

THE PRODUCTIVE PERFORMANCE OF LAYING HENS FED DIETS
CONTAINING FABABEANS INCLUDING STUDIES LEADING TO
ISOLATION, PURIFICATION AND IDENTIFICATION OF THE
EGG WEIGHT DEPRESSING FACTOR IN FABABEANS

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ABSTRACT

The effect of feeding high levels (40%) of heat treated fababeans, various levels (15 and 30%) of whole and dehulled fababeans which represented different energy levels and methionine supplemented fababeans (25%) to laying hens on productive performance was evaluated. Egg production was not affected ($P>0.05$) by the fababean content of the diet. A consideration of both egg weight and total egg mass results revealed a lower egg size with the fababean diets which was not corrected by heat treatment of fababeans but was significantly ($P<0.01$) improved by methionine supplementation at levels over and above the NRC (1971 and 1977) requirements for the laying hen. The extent of egg weight depression was proportional to the level of whole and dehulled fababeans added to the diet. Feed intake per se was not responsible for the observed egg size depression. In general fababean diets were utilized as efficiently as control diets. Body weight gain which was not ($P>0.05$) affected in all trials, tended to increase with increases in the level of methionine in the fababean containing diets. Mortality was normal.

Due to the observed consistency of the egg weight depressing effect of fababeans through the production trials, short term (32 days in length or less) trials were conducted and a standard bioassay test procedure was developed to determine the nature of the component in fababeans that caused

the depression in egg weight. This test procedure consisted of groups of individually caged hens, with one group designated as the control group and the other group(s) as treatment. Control diets were fed to the control group at all times whereas fababean diets were fed to the treatment group(s) during the test periods which were separated by a control period during which the control diet was re-fed. Eggs were collected and egg weight was recorded daily. The effects of the treatments were evaluated by representing the data graphically and by statistical analysis which involved a comparison between groups of the percent change in egg weight during a test period in relation to a preceding control period. Energy or protein level in the diet per se was shown not to be a major factor in egg weight response. Addition of 12% untreated or autoclaved (121°C for 10 min) fababean protein concentrate to a laying diet depressed ($P < 0.01$) egg weight. Fababean hulls (10% of the diet) or fababean starch (26% of the diet) did not ($P > 0.05$) depress egg weight. These results ruled out the possibility of trypsin inhibitors, hemagglutinins or condensed tannins being involved in egg weight depression. An ethanol-water extract of untreated or autoclaved fababean protein concentrate depressed ($P < 0.01$) egg weight. The magnitude of the egg weight depression was dependent on the concentration of the causative agent. Fractionation of the ethanol-water extract of autoclaved fababean protein

concentrate by lowering pH using HCl produced fractions which did not ($P>0.05$) depress egg weight. On the contrary, acetone fractionation of the extract produced a fraction (supernatant-H) that depressed ($P<0.05$) egg weight. Supernatant-H was composed of 84.09% of a very soluble fraction (supernatant) and only 11.45% of a relatively insoluble fraction (white precipitate). Both fractions depressed ($P<0.01$) egg weight, although the concentration of the active component was higher in the white precipitate. The white precipitate which contained 80 to 90% total vicine was recrystallized in water to produce crystals which by determination of various physical properties were identified as vicine crystals, containing 96% vicine. Convicine was detected in the residue of crystallization. It was concluded that total vicine (vicine + convicine) is the egg weight depressing factor in fababeans with vicine being the major principle. Chemical analysis of fababean fractions showed that the fababean fractions, hulls and starch that did not ($P>0.05$) depress egg weight contained little or no vicine activity while the potency relative to egg weight depression of the other fractions was proportional to vicine activity.

INTRODUCTION

Fababeans (Vicia faba) have been used as human food and animal feeds in a number of countries but primarily in Europe, Middle East and North Africa. Their use in America has been very limited. In Canada, the first commercial production of fababeans occurred in Western Canada in 1972, when about 800 hectares (2,000 acres) were planted and a further expansion was expected in the following years. Average yields exceeding 2,200 kg/ha have been obtained and should increase as producers become more familiar with the crop. The improved varieties of fababeans may well be of considerable potential as protein sources since their protein content is $2\frac{1}{2}$ times higher than that of cereal grains, concurrent with a much higher percentage of lysine. Fababeans have the further advantage of possessing the ability to fix atmospheric nitrogen in the soil, thus benefiting the succeeding crop.

The use of fababeans as a feedstuff, however, is still limited. With regard to their use in poultry feeds, research work has been conducted with growing chickens and to a lesser extent with laying hens. In some laying hen studies egg production has been shown to decrease with high levels of fababeans in the diet. The most consistent effect of adding fababeans to laying diets, however, has been that of egg weight depression.

The objectives of these studies were to evaluate the nutritive value of fababeans for laying hens and in particular to study the alleged egg weight depressing effect of fababeans. In this regard, an attempt was made to isolate, purify and identify the egg weight depressing factor in fababeans.