EFFECT OF REPLACING YELLOW CORN BY BAKERY BY-PRODUCT ON BROILER PERFORMANCE

BY

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Abstract: This study was conducted to investigate the effect of replacing yellow corn (YC) by bakery by-product (BBP) on growth performance, carcass traits, blood constituents and economical efficiency of broiler chicks. Three hundred un-sexed Arbor-Acres broiler chicks at one-week of age were divided into ten treatments (30 bird each), each treatment contained 3 replicates of 10 birds each. The experimental treatments were as follows:

Treatment 1 (T1)  A corn soybean diet and taken as a control (NRC requirements).
Treatment 2 (T2)  25% of YC in T1 was replaced by BBP (adjusted to NRC energy requirements).
Treatment 3 (T3)  25% of YC in T1 was replaced by BBP (non adjusted to NRC energy requirements).
Treatment 4 (T4)  T3 plus 0.05 % Xylam (B-xylanase and α-amylase).
Treatment 5 (T5)  50% of YC in T1 was replaced by BBP (adjusted to NRC energy requirements).
Treatment 6 (T6)  50% of YC in T1 was replaced by BBP (non adjusted to NRC energy requirements).
Treatment 7 (T7)  T6 plus 0.05 % Xylam.
Treatment 8 (T8)  75% of YC in T1 was replaced by BBP (adjusted to NRC energy requirements).
Treatment 9 (T9)  75% of YC in T1 was replaced by BBP (non adjusted to NRC energy requirements).
Treatment 10 (T10) T9 plus 0.05 % Xylam.

Live body weight (LBW): Chicks fed diet 10 had the highest values of LBW at 14 and 21 days of age, and Chicks fed diet 7 had the highest values of LBW at 28, 36 and 42 days of age. Live body weight gain (LBWG): Chicks fed diet 7 had the heaviest LBWG during the periods from 7 to 28 and 7 to 42 days of age, while chicks fed diet 10 had the heavier
LBWG during the period from 29 to 42 days of age as compared with the control (diet 1) and the other diets at the same periods. Feed intake (FI): Chicks fed the control diet had the lowest FI during the periods from 7 to 28, 29 to 42 and 7 to 42 days of age. Feed Conversion (FC), crude protein conversion (CPC) and caloric conversion ratio (CCR): Chicks fed diet 2 had the best FC and CPC during the periods from 29 to 42 and 7 to 42 days of age. Whereas, chicks fed diet 10 had the best CCR during the periods from 29 to 42 and 7 to 42 days of age. Growth rate (GR): Chicks fed diet 7 had higher GR values at the two periods (7 to 28 and 7 to 42 days). Carcass characteristics: Chicks fed the control diet had the highest value of abdominal fat whereas, chick fed diet 10 had the lowest value of abdominal fat as compared with the control or the other groups. Serum constituents: Chicks fed diet 7 had the highest value of GOT, total protein and albumin. Chemical composition of broiler meat: The highest fat % value was observed for the group fed diet 4, while the lowest fat % value was observed for the group fed diet 10. Carcass part significantly affects (P ≤ 0.01 and P ≤ 0.05) protein, fat, ash and NFE %. Front part had higher protein, ash and NFE % than rear part, while, rear part had a higher fat % than front part. Mortality %: Obtained results indicated that the percentage of mortality was 3.33 % in chicks fed diet 1, 5 and 8 as compared with the other groups during the starting period. Whereas, chicks fed diets 3 and 6 had the highest mortality % during the finishing and total periods. Economical efficiency (EEF): Chicks fed diet 9 gave the best economical and relative efficiency then chicks fed diet 6 when compared with the other treatments or the control. Whereas, the birds fed the control diet had the worst values. It can be concluded that BBP can be replaced from YC at level 75% in broiler diets to get best performance and highest income per chicken.

INTRODUCTION

Poultry production in Egypt has become one of the biggest agriculture industries and its improvement is one of the main objectives of both private and public sectors.

Feeding cost represents the major parts of total cost in poultry production. Yellow corn (YC) is the main source of energy in formulating poultry rations. Its price is increasing because of the limited world yield in covering the demands for both humans and livestock. So, it is important to search for other alternative cheap energy sources which can solve this problem. Minimizing the feed cost could be achieved through the use of untraditional cheaper feed ingredients or improving utilization of common
feeds by using some feed additives (i.e., enzymes) . Attention, therefore, should be drawn towards the use of some local by-products (especially, after the fluctuations in local market prices of corn due to the last world problems) available in certain areas of Egypt.

In the last few years, bakery by-product (BBP) had been used as an alternative energy source to substitute YC in poultry diets. The BBP could replace corn for its relatively lower cost in poultry feeding. The BBP is a popular feed ingredient and its nutritive value varies widely (Dale and Duke, 1987). Some of these by-products thrown in the garbage fermented and cause an environmental pollution. Several investigators analyzed BBP and found that it contains suitable amounts of nutrients (Table 1). Radwan (1995) found that incorporating of 25 % BBP into Baladi chick diets at level 10, 20, 30 or 40 % had no detrimental effect on body weight or dressing %, while, feed intake was increased, feed conversion was impaired. On the other hand, inclusion of BBP into Baladi chick diets resulted in a higher economical efficiency as compared to the control diet. El-Yamny, et al. (2003) reported that incorporating 25 % BBP in Japanese quail diet as un-traditional ingredients enhanced (P<0.05) body weight, body gain, feed intake and feed conversion efficiency at the market age (6 weeks old) compared with other dietary treatments.

Poultry diet is predominantly composed of plant ingredients, mainly cereals and vegetable proteins plus a little amount of animal proteins. Most of feed ingredients contain non-digested parts (Cellulose, xylose, arabinose, galactonic acid) which inhibit feed utilization and birds performance (Alam, et al., 2003). At high dietary concentrations, the feeding value of cereals, particularly those with low apparent metabolizable energy (AME), are reduced and result in a poor bird performance (Choct, et al., 1996).

A series of studies by Annison and Choct (1991) and Choct and Annison (1990, 1992a) demonstrated that pentosans affect the metabolizable energy value of wheat. Pentosans are comprised principally of arabinoxylans, which are linked to other cell wall components. Soluble arabinoxylans can absorb up to 10 times their own weight of water, forming highly viscous solutions. Choct and Annison (1992b) confirmed that it is the viscosity of arabinoxylans which exerts their anti-nutritive activity. The anti-nutritive effect is manifested by depressed nutrients utilization accompanied by a poor growth. These adverse effect could be overcome by supplementation of exogenous carbohydrate splitting enzyme (Xylanase), which have shown to decrease viscosity of intestinal contents and improve digestibility of starch, protein, fat and AME in diets containing wheat (Annison and Choct, 1991 and Bedford, 1995). The use of enzymes in the bird's diet has been
successful in reducing the viscosity of the digesta and has led to an improvement in feed conversion efficiency (Bedford, 1997).

The present study was conducted to evaluate the effect of incorporating different levels of 0, 25, 50 and 75 % BBP (with reference to enzyme supplementation) into Arbor-Acre broiler chick diets as replacement of corn on the performance, digestibility of nutrients responses and the economical efficiency.

**MATERIALS AND METHODS**

This work was carried out at El Takamoly Poultry Project, Fayoum, Egypt, to study the effect of replacing yellow corn by BBP in starter and finisher diets of broiler chicks. Chemical analyses were performed in the laboratories of the Poultry Production Department, Faculty of Agriculture, Fayoum University, according to the procedures outlined by A.O.A.C (1990).

Three hundred un-sexed Arbor-Acres broiler chicks at one-week of age were divided into ten treatments (30 birds each), each treatment contained 3 replicates of 10 birds. The experimental treatments were as follows:

- Treatment 1 (T1): A corn-soybean diet was taken as a control (NRC requirements).
- Treatment 2 (T2): 25% of YC in T1 was replaced by BBP (adjusted to NRC energy requirements).
- Treatment 3 (T3): 25% of YC in T1 was replaced by BBP (non-adjusted to NRC energy requirements).
- Treatment 4 (T4): T3 plus 0.05 % Xylam (β-Xylanase and α-amylase).
- Treatment 5 (T5): 50% of YC in T1 was replaced by BBP (adjusted to NRC energy requirements).
- Treatment 6 (T6): 50% of YC in T1 was replaced by BBP (non-adjusted to NRC energy requirements).
- Treatment 7 (T7): T6 plus 0.05 % Xylam.
- Treatment 8 (T8): 75% of YC in T1 was replaced by BBP (adjusted to NRC energy requirements).
- Treatment 9 (T9): 75% of YC in T1 was replaced by BBP (non-adjusted to NRC energy requirements).
- Treatment 10 (T10): T9 plus 0.05 % Xylam.
The BBP was available in sufficient amounts from local bakeries. It is a mixture of mainly scattered wheat flour plus wheat bran. The chemical analysis of the BBP as compared to wheat flour and corn is presented in Table 1. After collecting, the BBP was screened to eliminate any harmful materials and then weighed and mixed with the other ingredients. Table (2) illustrates the composition of the experimental diets used in this trial. Diets 4, 7 and 10 were supplemented with a commercial enzyme (Xylam$^{60}$) mixture of B-xylanase and α-amylase (the recommended level of manufacturer is 0.05%), while the other remaining diets had no enzyme supplementation.

The experimental diets (starter and finisher) were supplemented with a minerals and vitamins mixture and DL-methionine to cover the recommended requirements according to (NRC, 1994) and were formulated to be iso-nitrogenous. Chicks were individually weighed, wing-banded and randomly allotted to the dietary treatments. Chicks were raised in electrically heated batteries with raised wire mesh floors and had free access to feed and water. Batteries were placed into a room provided with a continuous light and fans for ventilation. The birds were reared under similar managerial conditions, and were given the experimental diets (Table 2) from the end of the first week until 28 days (starter diets) and from 29 to 42 days of age (finisher diets).

Birds were individually weighed to the nearest gram at weekly intervals during the experimental period. At the same time, feed consumption was recorded and feed conversion (g feed / g gain) and body weight gain were calculated. Growth rate (GR), was calculated using the following formula according to the equation of Larner and Asundson (1932):

$$GR = \frac{(LBW_2 - LBW_1)}{0.5 (LBW_2 + LBW_1)}$$

Where: LBW$_1$ and LBW$_2$ are body weights at initial and final ages studied.

Cumulative mortality % was calculated during the starting and finishing periods.

At the end of the experiment (42 days), a slaughter test was performed using four chicks (2 males and 2 females) around the average LBW from each treatment. Birds were individually weighed to the nearest gram, and slaughtered by severing the carotid artery and jugular veins (Islamic method). After four minutes of bleeding, each bird was dipped in a hot water bath for two minutes and feathers were removed by hand. After the removal of head, carcass were manually eviscerated to determine some carcass traits, i.e, dressing % (eviscerated carcass without head, neck and
legs) and total giblets % (gizzard, liver, spleen and heart). The eviscerated weight included the front part with wing and hind part. The abdominal fat was removed from the parts around the viscera and gizzard, and was weighed to the nearest gram. The weight of these organs and dressing weight were expressed as a percentage of live body weight. The bone of the front and the rear parts were separated and weighed to calculate meat percentage. The meat from each part was weighed and blended using a kitchen blender. Chemical analyses of representative samples of the experimental diets and carcass meat (including the skin) were carried out to determine percentages of DM, CP (N x 6.25), EE, CF and ash contents according to the methods of A.O.A.C (1990). Nitrogen-free extract (NFE) was calculated by difference.

Individual blood samples were collected during exsanguinations, immediately centrifuged at 3500 rpm for 15 min. Serum were harvest after centrifugation of the clotted blood, stored at –20°C in the deep freezer until the time of chemical determinations. The biochemical characteristics of blood were determined colorimetrically, using commercial Kits as previously described by Ragab (2001).

To determine the economical efficiency for meat production (as shown in table 7), the amount of feed consumed during the entire experimental period was obtained and multiplied by the price of one Kg of each experimental diet which was estimated based upon local current prices at the experimental time (April, 2003). Analysis of variance was conducted on the data according to Steel and Torrie (1980). Significant differences among treatment means were determined using Duncan’s multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Productive performance:

Live body weight (LBW):-

Data presented in Table 3 showed that BBP significantly affected LBW (P≤0.05 or P≤0.01) at 14, 21, 28, 36 and 42 days of age. Chicks fed diet 10 had the highest values of LBW at 14 and 21 days of age (242.57 and 459.63 g, respectively). Chicks fed diet 7 had the highest values of LBW at 28, 36 and 42 days of age (810.97, 1241.13 and 1627.23 g, respectively). However, insignificant differences were observed in LBW at 7 days of age. These results are in agreement with those reported by Greenwood, et al. (2002) who reported that supplementation corn-soybean meal broiler diets
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with enzyme preparation containing a mixture of protease, amylase and xylanase resulted in improved body weight.

**Live body weight gain (LBWG):**

Data presented in Table 3 showed that BBP significantly affected LBWG ($P \leq 0.01$) during all periods studied. Chicks fed diet 7 had the heaviest LBWG during the periods from 7 to 28 and 7 to 42 days of age (718.35 and 1540.5 g, respectively), while chicks fed diet 10 had the heaviest LBWG during the period from 29 to 42 days of age (822.91g) as compared with the control (diet 1) and the other diets at the same periods. This is in accordance with the previous data on LBW. This improvement may be due to the use of enzyme which play a critical role in improving poultry performance. These results are in agreement with Rose (1996) who reported that enzyme supplementation increased gain and improved FC ratio. He explained this result to the improvement in the digestibility of all nutrients and not simply to starch alone. Bakery by-product contains yeast (used in processing) which contains some nutrients (i.e. vitamins and enzymes) and have been necessary for increasing body weight gain for growing Japanese quail (Ali, et al., 2000). El Yamny, et al.(2003) reported that incorporating of 25 % BBP in Japanese quail diets as un-traditional ingredients enhanced ($P < 0.05$) body weight and body gain at the market age (6 weeks old) compared with other dietary treatments, they used in their study.

**Feed intake (FI):**

Data presented in Table 3 showed that BBP significantly affected FI ($P \leq 0.01$) during all periods studied. Chicks fed the control diet had the lowest FI during the periods from 7 to 28, 29 to 42 and 7 to 42 days of age (1188.0, 1679.6 and 2867.6 g, respectively). The data also indicated that there was no effect of adding enzyme preparations to broiler diets on FI (diets 4, 7 and 10). These results are in agreement with those reported by Ouhida et al. (2000) and Ghazalah, et al.(2005). While, Radwan (1995) found that incorporating of 25 % BBP into Baladi chick diets at 10, 20, 30 or 40 % levels had increased feed intake and feed conversion was impaired.

**Feed conversion, crude protein conversion and caloric conversion ratio (FC, CPC and CCR):**

Results presented in Table 3 indicated that BBP significantly ($P \leq 0.01$) affected FC, CPC and CCR during the periods from 29 to 42 and 7 to 42 days of age. Chicks fed diet 2 had the best FC (2.254 and 2.086 g, respectively) and CPC (0.908 and 0.391 g, respectively) during the periods
from 29 to 42 and 7 to 42 days of age. Whereas, chicks fed diet 10 had the best CCR during the periods from 29 to 42 and 7 to 42 days of age (14.03 and 5.671 g, respectively). However, insignificant effect were observed in FC, CPC and CCR during the period from 7 to 28 days of age. These results agreed with those reported by El-Yamny, *et al.* (2003) who reported that incorporating of 25% BBP in Japanese quail diets as un-traditional ingredients enhanced (P<0.05) feed conversion at the market age (6 weeks old) compared with the other dietary treatments. Wyatt *et al.* (1999) reported that the addition of multicomponent enzyme into corn-soy broiler diets enhanced the energy utilization by 3.3% and hence improved body weight gain and feed conversion. Zanella *et al.* (1999) also reported that enzyme supplementation improved overall crude protein digestibility in corn/soybean-based broiler diets by 2.9% (80% ± 0.7 vs. 82.9% ± 0.7). Performance studies by the same research group demonstrated that the enzyme supplementation improved body weight and feed conversion ratio by 1.9 and 2.2%, respectively. Because of its effect on nutrient digestibility improvement, Avizyme 1500 application focuses either on a diet cost reduction, through reduced diet energy content, or over-the-top (OTT) addition to improve overall poultry performance. Greenwood *et al.* (2002) reported that addition of Avizyme 1502 into low ME diets (2, 3 and 4% in starter, grower and finisher, respectively) improved performance in terms of 42-day body weight and FCR.

**Growth rate (GR):**

Data presented in Table 4 showed that BBP significantly affected GR during the starting and total periods. Chicks fed diet 7 had higher GR values at the two studied periods (being 1.569 and 1.774, respectively). However, insignificant effects were observed in GR during the finishing period.

**Mortality percentage:**

Cumulative mortality % are presented in Table 4. Obtained results indicated that the percentage of mortality was 3.333 % in chicks fed diets 1, 5 and 8 as compared with the other groups during the starting period. Whereas, chicks fed diets 3 and 6 had the higher mortality % during the finishing and for the total period.

**Carcass characteristics:**

Results presented in Table 5 revealed no significant difference among dietary treatments in the carcass traits except for abdominal fat %. Chicks fed the control diet had the highest value of abdominal fat being
1.702 % whereas, chicks fed diet 10 had the lowest corresponding value of abdominal fat being 0.492 % as compared with the control or the other groups. These results agreed with those reported by Radwan (1995) who found that incorporating of 25 % BBP into Baladi chick diets at 10, 20, 30 or 40 % levels had no detrimental effect on dressing %. On the other hand, these results disagreed with El-Yamny, et al. (2003) who reported that replacing corn by 25 % BBP resulted in the greatest values of carcass and liver as absolute weights compared with the other dietary treatments. Increasing BBP up to 50% replacement decreased the values of carcass weight and dressing percentage compared with the other dietary treatments.

**Serum constituents:**

Data of serum constituents are summarized in Table 5. The results indicated significant effects of BBP on GOT, total protein and albumin. Chicks fed diet 7 had the highest values of GOT, total protein and albumin (36.75, 5.030 and 3.867, respectively). In general, the results in Table 5 indicated that birds fed BBP showed higher serum globulin values compared with the control diet (the differences were not significant). These results may providing further evidence for the improved performance since, globulin is mainly involved in antibody formation as well as cell membrane activities and cell division and cell proliferation (Kwak, et al., 1999). This finding may be further indicate the beneficial effect of using BBP. However, insignificant effects were observed in other serum constituents (calcium, phosphorus, triglycerides and cholesterol) due to incorporating the un-traditional ingredient at any level in broiler diets.

**Chemical composition of broiler meat:**

Data presented in Table 6 showed that the BBP significantly affected fat (P≤0.05) % of broiler meat. The highest fat % value was observed for the group fed diet 4, while the lowest fat % value was observed for the group fed diet 10. However, insignificant differences were observed in moisture, protein, ash and NFE% of meat. Carcass parts significantly influenced (P≤0.01 and P≤0.05) protein, fat, ash and NFE%. Front part had higher protein, ash and NFE % than rear part (60.04, 2.915, 1.955 vs 48.90, 2.448 and 1.692%), rear part had higher fat % than front part (42.51 vs 30.65%). However, moisture% of meat was insignificantly affected by carcass parts.

**Economical efficiency (EEf):**

Results in Table 7 showed that EEf values at 7 weeks of age were improved in chicks fed BBP as compared with the control diet. Chicks fed
diet 9 gave the best economical and relative efficiency being 5.333 and 132.73%, respectively then chicks fed diet 6 (5.016 and 124.85%, respectively) when compared with the other BBP treatments or the control diet. Whereas, the birds fed the control diet had the worst values, being 4.018 and 100%, respectively. The relative efficiency values varied between 3.19 to 32.73% which are of minor importance considering the other factors of production. In general, the diets of un-traditional ingredient resulted in the highest economical efficiency (expressed % of net revenue/feed cost) compared with the control diet. These results agreed with El-Yamny, et al. (2003) who reported that the greatest economical efficiency values were obtained for diets contained 25% BBP. It can be concluded that BBP can be used as untraditional source of energy in broiler diets to get best performance and highest income per chicken.
Table 1: Analysis of dried bakery by-product.

<table>
<thead>
<tr>
<th>Item</th>
<th>Download 1994 (%)</th>
<th>Enzymes (2001)</th>
<th>Download 2001 (%)</th>
<th>TMEn (kcal/kg)</th>
<th>ME, kcal/kg</th>
<th>GE, kcal/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture, %</td>
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<td>11</td>
<td>11</td>
<td>11.9</td>
<td>11</td>
<td>11</td>
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<tr>
<td>Crude protein, %</td>
<td>12.5</td>
<td>11</td>
<td>11</td>
<td>11.9</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Ether extract, %</td>
<td>12.5</td>
<td>11</td>
<td>11</td>
<td>11.9</td>
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<td>11</td>
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<tr>
<td>Crude fiber, %</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Ash, %</td>
<td>12.5</td>
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<td>11</td>
<td>11.9</td>
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<td>NFE, %</td>
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<td>Calcium, %</td>
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<td>11</td>
<td>11</td>
<td>11.9</td>
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<td>Phosphorus, %</td>
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<td>11</td>
<td>11</td>
<td>11.9</td>
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<td>Sodium, %</td>
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<td>Potassium, %</td>
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<td>11.9</td>
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<td>11</td>
<td>11.9</td>
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<td>11</td>
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</table>

* Calculated from the following equation: TMEn (kcal/kg) = 4.34 + 10.10 (% CF) + 0.04 (% Ash) - 0.03 (% CP) + 0.01 (% EE)

NA = Non-analysed
Table 2: Composition and analyses of the experimental diets.

<table>
<thead>
<tr>
<th>Item, %</th>
<th>75% BBP</th>
<th>50% BBP</th>
<th>25% BBP</th>
<th>Control</th>
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<tr>
<td>Non NRC</td>
<td>16.20</td>
<td>48.60</td>
<td>29.03</td>
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<tr>
<td>NRC</td>
<td>2.40</td>
<td>1.80</td>
<td>0.30</td>
<td>1.30</td>
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<td>1.00</td>
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<tr>
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<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
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</table>

**Cost (L.E./ton):**

- **According to the local market price at the experimental time.**
- **Assuming economical efficiency of the control group equals 100.**

**Vit. and Min. premix:**

- **Vit. A, 12000000 IU ; Vit. D3 2500000 IU ; Vit. E, 10 g ; Vit. K3, 2.5 g ; Vit. B1, 1.5 g ; Vit. B2, 5 g ; Vit. B6, 1.5 g; Vit. B12, 10 mg ; Choline chloride, 1050 g ; Biotin, 50 mg ; Folic acid, 1 g ; Nicotinic acid, 30 g ; Ca pantothenate, 10 g ; Zn, 55 g ; Cu, 10 g ; Fe, 35 g ; Co, 250 mg ; Se, 150 mg ; I, 1 g ; Mn, 60 g and anti-oxidant, 10 g.**

**ME, K cal./Kg:**

- **According to NRC, 1994**

<table>
<thead>
<tr>
<th>Item</th>
<th>28.00</th>
<th>28.00</th>
<th>29.10</th>
<th>28.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
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</table>

***Table 2: Composition and analyses of the experimental diets.***

According to NRC 1994.

1. NRC: 1994; Energy: 2425 Kcal/kg, Protein: 290 Gm/kg, Fat: 32 Gm/kg. 2. To control for the possible errors. 3. To control for the possible errors.
Table (9): Growth performance (mean ± SE) of broiler chicks as affected by replacing yellow corn by bakery by-product.
Table (4): Growth rate and mortality % of broiler chicks as affected by replacing yellow corn by bakery by-product.

<table>
<thead>
<tr>
<th>Item</th>
<th>Treat</th>
<th>Growth rate</th>
<th>Mortality %</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>75% BBP</td>
<td>50% BBP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25% BBP</td>
<td>Control (T1)</td>
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<tr>
<td></td>
<td>T1</td>
<td>1.55±0.01A</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>T2</td>
<td>1.56±0.01A</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>1.50±0.01B</td>
<td>3.333</td>
</tr>
<tr>
<td></td>
<td>T4</td>
<td>1.57±0.01A</td>
<td>0.000</td>
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<tr>
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<td>T5</td>
<td>1.56±0.01A</td>
<td>0.000</td>
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<tr>
<td></td>
<td>T6</td>
<td>1.53±0.01A</td>
<td>3.333</td>
</tr>
<tr>
<td></td>
<td>T7</td>
<td>1.54±0.01A</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>T8</td>
<td>1.54±0.01A</td>
<td>0.000</td>
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<tr>
<td></td>
<td>T9</td>
<td>1.56±0.01A</td>
<td>3.333</td>
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<tr>
<td></td>
<td>T10</td>
<td>1.52±0.01A</td>
<td>3.333</td>
</tr>
</tbody>
</table>

Mean ± standard error of the mean.

a, and b, values in the same row followed by different superscripts are significantly different (at \( P \leq 0.05 \) for a and b, and \( P \leq 0.01 \) for A, B, and C).

Table (4): Growth rate and mortality % of broiler chicks, as affected by replacing yellow corn by bakery by-product.
Table (5): Carcass characteristics and serum constituents (Mean ± SE) of broiler chicks as affected by replacing yellow corn by bakery by-product.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>25% BBP</th>
<th>50% BBP</th>
<th>75% BBP</th>
<th>Control</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>T7</th>
<th>T8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Carcass traits</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dressing %</td>
<td>70.42±1.74</td>
<td>71.76±1.74</td>
<td>72.55±1.74</td>
<td>72.89±1.74</td>
<td>72.86±1.74</td>
<td>73.24±1.74</td>
<td>72.76±1.74</td>
<td>66.16±1.74</td>
<td>73.05±1.74</td>
<td>71.82±1.74</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liver %</td>
<td>2.12±0.146</td>
<td>2.36±0.146</td>
<td>2.30±0.146</td>
<td>2.24±0.146</td>
<td>2.33±0.146</td>
<td>2.45±0.146</td>
<td>2.30±0.146</td>
<td>2.59±0.146</td>
<td>2.35±0.146</td>
<td>2.26±0.146</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gizzard %</td>
<td>2.43±0.210</td>
<td>2.49±0.210</td>
<td>2.30±0.210</td>
<td>2.13±0.210</td>
<td>1.91±0.210</td>
<td>2.07±0.210</td>
<td>2.00±0.210</td>
<td>1.46±0.210</td>
<td>1.94±0.210</td>
<td>1.85±0.210</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spleen %</td>
<td>0.136±0.023</td>
<td>0.128±0.023</td>
<td>0.130±0.023</td>
<td>0.109±0.023</td>
<td>0.137±0.023</td>
<td>0.128±0.023</td>
<td>0.145±0.023</td>
<td>0.144±0.023</td>
<td>0.130±0.023</td>
<td>0.169±0.023</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart %</td>
<td>0.588±0.036</td>
<td>0.511±0.036</td>
<td>0.559±0.036</td>
<td>0.592±0.036</td>
<td>0.570±0.036</td>
<td>0.485±0.036</td>
<td>0.483±0.036</td>
<td>0.626±0.036</td>
<td>0.497±0.036</td>
<td>0.494±0.036</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total giblets %</td>
<td>5.275±0.213</td>
<td>5.493±0.213</td>
<td>5.292±0.213</td>
<td>5.069±0.213</td>
<td>4.946±0.213</td>
<td>5.142±0.213</td>
<td>4.933±0.213</td>
<td>4.823±0.213</td>
<td>4.926±0.213</td>
<td>4.878±0.213</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abdominal fat%</td>
<td>1.702±0.28 a</td>
<td>1.214±0.28 ab</td>
<td>0.506±0.28 b</td>
<td>1.670±0.28 a</td>
<td>1.420±0.28 ab</td>
<td>1.283±0.28 ab</td>
<td>0.981±0.28 ab</td>
<td>0.718±0.28 b</td>
<td>0.923±0.28 ab</td>
<td>0.492±0.28 b</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cholesterol g/l</td>
<td>163.50±63.3</td>
<td>75.5±63.3</td>
<td>94.00±63.3</td>
<td>83.33±51.7</td>
<td>137.00±63.3</td>
<td>228.50±63.3</td>
<td>225.50±63.3</td>
<td>68.50±63.3</td>
<td>141.00±63.3</td>
<td>103.50±63.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GOT mmol/L</td>
<td>28.75±0.717 b</td>
<td>29.15±0.717b</td>
<td>29.10±0.717b</td>
<td>30.25±0.717b</td>
<td>29.10±0.717b</td>
<td>29.95±0.717b</td>
<td>36.75±0.717a</td>
<td>28.20±0.717b</td>
<td>28.50±0.717b</td>
<td>28.80±0.717b</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPT mmol/L</td>
<td>47.75±2.88</td>
<td>45.15±2.88</td>
<td>45.45±2.88</td>
<td>45.45±2.88</td>
<td>45.30±2.88</td>
<td>47.50±2.88</td>
<td>55.30±2.88</td>
<td>41.75±2.88</td>
<td>42.50±2.88</td>
<td>41.70±2.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total protein g/dl</td>
<td>2.246±0.462b</td>
<td>2.784±0.462b</td>
<td>2.814±0.462b</td>
<td>2.605±0.462b</td>
<td>2.425±0.462b</td>
<td>2.695±0.462b</td>
<td>5.030±0.462a</td>
<td>2.186±0.462b</td>
<td>2.545±0.462b</td>
<td>2.395±0.462b</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albumin g/dl</td>
<td>1.734±0.458 b</td>
<td>1.411±0.458b</td>
<td>1.544±0.458b</td>
<td>1.089±0.458b</td>
<td>1.444±0.458b</td>
<td>1.556±0.458b</td>
<td>3.867±0.458a</td>
<td>0.778±0.458b</td>
<td>1.689±0.458b</td>
<td>1.733±0.458b</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Globulin g/dl</td>
<td>0.512±0.387</td>
<td>1.373±0.387</td>
<td>1.270±0.387</td>
<td>1.516±0.387</td>
<td>0.981±0.387</td>
<td>1.139±0.387</td>
<td>1.163±0.387</td>
<td>1.408±0.387</td>
<td>0.856±0.387</td>
<td>0.662±0.387</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albumin/Globulin ratio</td>
<td>6.099±2.74</td>
<td>1.028±2.74</td>
<td>1.244±2.74</td>
<td>0.977±2.74</td>
<td>1.527±2.74</td>
<td>1.355±2.74</td>
<td>4.229±2.74</td>
<td>0.457±2.74</td>
<td>7.493±2.74</td>
<td>3.750±2.74</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glucose mg/dl</td>
<td>60.07±31.07</td>
<td>34.53±31.07</td>
<td>85.61±31.07</td>
<td>64.53±31.07</td>
<td>45.32±31.07</td>
<td>65.47±31.07</td>
<td>33.45±31.07</td>
<td>66.19±31.07</td>
<td>30.22±31.07</td>
<td>93.52±31.07</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a, …b, values in the same row within the same item followed by different superscripts are significantly different (at $P\leq 0.05$ for a to b).
Table (6): Chemical analysis of carcass meat % (Mean ± SE) of broiler chicks (on dry matter basis) as affected by replacing yellow corn by bakery by-product.

<table>
<thead>
<tr>
<th>Item</th>
<th>Moisture</th>
<th>Protein</th>
<th>Fat</th>
<th>Ash</th>
<th>NFE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>4.2±0.0.15</td>
<td>42.2±0.0.15</td>
<td>37.8±0.0.15</td>
<td>2.4±0.0.15</td>
<td>1.5±0.0.15</td>
</tr>
<tr>
<td>T1</td>
<td>4.0±0.0.15</td>
<td>43.0±0.0.15</td>
<td>37.0±0.0.15</td>
<td>2.3±0.0.15</td>
<td>1.4±0.0.15</td>
</tr>
<tr>
<td>T2</td>
<td>4.1±0.0.15</td>
<td>43.1±0.0.15</td>
<td>36.9±0.0.15</td>
<td>2.2±0.0.15</td>
<td>1.3±0.0.15</td>
</tr>
<tr>
<td>T3</td>
<td>4.1±0.0.15</td>
<td>43.1±0.0.15</td>
<td>36.9±0.0.15</td>
<td>2.2±0.0.15</td>
<td>1.3±0.0.15</td>
</tr>
<tr>
<td>T4</td>
<td>4.1±0.0.15</td>
<td>43.1±0.0.15</td>
<td>36.9±0.0.15</td>
<td>2.2±0.0.15</td>
<td>1.3±0.0.15</td>
</tr>
<tr>
<td>T5</td>
<td>4.1±0.0.15</td>
<td>43.1±0.0.15</td>
<td>36.9±0.0.15</td>
<td>2.2±0.0.15</td>
<td>1.3±0.0.15</td>
</tr>
<tr>
<td>T6</td>
<td>4.1±0.0.15</td>
<td>43.1±0.0.15</td>
<td>36.9±0.0.15</td>
<td>2.2±0.0.15</td>
<td>1.3±0.0.15</td>
</tr>
<tr>
<td>T7</td>
<td>4.1±0.0.15</td>
<td>43.1±0.0.15</td>
<td>36.9±0.0.15</td>
<td>2.2±0.0.15</td>
<td>1.3±0.0.15</td>
</tr>
<tr>
<td>T8</td>
<td>4.1±0.0.15</td>
<td>43.1±0.0.15</td>
<td>36.9±0.0.15</td>
<td>2.2±0.0.15</td>
<td>1.3±0.0.15</td>
</tr>
<tr>
<td>T9</td>
<td>4.1±0.0.15</td>
<td>43.1±0.0.15</td>
<td>36.9±0.0.15</td>
<td>2.2±0.0.15</td>
<td>1.3±0.0.15</td>
</tr>
<tr>
<td>T10</td>
<td>4.1±0.0.15</td>
<td>43.1±0.0.15</td>
<td>36.9±0.0.15</td>
<td>2.2±0.0.15</td>
<td>1.3±0.0.15</td>
</tr>
</tbody>
</table>

Carcass parts:

- **Rear part**
  - Control: 4.4±0.0.15
  - T1: 4.3±0.0.15
  - T2: 4.2±0.0.15
  - T3: 4.1±0.0.15
  - T4: 4.0±0.0.15
  - T5: 3.9±0.0.15
  - T6: 3.8±0.0.15
  - T7: 3.7±0.0.15
  - T8: 3.6±0.0.15
  - T9: 3.5±0.0.15
  - T10: 3.4±0.0.15

- **Front part**
  - Control: 4.6±0.0.15
  - T1: 4.5±0.0.15
  - T2: 4.4±0.0.15
  - T3: 4.3±0.0.15
  - T4: 4.2±0.0.15
  - T5: 4.1±0.0.15
  - T6: 4.0±0.0.15
  - T7: 3.9±0.0.15
  - T8: 3.8±0.0.15
  - T9: 3.7±0.0.15
  - T10: 3.6±0.0.15

*a, b, c, A, and B values in the same column within the same item followed by different superscripts are significantly different at P ≤ 0.05 for a, b and c; P ≤ 0.01 for A and B.*
### Table (7): Economical Efficiency of Broiler Chicks as Affected by Replacing Yellow Corn by Bakery By-Product

<table>
<thead>
<tr>
<th>Item</th>
<th>Control</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>T7</th>
<th>T8</th>
<th>T9</th>
<th>T10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average feed intake (Kg/bird) starter</td>
<td>1.188</td>
<td>1.223</td>
<td>1.254</td>
<td>1.259</td>
<td>1.255</td>
<td>1.29</td>
<td>1.348</td>
<td>1.344</td>
<td>1.412</td>
<td>1.491</td>
<td>1.494</td>
</tr>
<tr>
<td>Price / Kg feed (P.T.) *starter</td>
<td>121.50</td>
<td>128.64</td>
<td>123.05</td>
<td>129.59</td>
<td>125.31</td>
<td>119.24</td>
<td>128.75</td>
<td>115.68</td>
<td>111.24</td>
<td>115.68</td>
<td></td>
</tr>
<tr>
<td>Total feed cost (P.T.) starter</td>
<td>1.9114</td>
<td>1.8819</td>
<td>1.9368</td>
<td>1.8433</td>
<td>1.805</td>
<td>1.7626</td>
<td>1.8519</td>
<td>1.9124</td>
<td>1.863</td>
<td>1.9114</td>
<td>1.9114</td>
</tr>
<tr>
<td>Average feed intake (Kg/bird) finisher</td>
<td>1.491</td>
<td>1.420</td>
<td>1.432</td>
<td>1.421</td>
<td>1.432</td>
<td>1.491</td>
<td>1.432</td>
<td>1.421</td>
<td>1.432</td>
<td>1.421</td>
<td>1.491</td>
</tr>
<tr>
<td>Price / Kg feed (P.T.) *finisher</td>
<td>145.13</td>
<td>144.69</td>
<td>168.55</td>
<td>169.80</td>
<td>160.85</td>
<td>144.69</td>
<td>168.55</td>
<td>139.47</td>
<td>153.23</td>
<td>145.13</td>
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</tr>
<tr>
<td>Total feed cost (P.T.) finisher</td>
<td>133.32</td>
<td>144.38</td>
<td>131.96</td>
<td>145.80</td>
<td>157.25</td>
<td>145.80</td>
<td>157.25</td>
<td>139.47</td>
<td>153.23</td>
<td>144.38</td>
<td></td>
</tr>
<tr>
<td>Average feed intake (Kg/bird)</td>
<td>1.500</td>
<td>1.469</td>
<td>1.332</td>
<td>1.575</td>
<td>1.575</td>
<td>1.575</td>
<td>1.575</td>
<td>1.575</td>
<td>1.575</td>
<td>1.575</td>
<td>1.575</td>
</tr>
<tr>
<td>Price / Kg live weight (P.T.)</td>
<td>824.78</td>
<td>847.28</td>
<td>712.75</td>
<td>847.28</td>
<td>793.87</td>
<td>793.87</td>
<td>847.28</td>
<td>807.90</td>
<td>712.75</td>
<td>847.28</td>
<td></td>
</tr>
<tr>
<td>Total revenue (P.T.)</td>
<td>691.47</td>
<td>702.89</td>
<td>661.91</td>
<td>702.89</td>
<td>641.96</td>
<td>641.96</td>
<td>702.89</td>
<td>680.32</td>
<td>661.91</td>
<td>702.89</td>
<td></td>
</tr>
</tbody>
</table>

Economical efficiency = \( \frac{\text{Net revenue (P.T.)}}{\text{Total feed cost (P.T.)}} \times 100 \)

**Based on average price of both starter and finisher diets during the experimental time.

*** According to the local market price of the experimental time.

**** Net revenue per unit feed cost.

Assuming economical efficiency of control group equals 100.
REFERENCES


Bakery By-Product, Enzymes, Broiler Performance


الملخص العربي
تأثیر استبدال الذرة الصفراء بمخلفات الخبز علي آداء بداري التسمين
منى سيد رجب ومحمد مصطفى نمره* و أحمد محمد رضوان عثمان
كلية الزراعة - قسم إنتاج الدواجن - جامعة القيوم
* معهد بحوث الإنتاج الحيواني - الدقيق - الجزيرة

أجريت هذه الدراسة لبحث تأثير استبدال الذرة بمخلفات الخبز علي معدل النمو وصفات الطيور ومكونات الدم والكفاءة الاقتصادية لبدوالي التسمين. استخدم عدد ١٠٠٠ كنوكوت أرور أكرز غير منس عسر أسبوع، قسمت الكتاكيت إلى عشر عمالات (٢٥ طائر/عملة)، كل عمالات تمثلت على ٣ مكررات (١٠ طيور/مكرر). والعمالات التجريبية كما يلي:

١. عاملة ١ مجموعة المقارنة (عليفة ذرة - صويا) مع ضبط الاحتكادات وفقا لـ NRC

٢. عاملة ٢ استبدال ٢٥% من الذرة في عليفة الكنترول بمختلفات الخبز مع ضبط احتياجات الطاقة وفقا لـ NRC

٣. عاملة ٣ استبدال ٢٥% من الذرة في عليفة الكنترول بمختلفات الخبز مع عدم ضبط احتياجات الطاقة وفقا لـ NRC

٤. عاملة ٤ تغذية الطيور علي عليفة ٣ + إنزيم الزيلام ٠٠٥ معدل ٠٠٥%
معاملة 6 استناد 50% من الذرة في علبة بعد الكرنب مع مخلفات المخابز مع ضبط
الاحتياجات وفقاً لـ NRC.

معاملة 7 استناد 50% من الذرة في علبة بعد الكرنب مع مخلفات المخابز مع ضبط
الاحتياجات وفقاً لـ NRC.

معاملة 9 استناد 75% من الذرة في علبة بعد الكرنب مع مخلفات المخابز مع ضبط
الاحتياجات وفقاً لـ NRC.

معاملة 10 تعقيد الطيور على علبة 9 + إضافة الزيليل 500 بمعدل 0.05%.

والنتائج المتحصل عليها يمكن تلخيصها في الآتي:

كان أعلى وزن للكتيك المغذاء على علبة رقم 1 على عمر 14 و 21 يوم من
العمر وكان أعلى وزن على عمر 28 و 32 و 34 يوم للكتيك المغذاء على علبة رقم 7.
وكان أعلى زيادة في وزن الجسم في النجاح المغذي على العلبة رقم 7 خلال فترة النامي
والقراءة الكلية. بينما الكتيك المغذاء على علبة رقم 10 أعلى زيادة في وزن الجسم خلال
فترة النامي. كانت الكتيك المغذاء على علبة بعد الكرنب أقل في استهلاك الغذاء خلال
الفترات من 28–7 و 21–7 و 24–7. يوم من العمر كانت أعلى كفاءة للتحويل الغذائي وأعلى
كشفة لتحويل البروتين الكتيك المغذاء على علبة رقم 2 ثم علبة رقم 7 خلال الفترات

كانت الكتيك المغذاء على علبة رقم 7 أعلى قيمة لعمل الدم خلال فترات البادي والقراءة
الكلية. كانت أعلى نسبة لدهن البطين بالنسبة للكتيك المغذاء في علبة رقم 10.
وأعلى نسبة لدهن البطين للكتيك المغذاء على علبة رقم 10 للمقارنة بمجموعة الكرنب أو
المجموعات الأخرى. كانت أعلى نسبة للبروتين الكلي والألياف في
GNOT بالنسبة للكتيك المغذاء على علبة رقم 7.

كانت أعلى نسبة دهن بالنسبة لحم الكتيك المغذاء على علبة رقم 4 و أعلى نسبة
بالنسبة للكتيك المغذاء على علبة رقم 8. كان للأجزاء الدقيقة تأثير معنوي على نسبة
المنوية للدهن والرماد والكربوهيدرات المامية. كأن الجزء الأمامي أعلى في نسبة البروتين و
الرماد والكربوهيدرات المامية عن الجزء الخفيف، بينما كانت الجزء الخفيف أعلى في
نسبة الدهن عن الجزء الأمامي. كانت نسبة الفوائد 33% بالنسبة للكتيك المغذاء على
علبة رقم 8 بالمقارنة بالمجموعات الأخرى خلال فترة البادي. بينما كانت الكتيك المغذاء
على علبة رقم 3 و أعلي نسبة فوق خلال فترة النامي والقراءة الكلية. أعطت الطيور

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المغذيات على غِلظة رقم ٦ أعلى كفاءة اقتصادية ونسبية ثم الطيور المغذية على غِلظة ٦ بالمقارنة بين مجموعة الكنترول والمجامع الأخرى. بينما الطيور المغذية على غِلظة الكنترول كانت أقل كفاءة اقتصادية ونسبة. ومن هنا يمكن استهلاك مخلفات المخابز بنسبة تصل إلى ٧٥% بدلاً من الذرة في علاقات بداري التسمين للحصول على أعلى أداء الإنتاج وأعلى كفاءة اقتصادية.