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Development of a mixed culture fermented sugarcane bagasse for supplementation in broiler feed

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Abstract

The present study has been proposed as a means of bioconversion of sugar cane bagasses, a large amount waste from sugar and alcohol industries, by a mixed culture of a cellulase producing fungal, *Aspergillus niger* BC19 and *Saccharomyce cerevisiae* for broiler feed supplementation. The improvement in the nutritional quality, including higher crude protein content and lower crude fiber content, was investigated after fermenting at room condition ($30\pm 2^\circ\text{C}$ and $60\pm 5\%$ RH). The growth performance of broiler chicks fed the commercial diet supplemented with fermented sugar cane bagasses (FSCB) was studied. A total of 84 seven-day-old broiler chicks were fed for 28 days on four experimental diets with the different FSCB supplemented ratio at 0, 5, 10 and 20% (w/w). The experiments were designed to find out the maximal proportion of FSCB in broiler rations to avoid deleterious effect on production performance, meanwhile develop supplemented broiler feedstuff at lower cost. The results revealed that FSCB could be supplemented beneficially up to 20% level with no significant difference ($P>0.05$) in weight gain at 35 day-old broilers, with no mortality, no disease and danger affecting the health of broilers. At lower FSCB supplemented levels (5% and 10%), both weight gain and feed conversion were improved significantly ($P<0.05$). Thus, FSCB can be an alternative economical supplementation to broiler feeding.

Keywords: sugar cane bagasse, broiler feed, *A. niger*, *S. cerevisiae*, bioconversion

Introduction

The use of agro-wastes, especially lignocellulosics, has received considerable attention in recent years for the production of various fermentation products. However, sugarcane bagasse has remained almost unexplored, even though as much as 135 kg of bagasse is generated for every ton of sugarcane processed. About 50% of sugarcane bagasse is used to generate heat and power to run the sugar mills and ethanol plants (Kewalramani et al., 1988). Because the concern of the environmental problems of burning process, it would be beneficial to develop a more environmental friendly use of bagasse. Since demand is increasing for non-conventional feed sources in developing countries due to an increase in meat demand and production, the conversion of different agro-wastes for animal feed by means of microorganisms has been an interesting subject. Thus, the aim of this study was to evaluate the utilization of sugar cane bagasse fermented by a mixed culture of the cellulase producing fungi, *Aspergillus niger* BC19 and *Saccharomyce cerevisiae* for broiler feed supplementation.

Materials and Methods

Preparation of fermented sugar cane bagasse (FSCB) Sugarcane bagasse used in this study was kindly provided by the "Phitsanulok" sugar production industry, Thailand. It was dried at 80°C for 24 h, milled to obtain small particles and kept at 4°C until use. Sugarcane bagasse (1 kg) was mixed with distilled water (2.5 l). After sterilization, a certain amount of 7-day-old fungal spores was added and fermented for 144 h at room condition (30±2°C and 60±5% RH). Then the fermented samples were sterile and dried at 80°C for 24 h. The dried samples were mixed thoroughly with the commercial broiler diet at 0, 5, 10 and 20% (w/w).

Experimental animal and feeding A total of 84 unsexed broiler chicks were fed with the commercial diet for incubation period at the first 7 days. Then they were randomly divided into 4 groups with 3 replications. Each group was placed and reared in a clean, disinfected pen measuring about 1.0 x 1.0 m. The dietary treatments consisted of the control diet, which contained the whole commercial diet, and three other diets each of which contained a fixed amount of 5, 10 and 20%(w/w) of FSCB. The chicks were allowed free access to water and experimental diets. Trials were carried out on chicks from 8 days to 35 days of age. The body weight gain and feed consumption were measured at the initial and every four days.

Results and Discussion

The results show that solid state fermentation with a mixed culture of *A. niger* BC19 and *S. cerevisiae* changed the nutritional characteristics of sugarcane bagasse. The 121.75% increase in crude protein content was observed in concomitance with 11.63% decrease in crude fiber content after fermentation.

The effects of FSCB on the growth performance of 35 day-old broilers are presented as weight gain and feed conversion ratio (Figure 1). The treatments with 5% and 10% FSCB supplementation was affected in higher body weight gain ($P < 0.05$), with no significant difference in feed conversion ratio ($P > 0.05$) as compared to the control treatment with no FSCB supplementation. This benefit caused the reduction of the commercial feed cost for 3.20 and 2.96 bath per kg of body weight for the broilers supplemented with 5% and 10% FSCB, respectively.

However, broilers fed with diets supplemented with 10% FSCB had a slower growth than those fed with only commercial diet during the early week feeding as shown in Figure 2. The slower rate of weight gain, when fed partially with FSCB, may be attributed to the typical character of the FSCB which contains high crude fiber that reduces the metabolizable energy concentrations of diets containing this ingredient (Zatari and Sell, 1990). For broilers fed with 20% supplemented diet, the higher feed conversion ratio was observed as compared to the other treatments. Thus, although FSCB can be used up to 20% for broiler feed supplementation, it is not suitable for economical consideration.

For all treatments, there were no mortality, no disease and danger affecting the health of broilers throughout the experiments. The examination of the broiler carcasses showed no specific deformities and lack of mortality supported the non-pathogenicity of FSCB inclusion in broiler diets. Hence, FSCB can be used as an alternative supplementary ingredient in broiler diets. However, the further experiments will be needed for more effective use of FSCB on broiler feeding. The use of FSCB as the supplementation in broiler feed could be of great economic importance in the developing countries where sugarcane bagasse is an abundant waste.

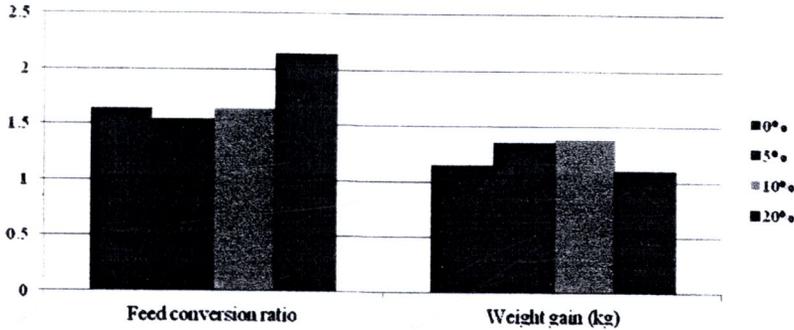


Figure 1. Effect of FSCB supplemented to the commercial broiler diet on the body weight gain and feed conversion ratio of 3 treatments (5, 10 and 20% w/w) as compared to the control treatment at 35 day-old age of broilers.

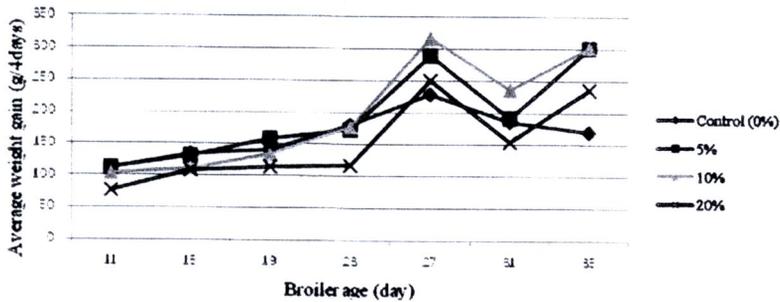


Figure 2. Effect of FSCB supplemented to the commercial broiler diet on the body weight gain of 3 treatments (5, 10 and 20% w/w) as compared to the control treatment throughout the 28-day feeding trial.

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รายงานสรุปการเงิน
รหัสโครงการ 2554A10702010
โครงการส่งเสริมงานวิจัยในอุดมศึกษาและพัฒนามหาวิทยาลัยวิจัยแห่งชาติ
สำนักงานคณะกรรมการการอุดมศึกษา
มหาวิทยาลัยนเรศวร
โครงการวิจัยเรื่อง การพัฒนากระบวนการหมักขานอ้อยด้วยจุลินทรีย์ผสมเพื่อใช้เสริมในอาหารไก่

ชื่อหัวหน้าโครงการวิจัย รศ. ดร. วารินทร์ พิมพา
รายงานในช่วงตั้งแต่วันที่ 1 พ.ย. 54 – 30 เม.ย. 2555 (งวด 2)
ระยะเวลาดำเนิน 1 ปี ตั้งแต่ 1 พ.ค. 54 – 30 เม.ย. 2555 (ตามสัญญา)

รายจ่าย

หมวด	รายจ่ายสะสม จากรายงานครั้ง ก่อน	รายจ่ายงวด ปัจจุบัน	รวมรายจ่าย สะสมจนถึง ปัจจุบัน	งบประมาณ รวมทั้งโครงการ	คงเหลือ (หรือเกิน)
1. ค่าตอบแทน	-	-		20,830 (งวด 3)	20830
2. ค่าจ้าง	-	-		-	-
3. ค่าวัสดุ	36,313.25	54,235.10	90,548.35	92,470	1,921.65
4. ค่าใช้สอย	67,838	29,098	96,936	95,000	-1,936
5. อื่น ๆ	-	-	-	-	-
รวม	104,151.25	83,333.10	187,484.35	208,300	

จำนวนเงินที่ได้รับและจำนวนเงินคงเหลือ

จำนวนเงินที่ได้รับ

งวดที่ 1	104,150.00 บาท	เมื่อ 13 กค. 2554
งวดที่ 2	83,320.00 บาท	เมื่อ 26 มี.ค. 2555
รวม	187,470.00 บาท	

ค่าใช้จ่าย

งวดที่ 1	104,151.25 บาท
งวดที่ 2	83,333.10 บาท
รวม	187,484.35 บาท

จำนวนเงินคงเหลือ -14.35 บาท

พิมพา วารินทร์

หัวหน้าโครงการผู้รับทุน

พิมพา วารินทร์

เจ้าหน้าที่การเงินโครงการ

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