YEAST CULTURE POULTRY RESEARCH REPORT 1993-2

EFFECT OF YEAST CULTURE IN BROILERS UNDER HEAT STRESS AND NONSPECIFIC ANTIGEN CHALLENGE

Summary

A factorial experiment was conducted to evaluate the effects of yeast culture in broilers under heat stress fed dirty poultry litter. Birds were placed on yeast culture (0, .25%, 1.25%) at hatching and reared to 3.5 weeks of age in floor pens. On day 25 posthatching, the birds were transferred to grower batteries in two large-scale environmental chambers and switched to a typical grower ration, with and without 1% litter. The birds were maintained on their respective yeast culture levels throughout the experiment. One chamber was maintained at 24 C, while the second had a cycling temperature between 24 C and 37 C to induce heat stress.

Yeast culture numerically increased gain and the response was consistent across litter and temperature. Yeast culture main effects resulted in improved feed efficiency (P=.062) for the 1.25% level. The yeast culture X litter interaction for feed efficiency borderlined on significance (P=.15). Yeast culture had a 5% improvement in feed efficiency in litter fortified rations (P=.02) and 2.5% in rations without litter (P=.05). The interaction between yeast culture and litter for bird survival was significant (P=.078). Yeast culture produced the greatest response when litter was fed.

Materials and methods

The objective of this experiment was to conduct a 3 yeast culture levels (0, .25%, 1.25%) X 2 poultry litter inclusion levels (0, 1%) X 2 ambient temperature environments (24 C, 24-37 C) in a factorial treatment arrangement such that yeast culture's ability to reduce heat stress and antigen toxicity may be evaluated. A total of 1400 Cobb-500 male chicks were bought for the study since males have the greatest heat stress susceptibility due to their higher growth rate. Birds were allotted to treatment such that individual treatment groups contained 16 replicates of 7 chicks per replicate.

Feed and water were available for *ad libitum* consumption at all times. Rations utilized were formulated to provide at least 105% of the requirement for essential nutrients specified by the National Research Council (NRC), with the exception that energy mimicked current industry standards. The energy-nutrient standards established by the NRC were used to establish nutrient/calorie ratios. The yeast culture utilized in this study was provided by Diamond V Mills, Inc., Cedar Rapids, Iowa ("XP" Yeast Culture).

During the first 28 days posthatching, chicks were raised on rice hull litter under thermostatically controlled brooder stoves housed within an unairconditioned building. During this pre-experimental period, the birds were exposed to ambient Oklahoma environmental conditions. The average daily high temperature during the starting period averaged 25.2 C ranging between 14 C and 29 C. The birds were not noted to be heat stressed during any portion of the pre-experimental period. On day 25 posthatching, the birds were transferred to the environmental chambers and the experiment initiated following an overnight fast. The control chamber was maintained at 24 C and the heat stress chamber set to oscillate between 24 C and 37 C in a manner simulating a summer day. The cycling ambient temperature environment increased 3 C daily, starting on day 25, until the chamber cycled between 24 C and 35-37 C daily. The heat distressed birds were exposed to approximately 6 hours in excess of 32.2 C per day, 6 hours of temperature transition and 12 hours at 24 C. Relative humidity was maintained between 45% and 50%.

Parameters monitored included live weight gain, feed consumption, feed efficiency and mortality. Feed efficiency was estimated by dividing total weight of birds surviving the study in each replicate by the total feed consumed and also by including the weight of birds dying of heat prostration. All data were subjected to analyses of variance using the General Linear Model of the statistical analysis system.

Results and discussion

Performance results are presented in Table 1. Compared to the thermoneutral birds, exposing control birds to heat stress reduced (P<.05) final bird weight (1966g vs 1819g), efficiency of gain unadjusted for survivability (.50 vs .47) and bird survivability (94% vs 82%). The reduced bird survivability resulted in a 3.5% increase in

Table 1: Effect of yeast culture (YC) on broiler performance under heat stress and antigen challenge.

Item	Thermoneutral			Heat Stress		
	Control	.25% YC	1.25% YC	Control	.25% YC	1.25% YC
No Poultry Litter						
Final Weight, gm	1966.4	1956.4	2001.9	1819.7	1861.5	1834.9
Feed Consumption, gm	2694.0	2684.9	2910.8†	2786.7	2841.3	2825.0
Gain/Feed	0.505	0.507	0.513	0.470	0.462	0.468
Survival, %	94.4	97.0	97.2	81.9	76.5	78.1
Gain/Feed - Adjusted	0.510	0.515	0.518	0.509	0.514	0.511
1% Poultry Litter						
Final Weight, gm	1817.5	1902.0†	1848.4	1790.4	1814.4	1803.2
Feed Consumption, gm	2643.3	2723.9	2770.0	2964.3	2885.0	2796.3†
Gain/Feed	0.493	0.506	0.502	0.434	0.465**	0.475**
Survival, %	90.7	96.7	95.4	73.5	79.2	84.5**
Gain/Feed - Adjusted	0.514	0.516	0.513	0.491	0.513†	0.512†

† Significantly different from control within temperature (P<.10).
** Significantly different from control within temperature (P<.01).

feed consumption attributed to each bird surviving the study. Adjusting feed efficiency for survivability by including the weight gain of birds dying of heat prostration improved feed efficiency of heat stressed birds to .49 which did not differ from the thermoneutral controls.

Overall, the environmental impact upon growth rate and feed efficiency is typical of what might be encountered by poultry producers. However, the mortality observed in this study is high by commercial standards, though not unheard of in the field. It is necessary to elicit a minimum of 8% mortality differential between the control and treatment groups in order to statistically separate treatment means with this replication schedule. The advantage of the slightly higher mortality differential (12%) is that it further enhances our ability to detect a treatment effect while the disadvantage is that it might elicit a treatment response that would not be present under milder stress exposures.

Several main effects and interactions were significant for litter and yeast culture addition to the basal ration. Overall, litter addition reduced (P<.01) final bird weight by 4%. However, the litter suppression was more apparent in the thermoneutral environment (6%) than the heat distressed (2%) where performance was already suppressed. Litter effects on the feed efficiency and survival were not significant. Yeast culture numerically increased final bird weight from 1848g to 1883g and 1872g for the 0, .25% and 1.25% inclusion levels, respectively. The response was consistent across litter and temperature criteria. Yeast culture main effects, averaged across both litter and temperature treatments, resulted in feed efficiency increasing from .475 to .490 (P=.062) for the 1.25% supplementation level, with the .25% level being intermediate. The yeast culture X litter interaction for feed efficiency borderlined on significance (P=.15) with the data suggesting that the yeast culture is more effective in birds consuming litter. Likewise, it appeared that yeast culture efficacy is greater in litter fed birds housed in the heat stressed environment as yeast culture increased feed efficiency by 8% during heat distress in contrast to just 2% at 24 C.

Neither the main effect for yeast culture nor poultry litter on bird survivability was significant (P>.20). However, the interaction between yeast culture and litter supplementation for bird survivability was significant (P=.078). Within the thermoneutral environment yeast culture numerically improved bird survivability consistently within litter fortification averaging 92.5%, 96.5% and 96% for the 0, .25% and 1.25% levels, respectively. Within the heat distressed environment, without litter, yeast culture had no impact on the temperature suppressed survivability. Within the heat stressed and litter fortified groups, yeast culture linearly improved survivability at 73%, 79% and 84% for the 0, .25% and 1.25% fortification levels, respectively. The bird survivability response was significant (P<.01) for the 73% vs 84% contrast. This effect fits the hypothesis that increased immune challenge during heat stress will increase heat production and thereby elevate bird mortality.

The data reported indicates that yeast culture has the potential to significantly interact with numerous environmental distressors with performance improvements.

Research source

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