

EVALUATION OF PACLOBUTRAZOL IN PECAN NUT TREES: GROWTH, YIELD AND RESIDUES

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INTRODUCTION & METHODS

Paclobutrazol is a triazole, generally applied as a fungicide, but with great growth inhibiting characteristics when applied to fruit and nut trees. Hence, paclobutrazol is registered for the use on tree crops, including pecan nuts, as a growth regulator. There are currently two products, with 250 g/L paclobutrazol, that may be used: Cultar and Avoset. In this research trial, Cultar was used to evaluate the effect of the applications, as per label recommendation, on growth, yield, and residue. The label stipulates different dosages should be used for different tree ages. We used young (3-7 years) and mature (8+ years) trees. The dosages evaluated on young trees were: 0, 5, and 10 ml/tree while the dosages evaluated on mature trees were 0, 20 and 40 ml/tree on 10 data trees per treatment (dosage). Some notes on these registered product labels states that additional nutrition might be required after use, and that trees shall not be treated within 6 months of planting. The cultivar "Wichita" was used and all treatments were done on three farms in the Hartswater area, Northern Cape, South Africa.

Applications were done as a soil drench around the base of healthy trees after removing all organic material from the application area during October. Applications were followed by irrigation to ensure optimum soil moisture status for at least one week after application. We did not retreat the replicated data trees, as trees treated with the high dosages, all within the recommended range, showed high growth suppression of the spring flush (evaluated a year after the first application, October 2021). The label also state that beneficial effects may only be seen in the following season, and for that reason we expect to find treatment effects during the next seasons' evaluations, and this report serves as a preliminary report to show the results of flush length, yield, quality, and residues as measured in the application season.

Flush lengths were measured from 10 replicated new growth points per data tree per tree age group and farm during February 2021 (N = 860 flushes) and yield data included a measurement in kilograms dropped nuts per tree, count of the total number of stick-tight nuts per data tree and count of the stick-tight nuts per tree, measured during June 2021 (N = 180 trees). Yield quality parameters were evaluated at the processor from 3 grouped samples from the collected yield (dropped nuts) per treatment, age group and farm (N = 54 samples). These parameters included sound edible kernel, inedible kernel, insect damaged kernel, foreign material, moisture content and kernel sizes: J, XL, L, M, S.

**“BENEFICIAL EFFECTS
MAY ONLY BE SEEN IN THE
FOLLOWING SEASON”**

Traces of residues of paclobutrazol were quantified (in mg/kg = ppm) from three sub-samples of nuts from each treatment per tree age group per farm (N = 56 samples). Replicated soil samples were taken from the highest dosage treatments from the mature tree age group per farm (N = 6 samples). The effect of the treatments was

evaluated statistically per age group using an ANOVA (after testing the assumptions using a Shapiro-Wilk and f-test), post-hoc test (Tukey's test) to identify homogenous groups, and correlation statistics.

RESULTS

The results are summarized in Table 1. All measured parameters and the summary of the ANOVA is given with means \pm standard errors for each treatment outcome. There were no significant treatment effects on:

- Branch lengths of young trees.
- Size of nuts from young trees.
- Dropped yield or stick-tights from young & mature trees.
- Total yield from young & mature trees.

The data showed a significant treatment effect on mature tree branch lengths (Table 1).

There were significant correlations between:

- The number of sticktights and weight of sticktights.
- Weight of sticktights and yield (kg) per tree.

There were no paclobutrazol residues detected in pecan nuts across all replicated treatment samples on all farms. Paclobutrazol residues were however detected in the soil from 2 farms, 1 replicate per farm each: 0.37 ppm and 0.017 ppm respectively (@ 40ml/tree).

CONCLUSION

With a well-replicated trial design, the results showed very little statistically significant effects of the treatment within the application season. No residues were detected in the nuts the first season after application.

Growers may use paclobutrazol, applied according to the label recommendations, however, should do their homework in terms of residual action in the soil, tree, and nuts.

Residue risks include:

- 1.) The active ingredient is not registered in countries e.g. the USA, so there could be a scenario where customers refuse to purchase your product where traces of the active ingredient can be detected.
- 2.) It is advised to do MRL analyses to test the nuts for residues, ensuring it is not exceeding allowable limits (0.05 ppm in South Africa).
- 3.) The Market: buyers can decide to buy or not to buy a product based on the risks associated with what was applied during the production season.

Table 1. Summary of effect of paclobutrazol (250 g/L) applied as a soil drench per tree on measured parameters in the first season of application.

Treatment (ml/tree)	Flush length (cm)	Yield (kg/tree)	Sound edible kernel (%)	Insect damaged nuts (%)	Size (%)				
					J	XL	L	M	S
Mature trees									
0	21.74 ± 0.49 ^a	28.74 ± 1.1 ^a	57.49 ± 1.29 ^a	19.11 ± 7.86 ^a	2.51 ± 0.87 ^a	41.47 ± 2.82 ^a	36.69 ± 1.50 ^a	17.08 ± 2.20 ^a	2.26 ± 0.65 ^a
20	18.88 ± 0.57 ^b	26.06 ± 1.39 ^a	57.4 ± 1.25 ^a	15.22 ± 6.63 ^a	3.21 ± 0.65 ^a	51.17 ± 1.99 ^{ab}	28.86 ± 2.05 ^b	15.41 ± 1.70 ^a	1.35 ± 0.45 ^a
40	18.79 ± 0.58 ^b	27.17 ± 1.19 ^a	58.22 ± 0.93 ^a	16.22 ± 6.06 ^a	4.8 ± 0.90 ^a	54.74 ± 4.47 ^b	26.42 ± 2.66 ^b	12.85 ± 2.33 ^a	1.19 ± 0.37 ^a
ANOVA:	F _(2,472) = 10.35, p < 0.001	F _(2,87) = 1.19, p = 0.31	F _(2,24) = 0.15, p = 0.86	F _(2,24) = 0.09, p = 0.92	F _(2,24) = 2.08, p = 0.15	F _(2,24) = 4.44, p = 0.02	F _(2,24) = 6.38, p < 0.01	F _(2,24) = 1.04, p = 0.37	F _(2,24) = 1.30, p = 0.29
Young trees									
0	16.24 ± 0.58 ^a	14.97 ± 1.9 ^a	59.82 ± 0.18 ^a	3.89 ± 2.02 ^a	2.83 ± 1.16 ^a	46.62 ± 6.41 ^a	27.99 ± 2.17 ^a	19.75 ± 4.78 ^a	2.8 ± 0.85 ^a
5	17.43 ± 0.5 ^a	13.29 ± 1.46 ^a	59.86 ± 0.14 ^a	8.29 ± 2.49 ^a	3.44 ± 1.47 ^a	48.37 ± 5.77 ^a	32.06 ± 4.84 ^a	14.99 ± 2.57 ^a	1.14 ± 0.64 ^a
10	17.22 ± 0.53 ^a	14.86 ± 1.74 ^a	59.5 ± 0.38 ^a	7.5 ± 2.03 ^a	4.37 ± 1.27 ^a	57.48 ± 6.22 ^a	25.27 ± 4.97 ^a	11.17 ± 2.07 ^a	1.71 ± 0.53 ^a
ANOVA:	F _(2,362) = 1.23, p = 0.30	F _(2,87) = 0.30, p = 0.74	F _(2,21) = 0.58, p = 0.57	F _(2,21) = 1.22, p = 0.32	F _(2,21) = 0.38, p = 0.69	F _(2,21) = 0.89, p = 0.42	F _(2,21) = 0.67, p = 0.52	F _(2,21) = 1.53, p = 0.24	F _(2,21) = 1.43, p = 0.26