



## Tall Oil vs. Plant Oils in Asphalt Rejuvenation Performance Summary Based on 2023 NCAT / TRB Study

2023 study by the **National Center for Asphalt Technology (NCAT)** at Auburn University, published in the Transportation Research Record, evaluated five bio-based asphalt rejuvenators. Four were vegetable or plant-oil-based (corn, soy, and mixed plant extracts), and one product-RA5- was derived from crude **tall oil**, a by-product of the paper industry. Each product was tested for its ability to restore aged asphalt, reduce cracking and resist long-term oxidation.

### Performance Findings

Category	Tall Oil (RA5)	Plant / Vegetable Oils (RA1-RA4)
<b>Durability After Aging</b>	Maintains flexibility and elasticity after long-term oxidative aging	Becomes brittle and loses ductility quickly
<b>Cracking Resistance (<math>\Delta T_c</math>)</b>	Higher (less negative) $\Delta T_c$ → superior resistance to embrittlement	Lower (more negative) $\Delta T_c$ → increased cracking potential
<b>Aging Stability (G-R Parameter)</b>	Lower G-R ratios → less stiffness growth and oxidation	Higher G-R ratios → significant hardening during aging
<b>Molecular Stability (GPC)</b>	Slower formation of large, brittle molecules; maintains binder integrity	Faster molecular growth; promotes early stiffening
<b>Oxidation Resistance (FTIR)</b>	Lower oxidation product formation (carbonyl/sulfoxide groups)	Higher oxidation and faster degradation
<b>Overall Field Performance</b>	Long-lasting rejuvenation, balanced flexibility & durability	Short-term softening only, rapid performance loss

### Key Takeaways

While both plant oils and tall oil can initially soften asphalt, the tall-oil-based rejuvenator delivers measurable, long-term restoration. Tall oil maintains ductility, flexibility, and oxidation resistance even after simulated years of field aging-whereas plant oils oxidize rapidly, harden, and lose rejuvenating power over time.

**In-short Plant Oils = Temporary Softening Tall Oil = Lasting Rejuvenation & Superior Performance**