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Studies on the Stimulation of Poultry Growth by  
Soybeans Molded with Species of *Aspergillus*

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Many workers have reported that cultures of molds grown on feedstuffs produce poisonous metabolites, "mycotoxins", which depress growth of farm animals and may cause high mortality.

Recent investigations in our laboratory, however, revealed that only 42% of 392 strains of *Aspergillus* were toxigenic. Some of the tested cultures exerted positive effects on growth when grown on soybeans or wheat and fed to chicks and mice.

Three of several experiments conducted to obtain further information on those cultures beneficial to chick growth will be discussed here. One-day-old Golden Giant male broiler chicks were used as experimental animals and uninoculated control soybeans were prepared for each study for comparison with the cultured soybeans. The control or molded soybeans were mixed with a premix in amounts to yield 15, 17 and 19% protein diets. Appropriate amounts of Cerelose (glucose monohydrate) were added to lower protein rations to maintain diet density. The experimental diets thus prepared were calculated to be adequate with respect to the essential amino acids, energy levels, minerals and vitamins required for chicks.

Mean body weights at 4 weeks of age are summarized in table 1 according to the respective trial. Although weights were very similar between treatments, experiment 1 illustrated a response to the 17% protein levels. Growth responses with 19% protein were observed for 28 *A. oryzae*. However, in the second and third experiments, each of the tested cultures allowed the chicks to grow faster than controls regardless of protein levels in the diets. Such responses were more pronounced with the 15% protein diets than with the 17 and 19% protein diets. Analysis of variance of the data showed highly significant ( $P > 0.01$ ) differences between control and test diets. Subsequent data on protein and amino acid analyses of the cultured soybeans used in these experiments (table 2) revealed that those growth stimulating preparations were consistently higher in protein content and in essential amino acids compared to the controls. In view of the nutritional significance of amino acid combinations, such higher values of available amino acids in the test soybeans were assumed to be largely responsible for the stimulation of chick growth.

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Table 1. Effect of Cultured Soybeans on 4-Week Chick Weights<sup>a</sup>  
(gms)

| <u>Experiment 1</u> |         |                  |                         |                     |        |
|---------------------|---------|------------------|-------------------------|---------------------|--------|
| Protein level       | Control | 28<br>A. oryzae  | 44<br>A. sydowi         | Mean                |        |
| 15%                 | 476.7   | 511.8            | 484.7                   | 491.1               |        |
| 17%                 | 555.1   | 547.6            | 571.3                   | 558.0*              |        |
| 19%                 | 539.9   | 582.0            | 527.0                   | 549.6 <sup>ns</sup> |        |
| mean                | 523.9   | 547.1            | 527.7                   | 532.9               |        |
| <u>Experiment 2</u> |         |                  |                         |                     |        |
| Protein level       | Control | 4<br>A. clavatus | 24<br>A. oryzae         | 28<br>A. oryzae     | Mean   |
| 15%                 | 441.4   | 451.1            | 459.5                   | 441.5               | 440.9  |
| 17%                 | 434.1   | 452.8            | 482.2                   | 467.2               | 459.1* |
| 19%                 | 477.7   | 484.8            | 488.1                   | 483.9               | 483.6* |
| mean                | 441.1   | 462.9**          | 476.6**                 | 464.2**             | 461.2  |
| <u>Experiment 3</u> |         |                  |                         |                     |        |
| Protein level       | Control | 7<br>A. flavus   | 17-14, 302<br>A. flavus | 33<br>A. sydowi     | Mean   |
| 15%                 | 418.2   | 516.8            | 495.8                   | 491.3               | 480.5  |
| 17%                 | 456.8   | 517.9            | 538.8                   | 494.3               | 502.0* |
| 19%                 | 512.2   | 552.2            | 570.6                   | 547.8               | 545.7* |
| mean                | 462.4   | 529.0**          | 535.1**                 | 511.1**             | 509.4  |

<sup>a</sup>Each value represents the average of 3 replicates of 10 chicks.

\* P < .05.

\*\* P < .01.

Table 2. Protein and Essential Amino Acids in Cultured Soybeans

|                            |                | <u>Experiment 1</u> |                  |  |
|----------------------------|----------------|---------------------|------------------|--|
|                            |                | 28                  | 4                |  |
| <u>Amino acids</u>         | <u>Control</u> | <u>A. oryzae</u>    | <u>A. sydowi</u> |  |
| Protein, %                 | 42.81          | 43.78               | 43.99            |  |
| Lysine <sup>a</sup>        | 0.079          | 0.088               | 0.092            |  |
| Methionine <sup>a</sup>    | 0.019          | 0.020               | 0.022            |  |
| Arginine <sup>a</sup>      | 0.068          | 0.077               | 0.079            |  |
| Leucine <sup>a</sup>       | 0.100          | 0.127               | 0.138            |  |
| Phenylalanine <sup>a</sup> | 0.064          | 0.068               | 0.075            |  |

  

|                            |                | <u>Experiment 2</u> |                  |                  |
|----------------------------|----------------|---------------------|------------------|------------------|
|                            |                | 4                   | 24               | 28               |
| <u>Amino acids</u>         | <u>Control</u> | <u>A. clavatus</u>  | <u>A. oryzae</u> | <u>A. oryzae</u> |
| Protein, %                 | 43.02          | 45.74               | 46.29            | 46.57            |
| Lysine <sup>a</sup>        | 0.060          | 0.082               | 0.090            | 0.088            |
| Methionine <sup>a</sup>    | 0.017          | 0.023               | 0.019            | 0.023            |
| Arginine <sup>a</sup>      | 0.071          | 0.087               | 0.086            | 0.095            |
| Leucine <sup>a</sup>       | 0.123          | 0.112               | 0.138            | 0.147            |
| Phenylalanine <sup>a</sup> | 0.054          | 0.069               | 0.081            | 0.072            |

  

|                            |                | <u>Experiment 3</u> |             |                  |
|----------------------------|----------------|---------------------|-------------|------------------|
|                            |                | 7                   | 17          | 33               |
| <u>Amino acids</u>         | <u>Control</u> | <u>A. flavus</u>    | <u>A-14</u> | <u>A. sydowi</u> |
| Protein, %                 | 40.90          | 43.68               | 43.22       | 45.44            |
| Lysine <sup>a</sup>        | 0.076          | 0.092               | 0.089       | 0.077            |
| Methionine <sup>a</sup>    | 0.018          | 0.022               | 0.019       | 0.023            |
| Arginine <sup>a</sup>      | 0.080          | 0.090               | 0.089       | 0.077            |
| Leucine <sup>a</sup>       | 0.110          | 0.138               | 0.117       | 0.134            |
| Phenylalanine <sup>a</sup> | 0.059          | 0.076               | 0.078       | 0.077            |

<sup>a</sup> Measured by Beckman Auto Analysis, m M/g protein.