PLANTS · CHEMICAL DEFENCE & BROWSERS

Talking Trees

Tannins, browsers and the famous kudu story — what the science supports, and what is still a campfire tale.

SERIES **SAFARI NOTES** FORMAT **FIELD & GUIDING NOTES** PUBLISHED BY **THE SAFARI SHOW**

> Ask almost any guide in southern Africa and you'll hear it: acacias poisoned thousands of kudu, then warned their neighbours with a gas on the wind. Parts of that story are good science. Other parts have never been shown. This note separates the two, so you can tell it honestly — and it's still a great story.

01 Trees can't run, so they fight with chemistry

A tree can't walk away from a browser, so many defend themselves with thorns and with chemicals. In African savanna trees, one of the most important chemical defences is **condensed tannin**.

Tannins work by **binding to proteins and enzymes**. In a ruminant such as a kudu, they reduce the activity of the rumen microbes that the animal depends on to break down plant material, so the animal gets less out of each mouthful.

FIELD EVIDENCE FROM SOUTH AFRICA

A classic South African savanna study (Cooper & Owen-Smith, 1985) tested how much kudu, impala and goats liked the leaves of **14 woody species**. Palatability was most clearly related to leaf condensed-tannin content: in the wet season, plants with more than about **5% condensed tannin** were refused as food. The authors pointed out that big browsers are hit hard by tannins because they rely on microbes fermenting plant cell walls for part of their energy.

A naming note: most African "acacias" have been moved into the genera Vachellia and Senegalia. The name Acacia now belongs to the mainly Australian wattles. You'll still hear "acacia" used for both in the bush.

02 Browsing makes leaves more bitter

A 12-month study of **giraffe feeding in the Kruger National Park** (Furstenburg & van Hoven, 1994) found that:

- Giraffes **avoided foliage with high tannin levels**, and tannin lowered both the appeal and the food value of browse.
- **Browsing disturbance increased the tannin content** of the foliage.

- Tannin levels changed **daily within a single tree's canopy**, varying with temperature, light intensity and the growth stage of the leaves.

The often-quoted detail that tannin levels jump **within minutes** of browsing comes from this work, but a later review points out it was based on only six trees, without statistical analysis, and couldn't say whether the tannin was newly made or already stored in the leaf. So: browsing-induced bitterness is well supported; the exact speed is less certain.

03 The kudu story

In the 1980s, kudu were dying on **fenced game ranches in the former Transvaal**, South Africa. Zoologist **Professor Wouter van Hoven** of the University of Pretoria investigated. The deaths ran into large numbers and drew wide press attention by 1990.

In his 1991 paper (*Journal of African Zoology*), van Hoven reported that post-mortems had ruled out disease and parasites, that the dead kudu were **not emaciated**, and that mortality was linked to **high kudu densities** and **high condensed-tannin levels** in the leaves. His explanation: kudu packed behind fences had no choice but to keep eating tannin-rich browse.

04 Then came the "talking"

The version that went round the world grew largely from a **1990 conference talk and the press coverage** that followed, including *New Scientist*. It added three striking claims:

CLAIM 1

An airborne alarm

Browsed trees release **ethylene** gas, which drifts up to about 50 yards (about 45 m) and warns neighbouring trees.

CLAIM 2

Neighbours respond

Trees downwind raise their own tannin levels within **5–10 minutes**, before they are even touched.

CLAIM 3

Giraffes know

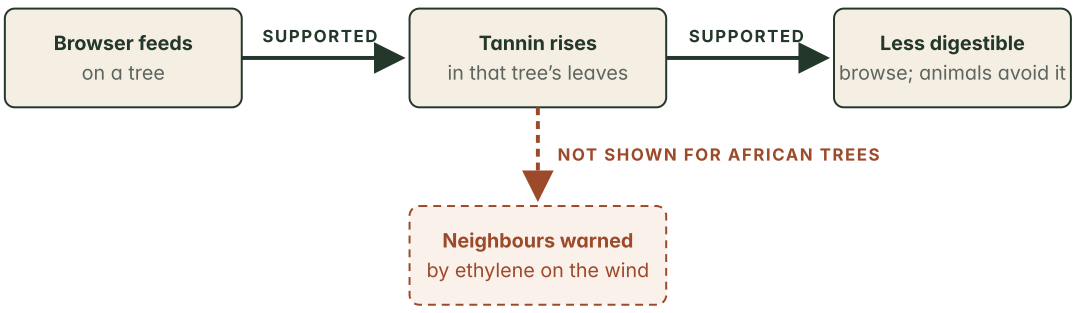
Giraffes browse only about **one tree in ten** and avoid trees downwind of the one they've just eaten.

THE PROBLEM

No published data

None of these airborne-warning claims appears with data in a **peer-reviewed** paper. They come from the talk and press reports.

HOW STRONG IS EACH LINK IN THE STORY?



Solid links are backed by peer-reviewed field studies. The dashed link is the famous part of the story — and the part with no published evidence.

05 What's solid, and what isn't

CLAIM	STATUS	WHY
Tannins make leaves less palatable and less digestible for browsers	WELL SUPPORTED	Field feeding trials with kudu, impala and goats; rumen studies.
Browsing raises tannin levels in the browsed tree	SUPPORTED	Kruger giraffe study. Exact speed ("minutes") rests on a small sample.
Kudu died on crowded, fenced Transvaal ranches, linked to high tannin and high density	REPORTED	Published by van Hoven (1991). A 2019 critical review also stresses winter drought and crowding on the ranches.
Acacias warn each other with ethylene gas	NOT SHOWN	Never published with data in a peer-reviewed journal. Critics call it unfounded.
Giraffes feed into the wind / skip downwind trees to dodge warned trees	NOT SHOWN	Press account only; no published test.

06 Do any plants "talk"?

The wider idea isn't nonsense — it just hasn't been shown for African acacias.

- **1983:** Baldwin & Schultz (*Science*) reported that undamaged poplar and sugar maple seedlings sharing an enclosure with damaged ones also raised their phenolic and tannin levels.
- **1985:** Fowler & Lawton (*American Naturalist*) argued that this early "talking trees" evidence was weak and statistically flawed.
- **2014:** A meta-analysis of **48 well-replicated studies** (*Ecology Letters*) found overall support that plants exposed to airborne chemicals from damaged neighbours become more resistant to herbivores — though the effect was weaker in field studies of wild plants than in labs, greenhouses and crops.

THE HONEST BOTTOM LINE

Plant-to-plant airborne signalling is real in some systems. African trees getting more bitter when browsed is real. The specific story of acacias warning each other with ethylene, and giraffes outwitting them by walking into the wind, has never been demonstrated.

AT THE TREE — HOW TO TELL IT HONESTLY

"These leaves carry tannin — a defence chemical that makes them harder to digest — and this tree makes more of it when it's being eaten. In the 1980s, kudu crammed onto fenced ranches in South Africa started dying, and the scientist who investigated linked it to tannin-heavy leaves they couldn't escape."

THEN ADD THE TWIST

"You may have heard the trees warn each other with a gas, and giraffes walk into the wind to beat them. It's a wonderful idea — but nobody has ever published the evidence. So watch the giraffes yourself, and see if they really do skip trees."

07 Key terms

Condensed tannin	A plant defence compound that binds proteins and reduces how well browsers can digest leaves.
Induced defence	A defence a plant switches on or increases after it is damaged, such as raising tannin after browsing.
Ruminant	A cud-chewing mammal (kudu, impala, giraffe) that relies on microbes in its rumen to break down plant material.
Ethylene	A gaseous plant hormone; proposed in the kudu story as the airborne alarm, but never shown to play that role in African acacias.
Vachellia / Senegalia	The genera that most African "acacias" now belong to.
Meta-analysis	A study that combines the results of many separate studies to look for an overall effect.

In summary

- Condensed tannins make browse **less palatable and less digestible**; kudu, impala and goats reject very high-tannin leaves.
- Browsing **increases tannin** in the browsed tree; giraffes avoid high-tannin foliage.
- Kudu deaths on **crowded, fenced Transvaal ranches** were linked by van Hoven to high tannin and high density.
- The **ethylene warning** and **giraffes feeding into the wind** were never published with data — treat them as unproven.
- Airborne plant signalling has support in other plants, but **not for African acacias**.

SOURCES

- Cooper, S. M. & Owen-Smith, N. (1985). Condensed tannins deter feeding by browsing ruminants in a South African savanna. *Oecologia* 67: 142–146. https://doi.org/10.1007/bf00378466
- Seresinhe, T. & Pathirana, K. K. (2003). Forage tannins in ruminant nutrition. *Tropical Agricultural Research and Extension* 6: 29–43. https://doi.org/10.4038/tare.v6i0.5437

- Furstenburg, D. & van Hoven, W. (1994). Condensed tannin as anti-defoliate agent against browsing by giraffe in the Kruger National Park. *Comparative Biochemistry and Physiology* 107A(2): 425–431.
- van Hoven, W. (1991). Mortalities in kudu (*Tragelaphus strepsiceros*) populations related to chemical defence in trees. *Journal of African Zoology* 105: 141–145. (Content as summarised in Delattre 2019.)
- Hughes, S. (1990). Antelope activate the acacia's alarm system. *New Scientist*, 29 September 1990, p. 19; summarised in Science Frontiers 73, https://www.science-frontiers.com/sf073/sf073b05.htm
- Delattre, A. (2019). Le koudou et l'acacia : histoire et analyse critique d'une anecdote. Tela Botanica. https://www.tela-botanica.org/2019/03/le-koudou-et-lacacia-histoire-et-analyse-critique-dune-anecdote/
- Baldwin, I. T. & Schultz, J. C. (1983). Rapid changes in tree leaf chemistry induced by damage: evidence for communication between plants. *Science* 221: 277–279. https://doi.org/10.1126/science.221.4607.277
- Fowler, S. V. & Lawton, J. H. (1985). Rapidly induced defenses and talking trees: the devil's advocate position. *American Naturalist* 126: 181–195.
- Karban, R., Yang, L. H. & Edwards, K. F. (2014). Volatile communication between plants that affects herbivory: a meta-analysis. *Ecology Letters* 17: 44–52. https://doi.org/10.1111/ele.12205
- WorldWideWattle. The Acacia name issue. https://worldwidewattle.com/infogallery/nameissue/index.php

— SAFARI NOTES · THE SAFARI SHOW —