THE EFFECT OF TRITICALE GRAIN ON THE PERFORMANCE OF CHICKS FROM BIRTH TO NINE WEEKS OF AGE

K. Charalambous, A. Koumas and S. Economides

AGRICULTURAL RESEARCH INSTITUTE
MINISTRY OF AGRICULTURE AND NATURAL RESOURCES

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SUMMARY

Triticale grain was used to replace partially or completely corn in diets of chicks from birth to 9 weeks of age. When 50% corn was replaced by an equal weight of triticale, growth rate, feed efficiency, final liveweight and carcass yield were similar to those of chicks fed the all-corn diet. However, the performance of chicks was lower when triticale replaced corn completely. Female chicks produced lighter carcasses and had higher dressing percentage than male chicks. Feathering was reduced with increasing proportion of triticale in the diet and the carcass was white when triticale was the only grain in the diet.

INTRODUCTION

Triticale, a wheat x rye hybrid, is grown in many regions of the world (Hulse and Laing, 1974). In Cyprus certain triticale lines outyielded Athenais barley by 8% and Ptic 62 aestivum wheat by 11% in dryland areas, and durum and aestivum wheat by 20% in irrigated areas (Hadjichristodoulou, 1984). The metabolizable energy (ME) and protein contents of triticale grain were 20 and 13% higher than Athenais barley grain used in sheep diets (Hadjipanayiotou et al., 1985). Triticale grain contained more lysine and sulphur amino acids than other cereal grains (Allee, 1973), and its ME content was 3.0 Mcal/kg, equal to that of wheat but lower than that of maize (Amerio et al., 1984). When supplemented with lysine and methionine its ME content was equal to that of hard spring wheat (Sell et al., 1962). Triticale grain has been used as an energy source in diets of different classes of livestock (Allee, 1973; Hulse and Laing, 1974) and particularly to replace wheat or maize in diets of growing chicks (Bixler et al., 1968; Bragg and Sharby, 1970).

The objective of the present work was to investigate the possibility of partial or complete replacement of corn by triticale grain in the diet of growing chicks.

MATERIALS AND METHODS

Fifty six birds (28 males and 28 females) were allocated to each of three treatment diets on the basis of the initial liveweight. Treatments were replicated twice in a randomized complete block design, i.e. the trial comprised a total of 336 birds.

RESULTS

Eighteen chicks died (3,6 and 9 in treatments C, CT and T, respectively) and ten suffered from perosis. Data from these chicks were excluded from the analysis.
Body weight of chicks at 5 or 9 weeks, and weight gain from 0 to 5, 6 to 9 and 0 to 9 weeks were similar in diets C and CT and higher (P=0.01) than those in diet T (Table 2). Body weight of male chicks at 5 or 9 weeks and weight gain from 0 to 5, 6 to 9 and 0 to 9 weeks were higher (P=0.01) than female chicks (Table 2). Initial body weight of chicks affected significantly (P=0.01) body weight at 5 weeks but not at 9 weeks. During the 6 to 9 week period male chicks on diet T gained less weight (P=0.01) than male chicks on the other diets but weight gain of female chicks on the three diets was similar. Feed consumption was similar with chicks on diets C and CT and higher (6%) than that of chicks on diet T (Table 2). Feed efficiency in male chicks on diets C and CT was also similar and better (3%) than in male chicks on diet T. However, feed efficiency in female chicks was similar for all three diets.

Cumulative weekly gain, cumulative weekly feed intake and cumulative weekly feed efficiency (kg of feed/kg body gain) are presented in Tables 5, 6 and 7.

Carcass yield and carcass plus edible giblets yield were similar in chicks on diets C and CT and higher (P=0.05) than those in chicks on diet T; they were also higher (P=0.01) in male than in female chicks (Table 3). Differences in feather weight were significant (P=0.01) only between diets C and T (Table 3). Weight of blood, feet and head plus intestines were higher (P=0.01) in male than female chicks. Skin colour ranged from 2 to 4 for chicks on diet C, was 1 for chicks on diet CT and 0 for chicks on diet T. Dressing percentage was similar in chicks on diets C and CT and higher (P=0.05) than that of chicks on diet T. Dressing percentage of female chicks was higher (P=0.01) than that of male chicks (Table 4).

**DISCUSSION**

Body weight at 5 and 9 weeks and growth rate were not affected when triticale formed 33-38% of the total ration, replacing an equal weight of corn, but total replacement of corn by triticale had an adverse effect on weight gain and growth rate. Similar findings have been reported for partial (33%) or complete replacement of corn by triticale in chick diets from birth to 2 weeks (Bixler et al., 1968) and from birth to 4 weeks (Angelova et al., 1980).

The higher crude protein content of triticale grain, compared to corn, reduces the inclusion rate of soybean meal in the rations (Bixler et al., 1968; Angelova et al., 1980; Amerio et al., 1984). This may have reduced the level of lysine, resulting in lower gain and feed efficiency (Bixler et al., 1968). In the present study, however, the diets were supplemented with lysine, and during the period birth to 5 weeks the level of lysine was 5.3% of the total protein while during the period 6 to 9 weeks it was 5.0%, compared to the recommended level of 4.9% (NRC, 1977). Despite this, growth rate was depressed with the triticale diet. This may be attributed to the lower feed intake (6%). Since the diets were isocaloric, total energy intake was reduced, and simultaneously the protein intake was also reduced. This is in agreement with the reduced performance of male and female chicks when energy was reduced by 5% during the finishing period (Morgan, 1980a).

In agreement with other reports (Krivosis and Kralik, 1975; Tarrago and Puchal, 1977; Moran, 1980a, 1980b) body weight and rate of growth were higher and feed efficiency better for male than for female chicks. The growth of female chicks was similar in all diets but male chicks on the triticale diet grew slower than male chicks on the other two diets during the finishing period because of lower protein intake. According to Grey et al. (1982) males continue to grow linearly until 76 days of age and have higher crude protein requirements than female chicks, which grow at a slower rate after 35 days of age and have lower protein requirements.

In agreement with other reports (Krivosis and Kralik, 1975; Moran, 1980a, 1980b; Grey et al., 1982) female chicks produced lighter carcasses with higher dressing percentage than male chicks. The higher offal weight of male chicks at slaughter (blood, feet, and head plus intestines) was due to the larger body size and larger digestive system of male chicks.

The decrease of feather weight with increasing proportion of triticale in the diet may indicate an effect of triticale grain on the degree of feathering. Males had higher feather weight because of richer plumage than females. Yellow skin colouring was present on chick carcasses reared on corn, but not on those reared on triticale grain, which contains very low level of xanthophylls (Amerio et al., 1984). This enables rearing chickens with white meat, which is preferred by many consumers.
Table 1. Composition (g/kg), and energy and protein content of the diets.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>0 - 5 weeks</th>
<th></th>
<th>6 - 9 weeks</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C</td>
<td>CT</td>
<td>T</td>
<td>C</td>
</tr>
<tr>
<td>Protein concentrate*</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>100</td>
</tr>
<tr>
<td>Soybean meal (44% C.P)</td>
<td>260</td>
<td>215</td>
<td>165</td>
<td>184</td>
</tr>
<tr>
<td>Corn</td>
<td>620</td>
<td>335</td>
<td>20</td>
<td>703.5</td>
</tr>
<tr>
<td>Triticale</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5.5</td>
</tr>
<tr>
<td>Dicalcium phosphate</td>
<td>11</td>
<td>6</td>
<td>6</td>
<td>7</td>
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<tr>
<td>Limestone</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>0.35</td>
</tr>
<tr>
<td>**DL-Methionine</td>
<td></td>
<td></td>
<td></td>
<td>0.85</td>
</tr>
<tr>
<td>**Lysine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metabolizable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy (MJ/kg)</td>
<td>12.33</td>
<td>12.30</td>
<td>12.30</td>
<td>12.70</td>
</tr>
<tr>
<td>Crude Protein (g/kg)</td>
<td>219</td>
<td>217</td>
<td>214</td>
<td>187</td>
</tr>
</tbody>
</table>

* Protein concentrate contained 50% C.P., 10.15 MJ ME/kg, 1.6% Methionine, 2.1% Methionine + Cystine, 3.5% Lysine, 5.3% Ca, 3.2% available P, 2.5% salt, 125,000 I.U./kg vitamin A and 300 I.U./kg vitamin E.

** DL - methionine and lysine were added to provide equal quantities per kg finished feed.

All diets were supplemented with a mineral-vitamin premix (VTN, SYN III, Cyprus) at the rate of 1.67 kg/ton finished feed and with Amprolplus (0.5kg/ton finished feed).

Table 2. The effect of partial or complete replacement of corn by triticale on the performance of broilers.

<table>
<thead>
<tr>
<th></th>
<th>Corn (C)</th>
<th>Corn + Triticale (CT)</th>
<th>Triticale (T)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males</td>
<td>Females</td>
<td>Males</td>
</tr>
<tr>
<td>Live weight (g)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial</td>
<td>37</td>
<td>38</td>
<td>37</td>
</tr>
<tr>
<td>5-week</td>
<td>1319</td>
<td>1128</td>
<td>1350</td>
</tr>
<tr>
<td>9-week</td>
<td>3055</td>
<td>2479</td>
<td>3110</td>
</tr>
<tr>
<td>Weight gain (g)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-5 weeks</td>
<td>1282</td>
<td>1090</td>
<td>1313</td>
</tr>
<tr>
<td>6-9 weeks</td>
<td>1735</td>
<td>1351</td>
<td>1760</td>
</tr>
<tr>
<td>0-9 weeks</td>
<td>3017</td>
<td>2441</td>
<td>3073</td>
</tr>
<tr>
<td>Feed intake (g)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-5 weeks</td>
<td>2453</td>
<td>2223</td>
<td>2526</td>
</tr>
<tr>
<td>6-9 weeks</td>
<td>4996</td>
<td>4274</td>
<td>5076</td>
</tr>
<tr>
<td>0-9 weeks</td>
<td>7449</td>
<td>6497</td>
<td>7602</td>
</tr>
<tr>
<td>Feed/gain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-5 weeks</td>
<td>1.91</td>
<td>2.04</td>
<td>1.92</td>
</tr>
<tr>
<td>6-9 weeks</td>
<td>2.88</td>
<td>3.16</td>
<td>2.88</td>
</tr>
<tr>
<td>0-9 weeks</td>
<td>2.47</td>
<td>2.66</td>
<td>2.47</td>
</tr>
</tbody>
</table>

* Number of birds from 6th week to end of trial.
Table 3. Slaughter data of chicks at nine weeks of age.

<table>
<thead>
<tr>
<th>Weight (g)</th>
<th>Corn (C) Males</th>
<th>Corn (C) Females</th>
<th>Corn + Triticale (CT) Males</th>
<th>Corn + Triticale (CT) Females</th>
<th>Triticale (T) Males</th>
<th>Triticale (T) Females</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>At slaughter</td>
<td>3083</td>
<td>2342</td>
<td>3073</td>
<td>2360</td>
<td>2892</td>
<td>2192</td>
<td>114</td>
</tr>
<tr>
<td>Carcass</td>
<td>2249</td>
<td>1718</td>
<td>2240</td>
<td>1739</td>
<td>2086</td>
<td>1596</td>
<td>86</td>
</tr>
<tr>
<td>Carcass + giblets</td>
<td>2369</td>
<td>1819</td>
<td>2364</td>
<td>1842</td>
<td>2202</td>
<td>1689</td>
<td>90</td>
</tr>
<tr>
<td>Feathers</td>
<td>175</td>
<td>151</td>
<td>160</td>
<td>137</td>
<td>142</td>
<td>139</td>
<td>10</td>
</tr>
<tr>
<td>Blood</td>
<td>108</td>
<td>74</td>
<td>119</td>
<td>83</td>
<td>117</td>
<td>82</td>
<td>7</td>
</tr>
<tr>
<td>Feet</td>
<td>133</td>
<td>76</td>
<td>132</td>
<td>85</td>
<td>125</td>
<td>77</td>
<td>7</td>
</tr>
<tr>
<td>Head + intestines</td>
<td>299</td>
<td>218</td>
<td>299</td>
<td>214</td>
<td>306</td>
<td>223</td>
<td>20</td>
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</table>

Table 4. Carcass and offals of slaughtered birds as a percentage of liveweight.

<table>
<thead>
<tr>
<th>Percent of liveweight</th>
<th>Corn (C) Males</th>
<th>Corn (C) Females</th>
<th>Corn + Triticale (CT) Males</th>
<th>Corn + Triticale (CT) Females</th>
<th>Triticale (T) Males</th>
<th>Triticale (T) Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcass</td>
<td>72.93</td>
<td>73.35</td>
<td>72.87</td>
<td>73.67</td>
<td>72.14</td>
<td>72.81</td>
</tr>
<tr>
<td>Carcass + giblets</td>
<td>76.83</td>
<td>77.64</td>
<td>76.91</td>
<td>78.04</td>
<td>76.16</td>
<td>77.00</td>
</tr>
<tr>
<td>Feathers</td>
<td>5.66</td>
<td>6.43</td>
<td>5.21</td>
<td>5.81</td>
<td>4.89</td>
<td>6.33</td>
</tr>
<tr>
<td>Blood</td>
<td>3.50</td>
<td>3.17</td>
<td>3.86</td>
<td>3.50</td>
<td>4.05</td>
<td>3.73</td>
</tr>
<tr>
<td>Feet</td>
<td>4.31</td>
<td>3.26</td>
<td>4.30</td>
<td>3.59</td>
<td>4.33</td>
<td>3.51</td>
</tr>
<tr>
<td>Head + intestines</td>
<td>9.69</td>
<td>9.31</td>
<td>9.71</td>
<td>9.06</td>
<td>10.57</td>
<td>10.19</td>
</tr>
</tbody>
</table>

Table 5. Cumulative weekly gain (g/bird).

<table>
<thead>
<tr>
<th>Week</th>
<th>Corn (C) Males</th>
<th>Corn (C) Females</th>
<th>Corn + Triticale (CT) Males</th>
<th>Corn + Triticale (CT) Females</th>
<th>Triticale (T) Males</th>
<th>Triticale (T) Females</th>
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</thead>
<tbody>
<tr>
<td>1</td>
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<td>85</td>
<td>96</td>
<td>87</td>
<td>84</td>
<td>80</td>
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<tr>
<td>2</td>
<td>264</td>
<td>241</td>
<td>276</td>
<td>243</td>
<td>243</td>
<td>218</td>
</tr>
<tr>
<td>3</td>
<td>525</td>
<td>463</td>
<td>540</td>
<td>462</td>
<td>485</td>
<td>425</td>
</tr>
<tr>
<td>4</td>
<td>877</td>
<td>766</td>
<td>889</td>
<td>752</td>
<td>821</td>
<td>700</td>
</tr>
<tr>
<td>5</td>
<td>1282</td>
<td>1090</td>
<td>1313</td>
<td>1085</td>
<td>1213</td>
<td>1011</td>
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<tr>
<td>6</td>
<td>1713</td>
<td>1550</td>
<td>1780</td>
<td>1431</td>
<td>1625</td>
<td>1313</td>
</tr>
<tr>
<td>7</td>
<td>2205</td>
<td>1813</td>
<td>2222</td>
<td>1776</td>
<td>1993</td>
<td>1636</td>
</tr>
<tr>
<td>8</td>
<td>2645</td>
<td>2137</td>
<td>2675</td>
<td>2107</td>
<td>2465</td>
<td>1978</td>
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<td>9</td>
<td>3017</td>
<td>2441</td>
<td>3072</td>
<td>2413</td>
<td>2862</td>
<td>2286</td>
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</tbody>
</table>
Table 6. Cumulative weekly feed intake (g/bird).

<table>
<thead>
<tr>
<th>Week</th>
<th>Corn (C) Males</th>
<th>Corn (C) Females</th>
<th>Corn + Triticale (CT) Males</th>
<th>Corn + Triticale (CT) Females</th>
<th>Triticale (T) Males</th>
<th>Triticale (T) Females</th>
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<tr>
<td>1</td>
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<td>122</td>
<td>141</td>
<td>122</td>
<td>143</td>
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<tr>
<td>2</td>
<td>417</td>
<td>401</td>
<td>436</td>
<td>393</td>
<td>422</td>
<td>402</td>
</tr>
<tr>
<td>3</td>
<td>876</td>
<td>831</td>
<td>908</td>
<td>787</td>
<td>859</td>
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<td>4</td>
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<td>1559</td>
<td>1425</td>
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<td>6497</td>
<td>7602</td>
<td>6419</td>
<td>7296</td>
<td>6064</td>
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</table>

Table 7. Cumulative weekly feed efficiency (kg feed/kg weight gain).

<table>
<thead>
<tr>
<th>Week</th>
<th>Corn (C) Males</th>
<th>Corn (C) Females</th>
<th>Corn + Triticale (CT) Males</th>
<th>Corn + Triticale (CT) Females</th>
<th>Triticale (T) Males</th>
<th>Triticale (T) Females</th>
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</thead>
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<td>1</td>
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<td>1.45</td>
<td>1.40</td>
<td>1.70</td>
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<td>1.60</td>
<td>1.65</td>
<td>1.60</td>
<td>1.60</td>
<td>1.75</td>
<td>1.85</td>
</tr>
<tr>
<td>3</td>
<td>1.65</td>
<td>1.80</td>
<td>1.70</td>
<td>1.70</td>
<td>1.75</td>
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<td>1.90</td>
<td>2.00</td>
<td>2.00</td>
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<tr>
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<td>2.00</td>
<td>2.20</td>
<td>2.15</td>
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<td>2.50</td>
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<td>2.65</td>
<td>2.55</td>
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</tbody>
</table>

It may be concluded that the performance of chicks on diets containing 33-38% triticale (replacing equal quantity of corn) from birth to 9 weeks of age is similar to that of chicks on a corn-soybean meal diet. However, complete replacement of corn by triticale reduces final liveweight, weight gain, feed efficiency and carcass yield, the main contributing factor being the lower feed consumption. Although more work is needed to clarify the cause of this lower feed consumption in order to increase the efficiency of utilization of triticale grain, its use as the sole grain in chick diets may not be excluded if cost of production is lower than with corn based diets. Indeed, there are suggestions that certain feedstuffs promoting slower growth rate and weight at slaughter but leading to lower cost per unit gain may be preferred in chick diets (Ward, 1978).

Economic analysis based on the performance data of the present study showed that feeding cost per unit carcass gain, which comprises over 70% of the total cost of production, was 38.1, 36.1 and 34.7 cent/kg for corn, corn plus triticale and triticale diets, respectively. From the same economic analysis the selling price of triticale grain was calculated to be £52.7 in the corn-triticale diet (CT) and £48.9 in the triticale diet (T) compared to the selling price of corn at £37/ton (subsidized price). It is obvious, that triticale grain should be given more attention as a poultry feed in the future.
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REFERENCES


