

# Long-Term Effects of "Yer Malhami" Fertilizer: A Study on its Impact and Effectiveness

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**Abstract.** This study evaluated the long-term toxicological and hygienic effects of the biological fertilizer "Yer Malhami" in white rats. The study used hygienic, toxicological, biochemical and statistical methods in accordance with the guidelines for environmental testing of bioinsecticides. A 12-month chronic experiment was conducted focusing on potential gonadotoxic, embryotropic and mutagenic effects. Rats were administered different doses of "Yer Malhami" and changes in body weight, reproductive cycles and cellular composition were observed. The results showed no significant disturbances in reproductive cycles or spermatogenesis, and chromosomal aberration tests showed no mutagenic effects. Although a slight decrease in fetal survival was observed at toxic doses, this was due to general toxicity rather than specific reproductive harm. The study concluded that Yer Malhami is safe for long-term use as a biofertilizer, with no adverse effects on reproductive or genetic health in the animals tested. Further studies are recommended to examine its safety in different species and environmental conditions.

**Keywords:** hygienic standardization, degree of toxicity and danger, gonadotoxic effect, embryotropic effect, mutagenic effect.

## 1 Introduction

The protection of public health and the environment remains one of the most pressing issues today, especially concerning the impact of pesticides and mineral fertilizers. Population health is often used as a marker to assess environmental risks, including exposure to small doses of chemicals that may lead to nonspecific intoxication [1]. Chronic exposure to low doses of toxins, such as those found in fertilizers, can contribute to the development of various diseases, including respiratory, digestive, and nervous system disorders [2]. While nitrogen fertilizers improve plant composition and protein content, excessive use can lead to harmful nitrate accumulation in food crops, posing a risk to both livestock and humans [3]. This accumulation is particularly high in certain crops like beets and corn, which can transfer nitrates into animal-based food products [4]. Given these concerns, this study aims to evaluate the toxicological and hygienic properties of the biological fertilizer "Yer malhami,"

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which is proposed as a safer alternative that could mitigate these risks and offer significant benefits to the field of medical sciences.

## 2 Materials and Methodology

The study used hygienic, toxicological, biochemical and statistical methods for assessing the biological fertilizer "Yer Malhami". The toxicity and risk level were assessed in accordance with Sanitary Rules and Norms No. 0321-15, classifying toxicity and hazard. The studies were conducted in accordance with the recommendations for determining the impact of bioinsecticides on the environment and assessing new pesticides [5]. A 12-month chronic experiment was conducted using integral indicators to assess the general condition, behavior and body weight dynamics of the experimental animals. Specific tests were aimed at identifying the gonadotoxic, embryotropic and mutagenic effects of "Yer Malhami". To assess the gonadotoxic effect after 12 months of intragastric administration of the fertilizer, the estrous cycle of female white rats and spermatogenesis indices in male white rats were studied. Data analysis was performed using variation statistics, differences were considered significant at  $P < 0.05$  using the Student's t-test. Only healthy animals without any concomitant diseases were included in the study, and animals with incomplete data or deviations in health status were excluded.

## 3 Results

The biofertilizer is intended for pre-sowing treatment of seeds and seedlings of vegetable, industrial crops, potatoes, as well as the roots of young seedlings of fruit trees and forest crops in order to accelerate plant growth, increase crop yields, improve product quality, and suppress phytopathogenic microflora. Tests in agricultural production have shown the effectiveness of "Yer Malhami", noting an increase in cotton yields by more than 8-10%. Cytological and morphometric studies of spermatogenesis revealed statistically significant changes in animals of the first group (Tables 1, 2). The experimental animals showed a decrease in testicular weight ( $P < 0.05$ ) and significant spermatogenesis disorders in almost all formed elements: spermatocytes, spermatids, and Sertoli cells ( $P < 0.001$ ,  $P < 0.01$ ). In an experiment to study the embryotropic effect of Yer Malhami, female white rats were placed with males in a 2:1 ratio at the end of a 12-month trial.

**Table 1.** Indicators of morphometric study of spermatogenesis during intragastric administration of "Yer malhami".

Group	Statistical indicator	Body weight (gr)	Testis weight (gr)	Weight coefficient of testis mass	Testis length (cm)
<b>I</b>	M	274.1	2.06	7.5	2.05
	±m	12.4	0.00086	0.049	0.00036
	P	>0.001	>0.05	<0.001	>0.05
<b>II</b>	M	282.5	2.08	7.3	2.01
	±m	77.6	0.00068	0.0028	0.0011
	P	>0.05	>0.05	>0.05	>0.05
<b>III</b>	M	301.6	2.12	7.0	2.02
	±m	12.4	0.00059	0.0012	0.00029
	P	>0.05	>0.05	>0.05	>0.05
<b>Control</b>	M	299.1	2.09	6.95	2.05
	±m	19.45	0.0019	0.0029	0.0015

**Table 2.** Indicators of cytological study of “Yer malhami” during intragastric chronic exposure.

Group	Statistical indicator	Spermatogonia	Spermatocytes	Spermatids	Spermatosomes	Sertoli cells
<b>I</b>	M	188.6	131.0	296.0	212.0	38.0
	±m	2.11	2.29	2.47	1.41	1.41
	P	>0.05	<0.05	<0.001	<0.001	<0.01
<b>II</b>	M	190.0	135.0	310.3	236.1	40.3
	±m	2.29	2.11	2.64	3.35	1.41
	P	>0.05	>0.05	>0.05	>0.05	>0.05
<b>III</b>	M	194.8	137.0	318.5	238.0	42.3
	±m	5.25	2.47	6.35	7.41	0.88
	P	>0.05	>0.05	>0.05	>0.05	>0.05
<b>Control</b>	M	195.1	140.2	320.6	234.6	43.5
	±m	1.94	3.35	5.29	5.64	1.05

The first day of pregnancy was determined by the presence of sperm in vaginal smears. Throughout pregnancy, females continued to administer “Yer malhami” in the same doses. On the 20th day of pregnancy, half of the females from each group were killed. During the autopsy, the uterine horns and placenta were examined, the number of corpora lutea in the ovaries, the weight of the placenta, the number of implantation sites, the number of living and dead fetuses, the number of resorptions, the weight of the fetus, and the presence of gross developmental anomalies were taken into account.

The remaining pregnant females were brought to natural birth in order to monitor the results of the offspring. At the same time, the number and weight of newborn rat pups and the development of young animals were taken into account. The research results are presented in Tables 3 and 4, from which it is clearly seen that “Yer malhami” in the studied doses did not cause changes in the frequency of embryo death, only a slight decrease in fetal survival was noted when a toxic dose of the drug was administered, but these changes can be attributed to the general toxic effect his.

**Table 3.** Summary table on the study of the embryotropic effect of biofertilizer “Yer malhami” during chronic intragastric administration to white rats.

Group	Number of pregnant females	General number of living embryos	General number of dead embryos	General number of yellow bodies	General number of implant sites.	Embryo mortality %	Until implant mortality %	After implant mortality %	Survival. %
<b>I</b>	6	37	1	38	38	11.9±0.70	9.6±0.52	2.63±0.17	88.1±0.35
<b>II</b>	6	39	2	48	41	18.75±1.0	14.6±0.88	4.8±0.35	81.25±0.7
<b>III</b>	6	47	4	64	51	26.6±1.41	20.3±1.23	7.8±0.7	73.4±1.5
<b>Control</b>	6	50	2	74	52	32.5±1.23	29.8±1.23	3.8±0.35	67.5±1.23

**Table 4.** Survival rates of fetuses of female white rats after chronic intragastric administration of "Yer malhami".

Group	Statistical indicator	Number of newborns	Birth alive	Medium. weight	Whole. body length	Timing of pubescence	Timing of emergence	Timing of independent eating
<b>I</b>	M	9	16.6	2.18	2.26	5.5	12.8	18.8
	±m	0.49	1.64	0.059	0.044	0.029	0.12	0.12
	P	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05
<b>II</b>	M	10.3	16.6	2.42	2.56	5.3	13.5	18.6
	±m	0.27	0.71	0.0077	0.0077	0.029	0.27	0.029
	P	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05
<b>III</b>	M	9.8	16.6	2.3	2.6	4.3	13.1	18.6
	±m	0.49	1.42	0.01	0.022	0.12	0.12	0.029
	P	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05
<b>Control</b>	M	10	16.6	2.48	2.59	4.8	19.3	18.6
	±m	0.27	0.77	0.023	0.023	0.12	0.12	0.12

When studying the internal organs and skeletal system of 20-day embryos in animals of these groups, no significant deviations were revealed with those in the control group. Data from studies of the frequency of chromosome aberrations in the bone marrow of experimental white rats are presented in Table 5. It has been established that "Yer malhami" in the studied doses does not have a mutagenic effect.

**Table 5.** Frequency of aberration of bone marrow chromosomes of white rats under chronic intragastric action of biofertilizer "Yer malhami"

Experience Options	Number of studied		Metaphases with rearrangements	
	animal	metaphases	number	%
<b>Control</b>	9	1122	10	0.89±0.28
<b>I</b>	6	746	6	0.80±0.32
<b>II</b>	6	868	8	0.92±0.32
<b>III</b>	6	776	6	0.77±0.31

## 4 Discussion

When introducing new drugs into agricultural practice, it is essential to study their potential long-term effects on the body. This is because numerous studies have shown that toxic agents can alter the structure and function of the gonads and induce gene, chromosomal, and genomic mutations. In this study, animals receiving doses of 78.5 mg/kg, 7.85 mg/kg, and 0.78 mg/kg of "Yer Malhami" showed no changes in the number of days spent in the resting (diestrus) or active (estrus) phases compared to control animals. The average cycle duration remained normal, and the number of cycles per month was within physiological norms [6].

The study also found that "Yer Malhami" did not significantly affect the frequency of embryo death, though there was a slight decrease in fetal survival at toxic doses, which could be attributed to the general toxic effect. Additionally, chromosomal aberration tests in the bone marrow of experimental rats revealed that "Yer Malhami" does not have a mutagenic effect at the doses studied.

Overall, the results indicate that "Yer Malhami" does not have gonadotoxic, embryotropic, or mutagenic effects on white rats at the tested doses.

## 5 Conclusion

This study evaluated the long-term effects of the biological fertilizer "Yer Malhami" on white rats using hygienic, toxicological, biochemical, and statistical methods. A 12-month chronic experiment was conducted to examine the overall health of the test animals, focusing on potential gonadotoxic, embryotropic, and mutagenic effects. Rats were administered different doses of "Yer Malhami" and were monitored for changes in body weight, reproductive cycles, and cellular composition. The results showed no significant disruptions in the estrous cycle or spermatogenesis, and chromosomal aberration tests revealed no mutagenic effects. Although a slight decrease in fetal survival was noted at higher doses, this was attributed to general toxicity. Overall, the findings suggest that "Yer Malhami" does not have harmful long-term effects on reproductive or genetic health in white rats at the doses tested. These results support the safe use of "Yer Malhami" as a biofertilizer, and future studies could explore its application across other species and environmental conditions to further assess its safety.

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