balchem

Tannino™50
Encapsulated Tannin

Evaluating Tannino 50
Multi-Study Research Summary

Trial 1: Assessing total tract digestibility of five commercially available encapsulated tannin products.

Trial 2: Evaluating Tannino 50's effects on egg and eggshell quality in late-laying hens.

Trial 3: Evaluating Tannino 50's impact on production performance and intestinal health in Ross 308 broilers.

Trial 4: Investigating Tannino 50's suitability as an antibiotic alternative in creep and nursery feed for swine.

Summary written by Dr. Zack Lowman, Global Monogastric Technical Services, Balchem Corporation, Montvale, NJ.

Introduction

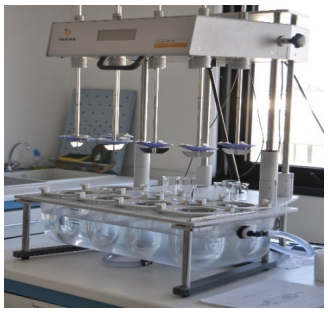
Tannins are polyphenolic compounds found in various plant sources, including seeds, bark, wood, leaves, and fruit skins (e.g., grapes and chestnut derivatives). While high concentrations of tannins can cause antinutritional effects in monogastric animals—such as reduced feed intake due to their bitter taste and nutrient binding—in the correct form and feeding rate, tannins can provide many benefits, including gut health and antioxidant properties.

Tannino™ 50 is an encapsulated product derived from chestnut wood extract. Its unique matrix protection and slow-release characteristics provide taste-masking and improved feed stability while allowing for controlled intestinal release. This optimizes its efficacy compared to unprotected tannins, which are largely absorbed in the stomach. This summary discusses results from four experiments: one *in vitro* study and three *in vivo* trials.

Methodologies

Trial 1. *In Vitro* Boisen Test This study evaluated Tannino 50, raw tannin and five commercially available encapsulated tannin products for total tract digestibility using an *in vitro* procedure based on the Boisen Method (Boisen and Fernandez, 1997). This three-step enzymatic incubation simulates digestion in swine, with each phase representing different sections of the gastrointestinal tract:

- **Phase 1:** Stomach (2-hour incubation at pH 2 with pepsin)
- **Phase 2:** Duodenum/ Jejunum (4-hour incubation at pH 6,8 with pancreatin)
- **Phase 3:** Ileum (18-hour incubation at pH 4,8 with lipase and bile extract)



All phases were maintained at 39°C and solutions were under constant agitation. Samples from each phase were analyzed for tannin content.

Trial 2. Tannino 50 Layer Trial A large-scale trial at Chaozhou Xiang Xiang poultry farm evaluated Tannino 50's effects on egg and eggshell quality in late-laying hens. 25.000 Jinfeng breed hens, aged 44 weeks and 5 days, were divided into a control group (basal diet) and a treatment group (basal diet + Tannino 50) for 8 weeks. Egg quality metrics—including albumin height, pH, eggshell strength, and production performance—were assessed post-trial.

Trial 3. Tannino 50 Broiler Trial The objective of this trial was to evaluate Tannino 50's impact on production performance and intestinal health in Ross 308 broilers. Three treatment groups were established: no Tannino (Control), Tannino 50 at 260g/ton (T1), and Tannino 50 at 500g/ton (T2). Key performance indicators such as feed intake, weight gain and mortality were monitored throughout the trial (Table 1).

Table 1 **Treatment groups tested in the Tannino 50 broiler trial**

Treatment	Experimental Diet	Supplementation Period	# of Chicks
Control	Basal diet	Constant	94.800
T1	Basal diet+ 260g Tannino	Day 9-Day 40	38.000
T2	Basal diet+ 500g Tannino	Day 30-Day 40	19.000

Trial 4. Tannino 50 Swine Trial This trial investigated Tannino 50 as an antibiotic alternative in creep and nursery feed for swine. A total of 270 piglets were assigned to one of three treatment groups (6 replicates of 15 piglets each): control (basal diet), Tannino 50 at 500 mg/ton (T2), and a combination of Enramycin and Aureomycin (T3). Diets were administered starting on Day 25.

Results and Discussion

Trial 1. *In Vitro* Boisen Test Results from the modified Boisen test are shown in Figures 1 and 2. Results shown in Figure 1 indicate that nearly 100% of raw unprotected tannin was released within the first 1,5 - 2 hours, while Tannino 50 demonstrated a controlled release of the tannin content over 18 hours. These results demonstrate the need for encapsulation to help control the release of tannin over time, allowing for prolonged benefits to the animal. Figure 2 compares Tannino 50's release profile to various competitive products. Two competing products demonstrated nearly complete release within the initial 1,5 to 2 hours, similar to the raw tannin, indicating that their encapsulation was entirely ineffective. Other encapsulated products offered varying degrees of protection, with few showing the high level of consistent, slow-release tannin as seen with Tannino 50.

Figure 1 **Release rate of unprotected tannin and Tannino 50 *in vitro.***

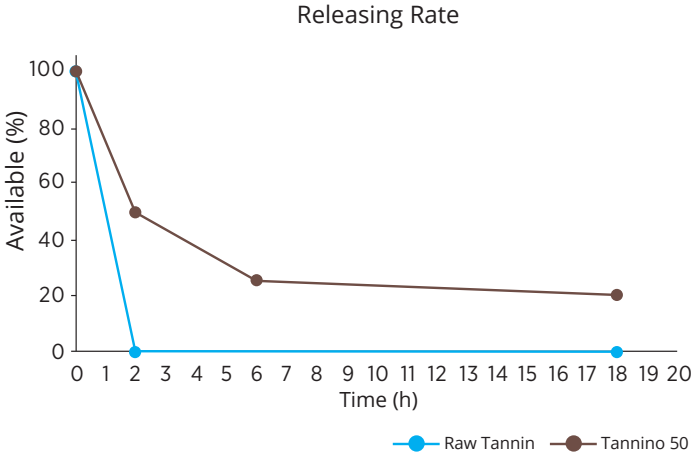
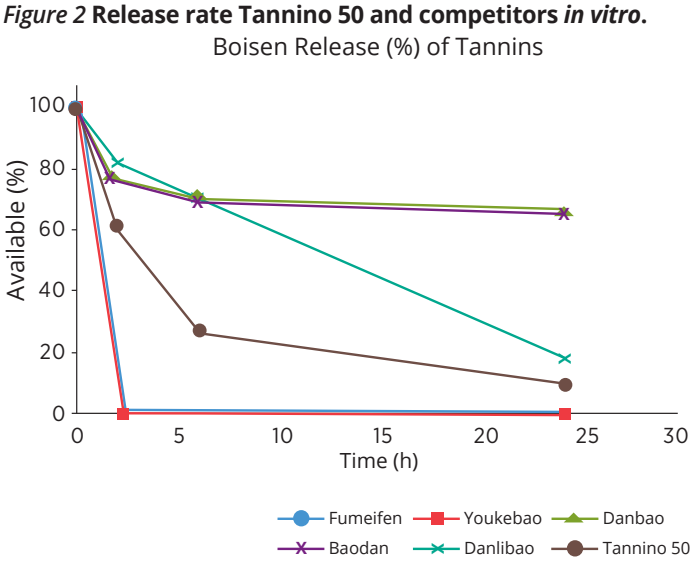


Figure 2 **Release rate Tannino 50 and competitors *in vitro*.**



Trial 2. Tannino 50 Layer Trial In this experiment, Tannino 50 supplementation helped mitigate the typical decline in Haugh units associated with aging in late-lay hens, achieving an average of 79,12 compared to 72,69 in the control group. Additionally, hens in the Tannino 50 group showed higher albumin heights in late lay (6,43 vs. 5,67) for the control. Haugh units and Albumin heights are indicators of egg freshness, so eggs with higher scores can typically be stored for longer periods and still appear as "fresher" for the customer. The Tannino group also demonstrated improved shell strength (35,06 vs. 29,98) in both mid and late-laying periods (Table 2). Improved shell strength is important to both the producer and the consumer, resulting in stronger egg shells and less breakage during collection, packaging and shipping. The supplemented birds also maintained a more consistent rate of egg production throughout the trial (Table 3). Initially, both groups had comparable lay rates (93,53 vs. 93,51), but by week 53, the Tannino 50 group showed a 2,85% higher lay rate than the control (88,28% vs. 85,43%). As hens age, egg production declines. The producer's goal is to get as many eggs per hen housed per week as possible. While a 2,85% difference may not seem significant, in a house with 100.000 hens, that equated to an additional 2.850 eggs per week.

Table 3 **Percent lay in layer chickens fed diets either with or without Tannino 50.**

Percent Lay	Week 44(%)	Week 48 (%)	Week 53 (%)
Control	93,53	86,59	85,43
Treatment	93,51	88,79	88,28

Trial 3. Tannino 50 Broiler Trial In reviewing the results of this study (Table 4), broilers supplemented with Tannino 50 from day 9 to day 40 (T1) had higher livability (96,05%), final body weight (2,932 kg), and feed intake (4,78 kg) than the control group (94,79%, 2,792 kg, and 4,61 kg, respectively). The shorter supplementation period in T2 (day 30-40) also showed improvement over the control, though to a lesser extent. This 1,26% improvement in mortality could be highly beneficial to commercial producers. For instance, in the control group of 94.800 birds, this increase in livability translates to a reduction of 1.194 bird losses in just this trial alone. These results suggest that the benefits of Tannino 50 are more pronounced when supplementation begins earlier and continues through the grow-out period. Overall, Tannino 50 was shown to support intestinal health in broilers, with indications of improved mortality rate, improved water and feed stools, and favorable effects on certain production performance indicators.

Table 4 **Performance results of boilers supplemented with or without Tannino 50.**

Performance Data	T1 (Day 9-40)	T2 (Day 30-40)	Control
Grow Out Days	43	42	41,8
Placement #	38.000	19.000	94.800
# Return to Plant	36.499	18.092	89.861
Livability (%)	96,05	95,22	94,79
Average Final wt. (kg)	2,932	2,85	2,792
Feed Intake/Chick (kg)	4,78	4,68	4,61
FCR	1,63	1,641	1,651
ADG (kg)	0,068	0,068	0,067

Table 2 **Egg quality results in layer chickens fed diets either with or without Tannino 50.**

Treatment	Week	Sample	Egg Weight (g)	Eggshell Strength (N)	Yolk pH	Albumin pH	Albumin Height	Haugh Unit
Control	Week 44	n=60	56,05	35,93	5,88	8,18	6,28	80,17
	Week 48	n=60	60,49	30,69	6,12	8,37	5,78	74,18
	Week 53	n=60	59,31	29,98	6,14	8,02	5,67	72,69
Tannino 50	Week 44	n=60	56,05	35,93	5,88	8,18	6,28	80,17
	Week 48	n=60	58,95	34,15	5,85	8,21	6,37	80,61
	Week 53	n=60	61,71	35,06	6,16	8,13	6,43	79,12

Trial 4. Tannino 50 Swine Trial This trial compared three treatment groups: a control group, receiving only the basal diet, a group supplemented with Tannino 50 (T2), and a group supplemented with a combination of Enramycin and Aureomycin used as growth promoters (AGPs; T3). Results (Table 5) showed that piglets in the Tannino 50 group achieved a statistically higher final weight (15,99 kg) compared to the control (14,25 kg) and performed similarly to the AGP group (15,61 kg). The average daily gain (ADG) was also significantly higher for the Tannino 50 fed group (321,4 g) compared to the control (261,2 g) and was comparable to the AGP group (308,3 g). Tannino 50 fed piglets also had greater feed intake over the first 7 days (337,4 g/day vs. 249,6 g/day) for control and across 28 days (463,5 g/day for Tannino vs. 380,4 g/day for control). No significant differences were observed in FCR across the groups. This trial showed that Tannino 50 supplementation improved performance compared to no additives, and achieved results comparable to pigs supplemented with AGP's. This suggests that Tannino 50 can effectively replace antibiotics, offering the same benefits as a natural feed additive.

Summary

The results from these research trials demonstrate that Tannino 50 provides numerous benefits across different animal species, including commercial layers, broilers, and piglets. Tannino 50's proprietary encapsulation process sets it apart from other tannin products, allowing for a consistent, slower release of tannin. Additionally, the proprietary encapsulation of Tannino 50 offers superior performance while overcoming the negative effects of raw tannins on feed intake and nutrient binding while also providing protection during feed processing.

Table 5 **Performance results of pigs supplemented with or without Tannino 50.**

	Control (basal diet)	T2 (Tannino 50)	T3 (AGPs)	P-value
Initial Weight, kg	6,94 ±0,24	6,98 ±0,48	6,97 ±0,25	0,447
Final Weight, kg	14,25 ±0,97^{b}	15,99 ±1,14^{a}	15,61 ±1,09^{a}	0,037
Average Daily Weight Gain, g/pig/day	261,2 ±34,3^{b}	321,4 ±33,6^{a}	308,3 ±31,9^{a}	0,044
Food Intake in 0-7 days g/pig/day	249,6 ±6,0^{c}	337,4 ±19,0^{a}	311,4 ±6,8^{b}	0,01
Feed Intake in 0-28 days, g/pig/d	380,4 ±40,0^{c}	463,5 ±10,9^{a}	437,2 ±18,8^{ab}	0,021
FCR	1,45 ±0,05	1,45 ±0,13	1,42 ±0,09	0,885

^{a,b,c} Different superscripts indicate a significant difference between treatments

Balchem ANH - EMEA Region
Balchem Italia
Via del Porto Snc | 28040 Marano Ticino (NO) | Italy
+39 0321979 1 Italy
anh.marketing@balchem.com
Balchem.com

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