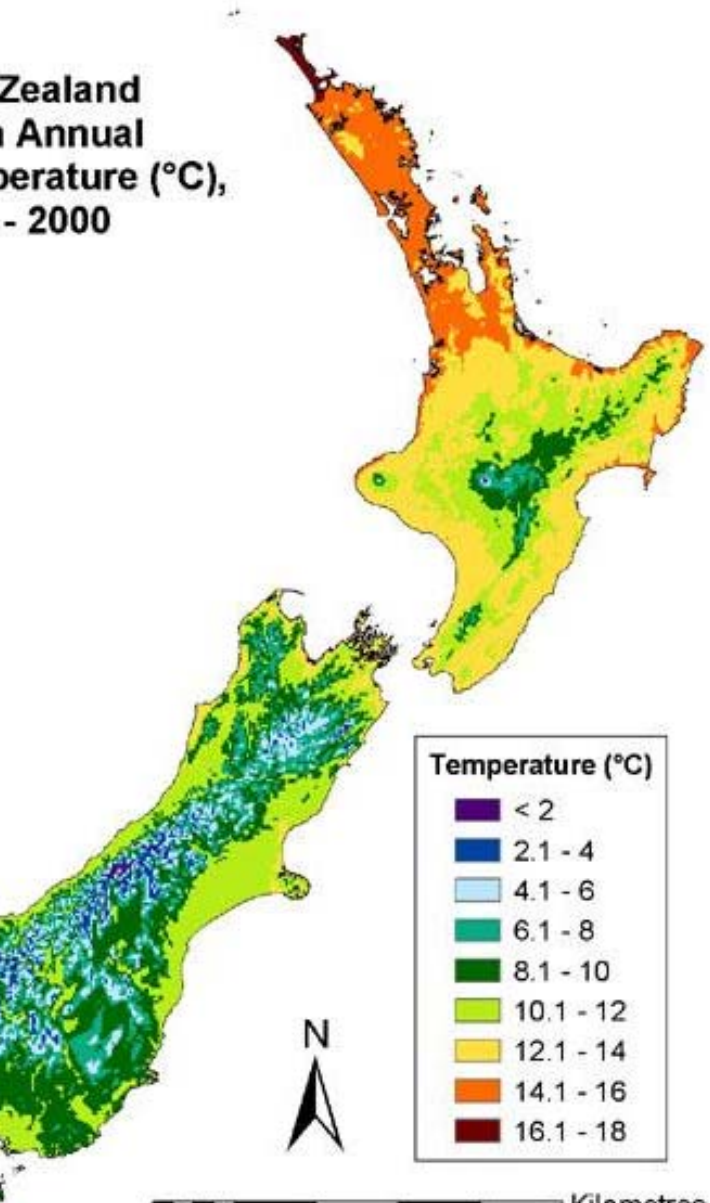
iginal ‘Podocarp’ temperate forest,
ntral North Island, New Zealand.



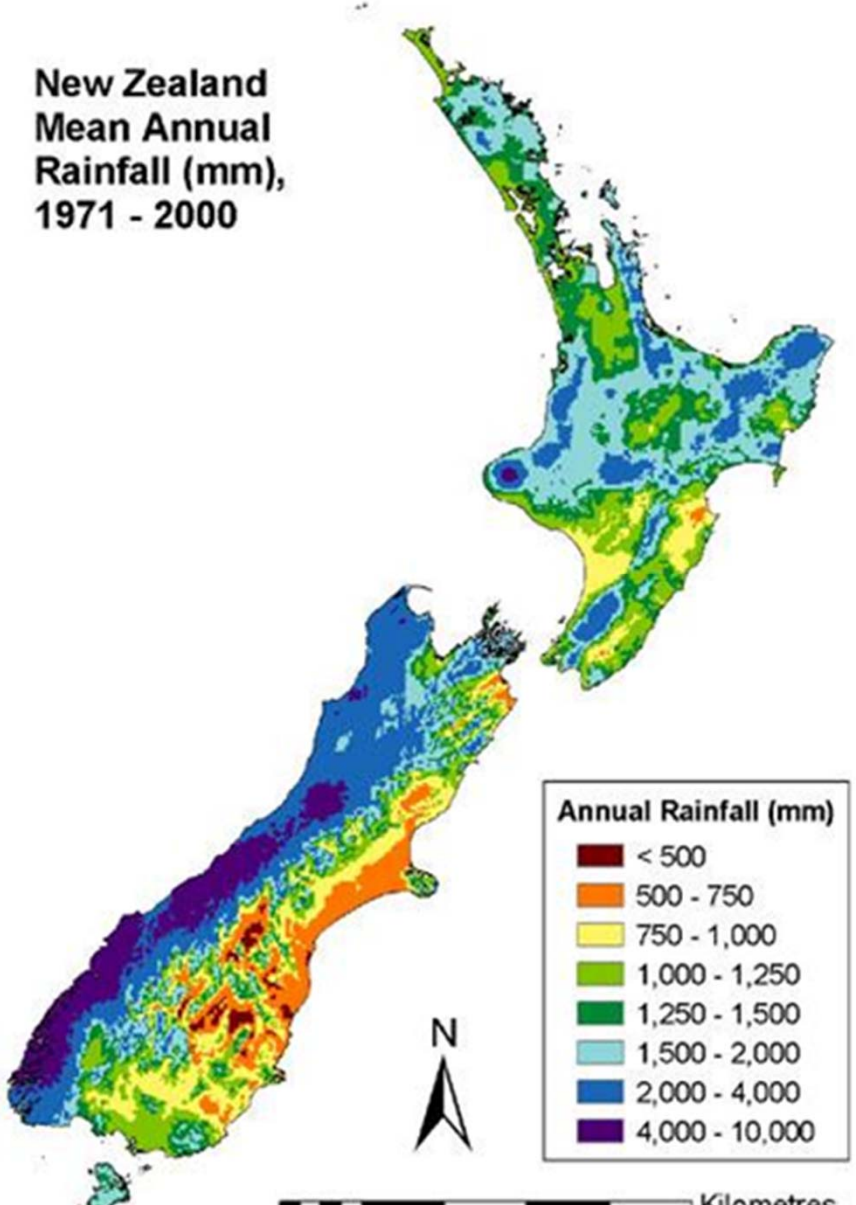
st clearing

A dairy farm today

Zealand
Annual
perature (°C),
- 2000



New Zealand
Mean Annual
Rainfall (mm),
1971 - 2000



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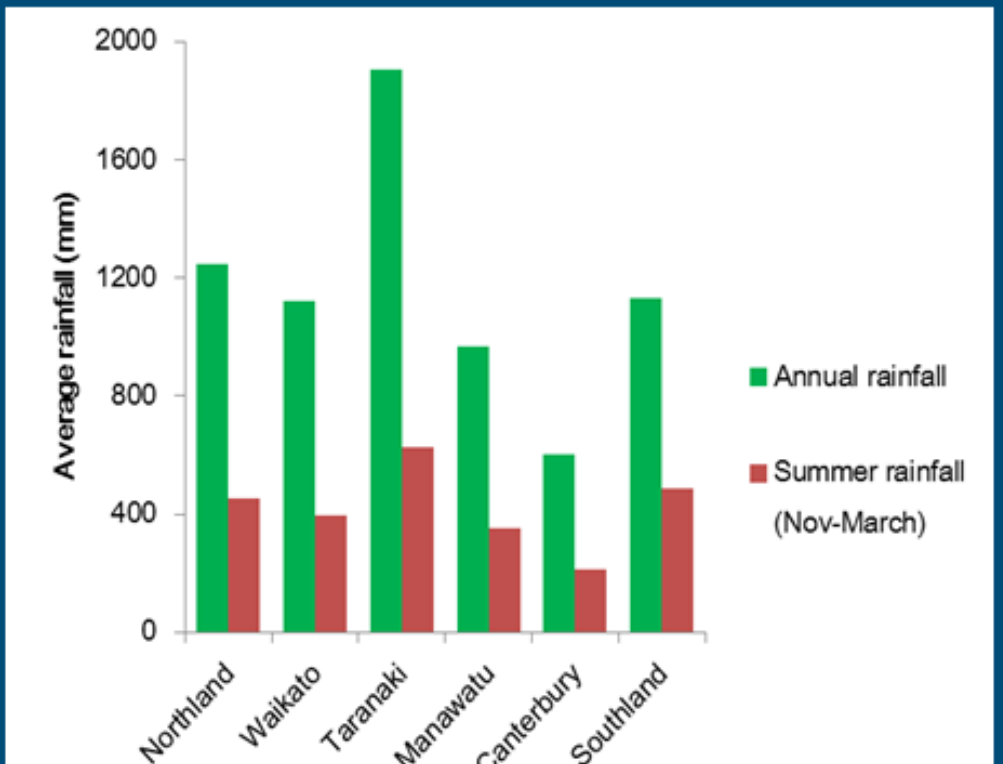
Rainfall



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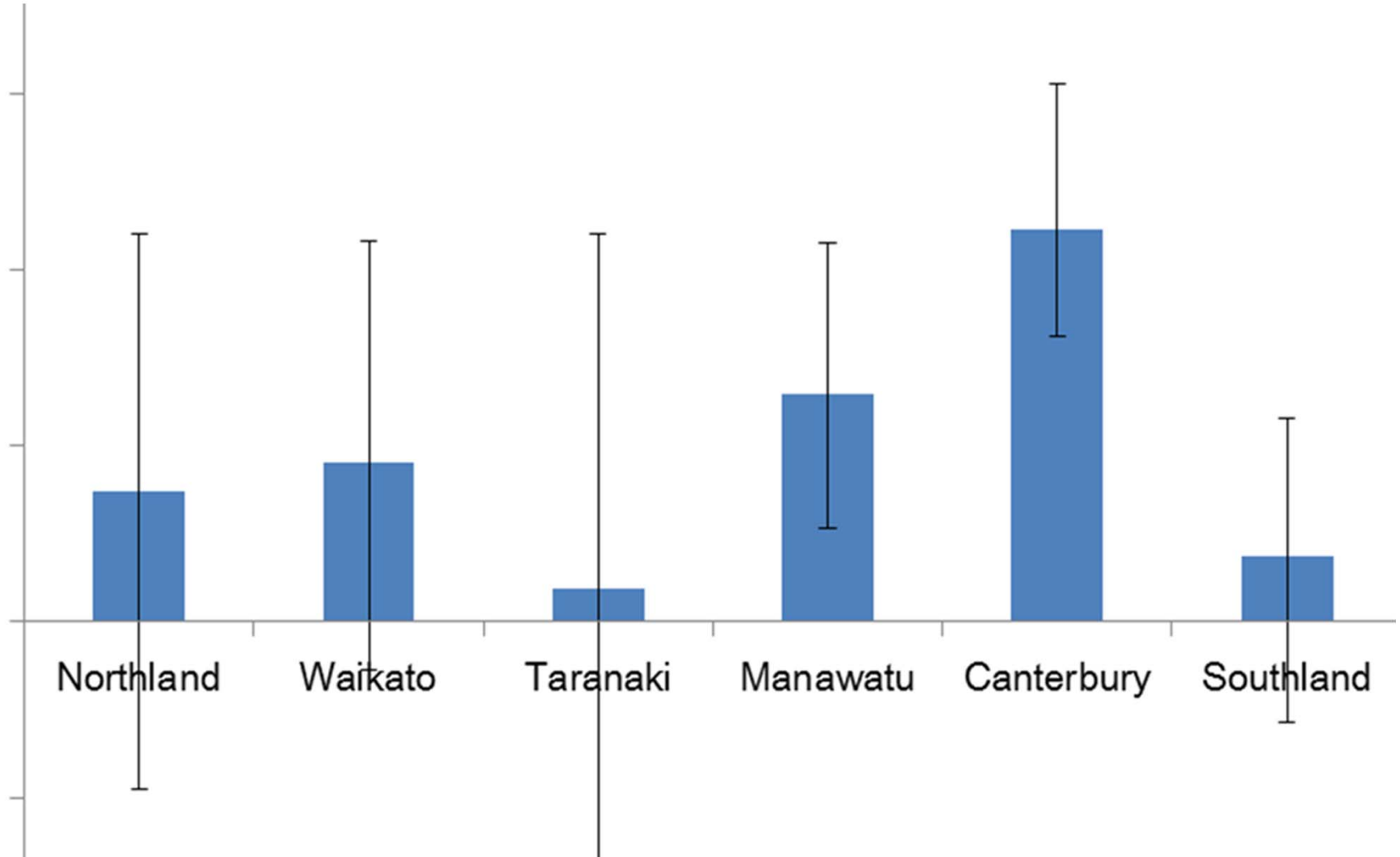
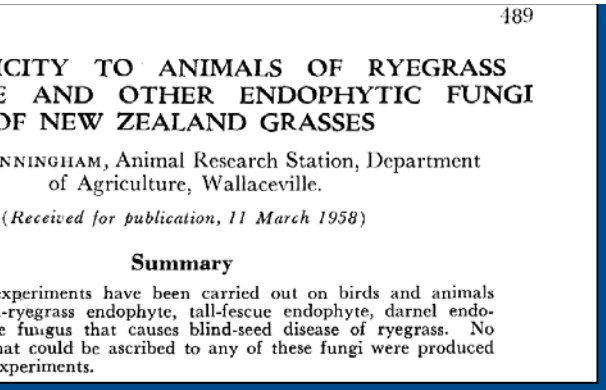


NZ Drought March 2013



489

ICITY TO ANIMALS OF RYEGRASS
E AND OTHER ENDOPHYTIC FUNGI
OF NEW ZEALAND GRASSES

NNINGHAM, Animal Research Station, Department
of Agriculture, Wallaceville.

(*Received for publication, 11 March 1958*)

Summary

xperiments have been carried out on birds and animals
-ryegrass endophyte, tall-fescue endophyte, darnel endo-
e fungus that causes blind-seed disease of ryegrass. No
hat could be ascribed to any of these fungi were produced
xperiments.

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Cunningham, IJ

on-toxicity to animals of ryegrass endophyte and her endophytic fungi of New Zealand grasses.

w Zealand Journal of Agricultural Research
lume 1(1958):489–497

stract: It is reported from the Animal Research Station, allaceville, that in feeding experiments on fowls, arrows, rats, mice, and sheep rye-grass [*Lolium*] ected by the blind seed fungus (*Gloeotinia temulenta*) d perennial rye-grass, tall fescue [*Festuca arundinacea*] d darnel [*L. temulentum*] carrying their endophytes were

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arching for the cause of ryegrass
ggers (1978 – 1981)

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- Farm hand" with Reg Keogh, DSIR Grasslands – ecology" approach – visit outbreaks, look for common ctors, etc.;
- ther active scientists Rex Gallagher (chemist) and argaret di Menna - hypothesis: toxin produced by soil *enicillium* spp and translocated from roots to leaves, andidate alkaloid verruculogen;
- est fungal isolates supplied by RG (intraperitoneal jection to mice) to assess tremorgenic activity & dminister verruculogen to sheep;
- oncluded verruculogen not ryegrass staggers causal gent (metabolic half life too short – hours not days).

1983; Endophyte identified as
ause of ryegrass staggers

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Identification of alkaloids;

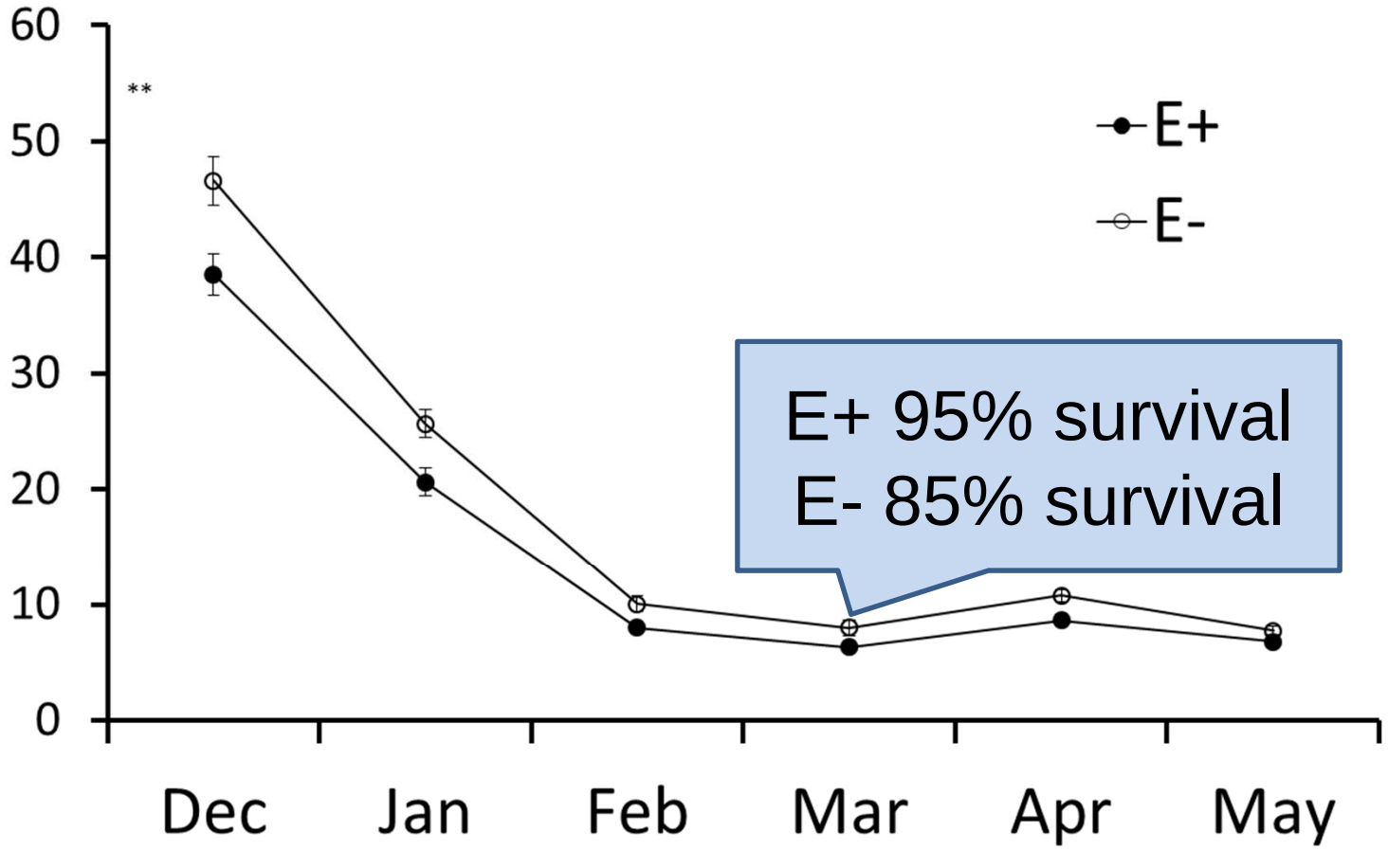
- Lolitrem Bad
- Peramine Good
- Ergovaline Vasoconstrictor + Insect deterrence
- Lolines Good (Little in ryegrass)

Endophyte receives a Latin name;

Characteristically strong (highly significant)
endophyte strain x plant genotype interactions

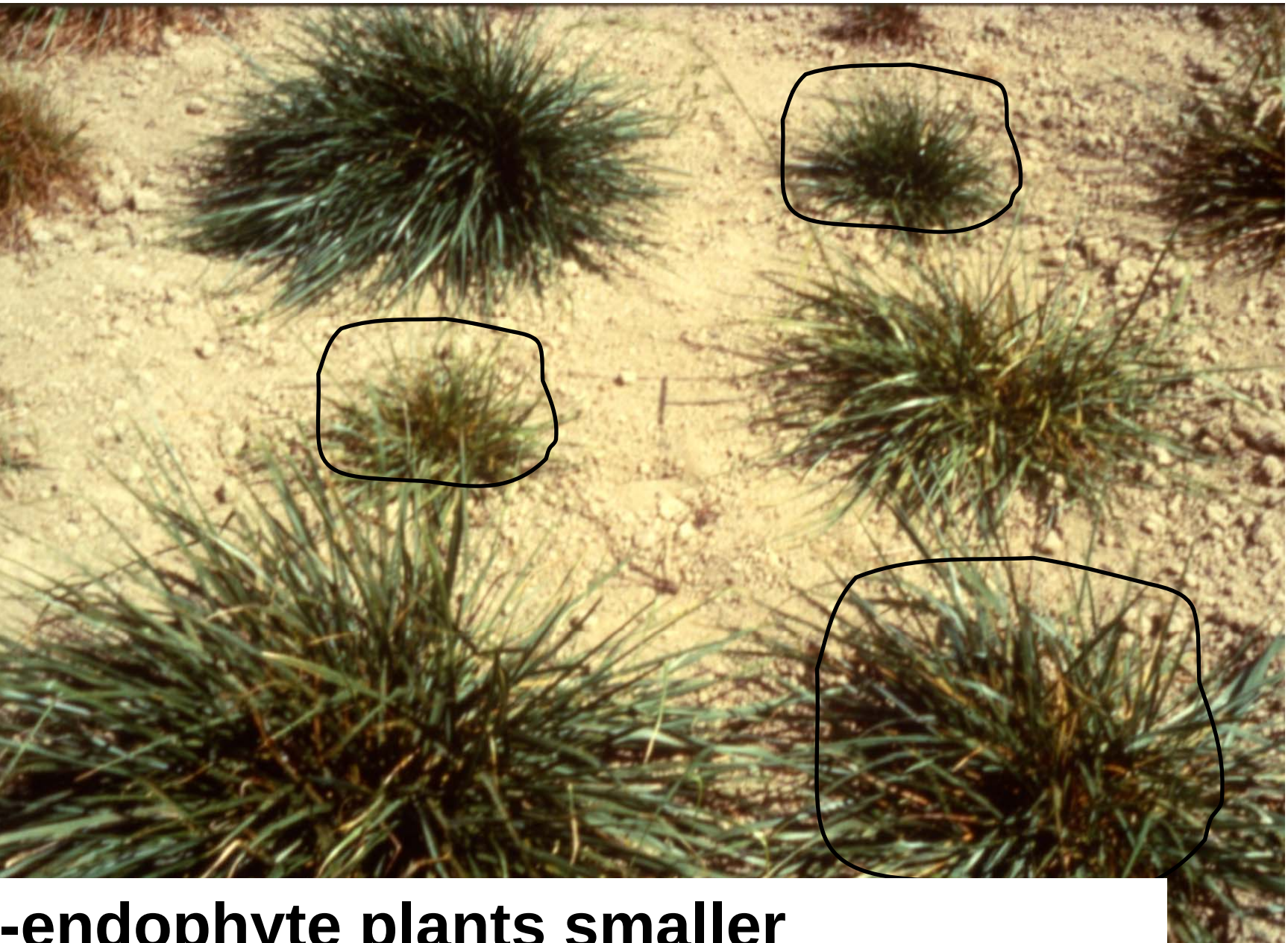
gy substrates for endophyte MUST come by
ion from plant cells

etabolic cost to the st plant (?)

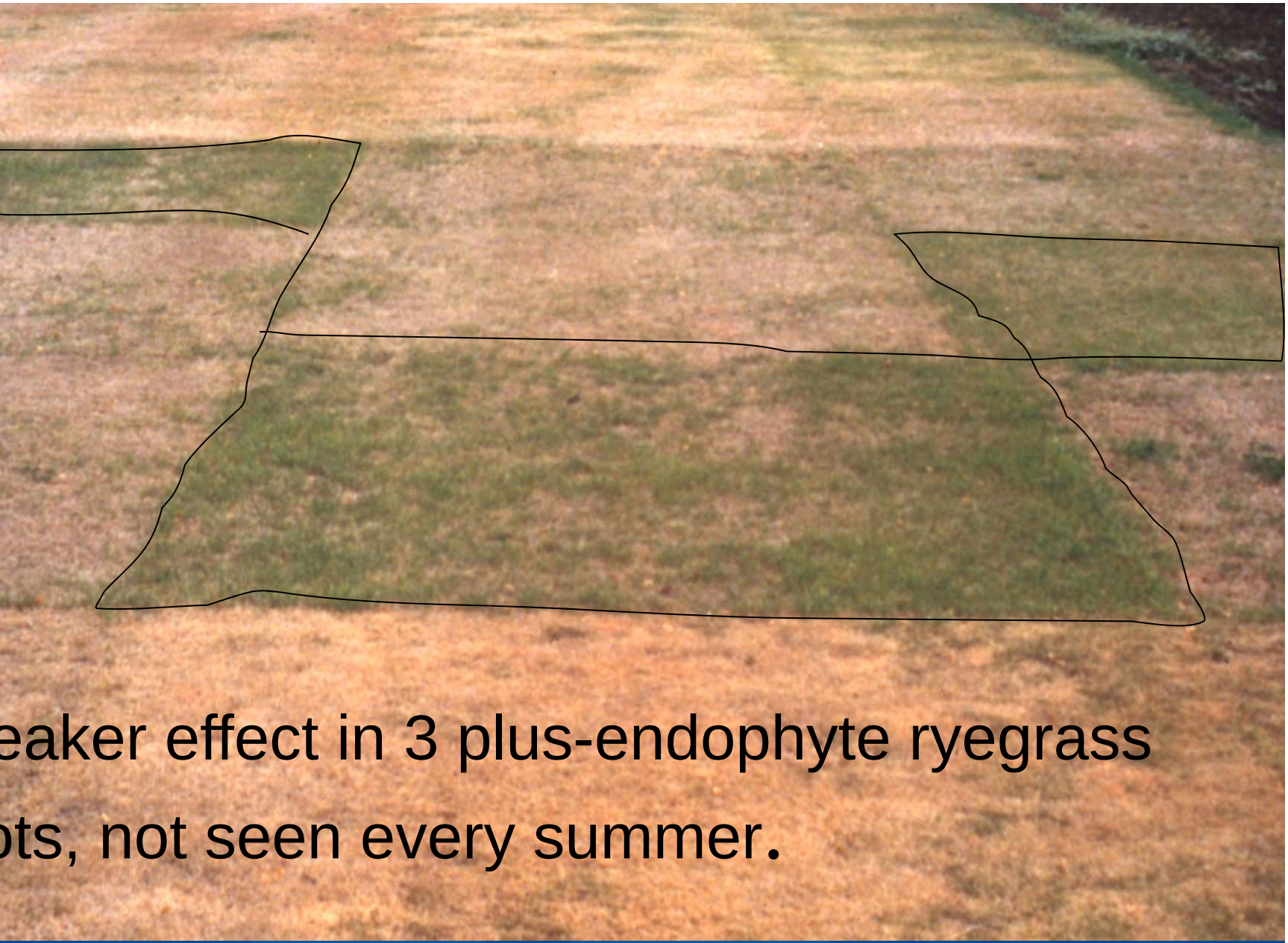


Endophyte-mediated feeding deterrence in AR1 endophyte, attributable to peramine alkaloid.

Photo courtesy Alison Popay.



-endophyte plants smaller



eaker effect in 3 plus-endophyte ryegrass

ots, not seen every summer.

Endophyte effects on water balance

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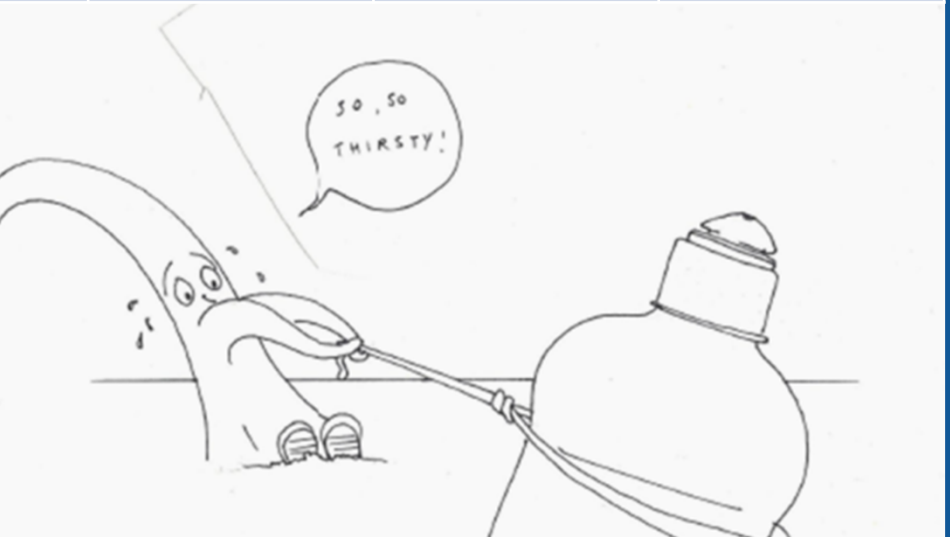
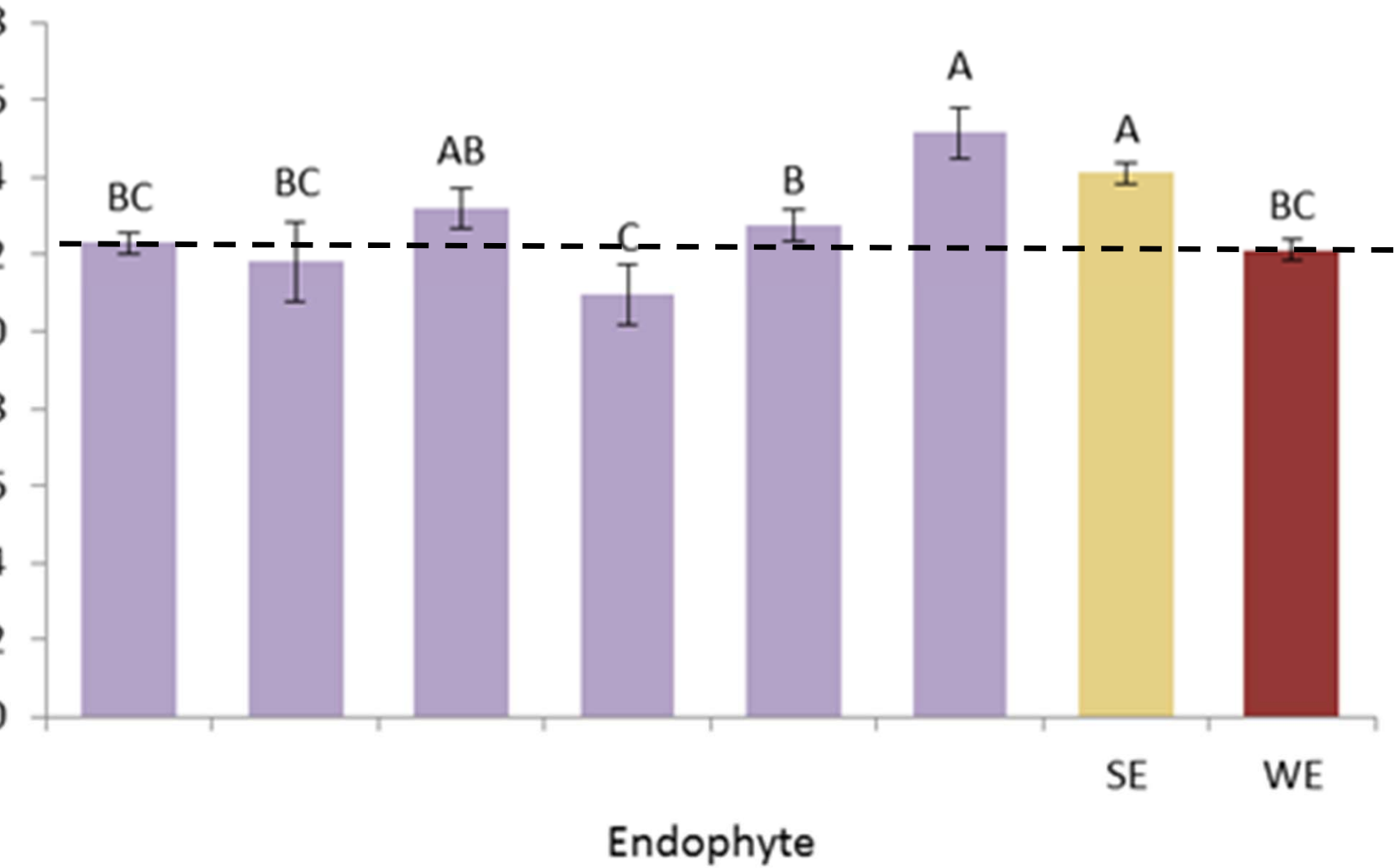
Osmotic Potential (Mpa)			
ll watered		Stressed	
	E+	E-	E+
6	-0.45	-1.29	-0.85



- Anecdotally widely agreed that endophyte enhances drought resistance;
- He (2013, NZGA in press) obtained P < 0.10 for endophyte x water interaction for LWP (MPa) (similar result for RWC):

Other points

- Transmission consistency in seed production a significant concern in some commercial strains;
- Adds $NZ 2.00 to market value of seed;


BC
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AB
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Endophyte

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Concluding Remarks

A 75 year technology development journey since first described in NZ by Neall (1939);

Likely will be major future developments (new secondary metabolites with antibiotic activity or development of drought resistance activity);

Commercial opportunities derive from endophyte technology;

Esstimated 90% adoption by farmers in NZ (less