

## The Effect of Feeding Increased Levels of Cotton-seed Meal on the Performance of Laying Hens

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ONE hundred eighty B.W. (Baladi White) pullets and 24 E.W. cocks, were divided randomly into four equal groups. In the mean time one hundred sixty eight R.I.R. (Rhode Island Red) pullets and 24 R.I.R. cocks were divided also into four equal groups. Four rations contained U.D. C.S.M. (undecorticated cottonseed meal) at levels 0, 10, 20 and 30% were used for feeding the four groups of the B.W. birds, while with the R.I.R. breed, other four rations contained D. C.S.M. (decorticated cottonseed meal) at levels, 0, 10, 20 and 30% were used respectively for feeding the four groups.

The results showed that increasing the level of U.D. C.S.M. in B.W. and D. C.S.M. in R.I.R. hen rations up to 30% (0.027 and 0.032% free gossypol of the ration) had no adverse effect on egg production, egg weight and feed efficiency. There was no increase in mortality rate by increasing the level of U.D. C.S.M. in B.W. hen rations up to 30%. The level of 20% D. C.S.M. in R.I.R. hen rations did affect mortality rate, while the level of 30% increased it. The level up to 30% U.D. C.S.M. in B.W. hen rations did not affect fertility percentage. Using D. C.S.M. at levels up to 20% (0.022% free gossypol of the ration) in R.I.R. hen rations did not decrease fertility, while the level of 30% decreased it. The level of 10% U.D. C.S.M. (0.009% free gossypol of the ration) in B.W. hen rations did not depress hatchability, while the levels 20 and 30% (0.018 and 0.027% free gossypol) had significantly depressed it. With the R.I.R. breed, 10% D. C.S.M. did not affect hatchability, while the levels 20 and 30% had significantly depressed it.

In formulating poultry rations, most of the protein requirements are generally covered from plant protein concentrates. Owing to the low price of cottonseed meal, the economical trend of feeding poultry necessitated the incorporation of cottonseed meal with the maximum level possible. Employment of cottonseed meal in poultry rations has been curtailed by problems attributed to gossypol.

Reiser (1950) and Heywang and Bird (1954) showed that optimum levels of cottonseed meal in poultry rations did not decrease egg production. Narin *et al.* (1957) Heywang *et al.* (1965) indicated that greater levels of experimental gossypol in cottonseed meal decreased egg production.

Heywang *et al.* (1950) and Heywang *et al.* (1952) showed that there was no adverse effect on egg weight when layers were fed on a ration containing free gossypol up to 0.036%. Narain *et al.* (1957) found a reduction in egg weight when 0.04% free gossypol was fed.

Lipstein and Bronstein (1964) emphasized that gossypol usually affects feed intake more than feed efficiency. On the other hand, Heywang and Vavich (1965) demonstrated that there was no difference in feed intake, efficiency of feed consumption when comparing pullets fed on soybean, glandless and glanded cottonseed meal.

Reiser (1950) reported that cottonseed oil given in hen ration gave higher mortality than in fat free ration. On the other hand, Narain *et al.* (1957), (1960) found that mortality was not affected by increasing the levels of gossypol.

Naber and Morgan (1957) and Kemmerer *et al.* (1965) indicated that high levels of gossypol depressed hatchability. Heywang *et al.* (1950) showed that 0.012% free gossypol did not depress hatchability. Heywang and Vavich (1965) showed that up to 16.5% cottonseed meal did not depress hatchability.

#### Material and Methods

One hundred eighty B.W. (Baladi white) and one hundred sixty eight R.I.R. (Rhode Island Red pullets of similar age and weight were used in this study. Hens within each breed were divided into four equal groups, each was confined in an earth floor pen six cocks from the same breed were used to each group.

For rations of nearly isonutritive value contained U.D.C.S.M. (uncorticated cottonseed meal at levels, 0,10,20 and 30% were used respectively for feeding the four groups of the B.W. birds, while with the R.I.R. breed, other four rations similar in their nutritive value contained D.C.S.M. (decorticated cottonseed meal at levels 0,10,20 and 30% were used respectively for feeding the four groups. The crude fat of the different rations was within the limits recommended by Titus (1961) while crude fiber was within the possible limits recommended by Titus (1961) while crude fiber was within the possible limits recommended by Ibrahim (1969). The allowances of starch value and digestible protein for B.W. and R.I.R. layers rations were taken after Ghoneim (1957). The starch values of the different ingredients of the rations were calculated after Abou-Raya (1967). Table (1) shows the composition and nutritive value of the experimental rations. The chemical analysis of the rations was done according to Raafat (1969). Total and free gossypol of the cottonseed meal were determined according to Smith (1958) and A.O. C.S., (1957) respectively.

Each group of the B.W. and R.I.R. birds were given its diet ad libitum and the actual amount of feed consumed was calculated monthly throughout the experimental period which lasted for six months (Dec., 1967 to May, 1968). Eggs were collected from each group, weighed and recorded daily at 4 P.M.

For studying fertility and hatchability, 3365 B.W. and 3046 R.I.R. eggs were selected from all tested groups of hens. The selection of the incubated eggs and the required operation conditions of the incubator were conducted according to Ghany and Kamar (1963).

Snedecor's book (1959) was consulted for statistical analysis.

TABLE 1. The composition of the experimental rations.

Ingredients, kg	B.W. rations				R.I.R. rations			
	1	2	3	4	5	6	7	8
Corn (White) . . . . .	15.	15	20	45	10	13	20	24.5
Barley . . . . .	15	15	20	—	6	10	10	20
Wheat bran . . . . .	20	25	15	10	15	15	10	10
Rice bran . . . . .	38	25	15	8	25	22	25	10
Uncorticated C.S.M. . . . .	—	10	20	30	—	—	—	—
Decorticated C.S.M. . . . .	—	—	—	—	—	10	20	30
Beans ( <i>Vicia Faba</i> ) . . . . .	8	6	6	3	38.5	24.5	9.5	—
Dried skim milk . . . . .	4	4	4	4	5.5	5.5	5.5	5.5
Starch value (Calculated) . . .	67.89	66.16	65.01	64.39	69.15	69.67	70.05	7.
Crude protein, % . . . . .	15.41	14.63	16.09	15.51	18.92	18.46	19.83	19.69
Crude fiber, % . . . . .	10.36	11.66	11.93	11.58	9.05	9.46	8.83	7.68
Crude fat, % . . . . .	4.96	4.95	4.10	3.62	3.69	3.36	4.49	4.01
Crude ash, % . . . . .	9.06	8.27	8.64	7.44	9.15	8.87	8.95	8.43
Nitrogen - free extract % . . .	50.01	49.92	48.90	51.43	38.36	49.02	47.22	49.79
Total gossypol, % . . . . .	0.000	0.104	0.208	0.312	0.000	0.137	0.275	0.412
Free gossypol, % . . . . .	0.000	0.009	0.018	0.027	0.000	0.011	0.022	0.032
Bound gossypol, % . . . . .	0.000	0.095	0.190	0.285	0.000	0.126	0.253	0.380

Each ration was supplied by 0.2 kg vit. A+D<sub>3</sub> powder, 0.5 kg sodium chloride and 1.5 kg calcium carbonate. Mineral mixture was added (Titus, 1961). Excess of Ca CO<sub>3</sub> was available for hens in separate containers.

## Results and Discussion

### 1. Egg production

The data in Table (2) reveal that increasing the level of U.D. C.S.M. in B.W. and D. C.S.M. in R.I.R. hen rations up to 30% (0.027 and 0.032 % free gossypol of the ration) had no adverse effect as egg production. These results are in good agreement with that obtained by Reiser (1950), Abou-El Ela (1964) and Heywang and Varich (1965). On the other hand, Heywang and bird (1954) showed that levels of gossypol greater than 0.016% adversely affected egg production.

### 2. Egg weight

The results showed that increasing U.D. C.S.M. in B.W. and D. C.S.M. in R.I.R. hen rations up to 30% (0.027 and 0.032 % free gossypol of the ration) had no adverse effect on egg weight, Table 2. These data are in agreement with that obtained by Narain *et al.* (1957) and Phelps (1966).

### 3. Feed efficiency

The results in Table 2 indicate that increasing the U.D. C.S.M. in B.W. and D. C.S.M. in R.I.R. hen rations up to 30% (0.027 and 0.032% free gossypol of the ration) had no adverse effect on feed efficiency. These results indicate that increasing the U.D. C.S.M. in B.W. and D. C.S.M. in R.I.R. hen rations up to 30% (0.027 and 0.032% free gossypol of the ration) had no adverse effect on feed efficiency. These results are in agreement with that obtained by Abou El-Ela (1964) and Heywang and Varich (1965).

### 4. Mortality rate

The results show that there was no increase in mortality rate by increasing the level of U.D. C.S.M. in B.W. in B.W. hen rations up to 30%. The level of 20% D. C.S.M. in R.I.R. hen rations did not increase mortality rate, while the level of 30% increased it Table 2.

It is interesting to note that Lillie and Bird (1950) reported that purified gossypol and gossypol furnished by pigment glands appeared to be of approximately equal toxicity, whereas Eagle and Davis (1958) reported that pigment gland gossypol was more toxic than pure gossypol.

## 5. Fertility

The results indicate that increasing the level of U.D. C.S.M. in B.W. hen rations up to 30% (0.027% free gossypol of the ration) did not affect the fertility percentage. With the R.I.R. breed it was found that increasing the level of D. C.S.M. in the layers rations up to 20% (0.022% free gossypol of the ration) did not affect fertility but the level of 30% (0.032% free gossypol of the ration) was accompanied with a noticeable decrease in fertility, Table 2.

In this connection Reiser (1950) concluded that cottonseed oil added to hen rations gave lower fertility than the fat free ration. Abou El-Ela (1964) found that fertility was not affected by increasing the level of undecorticated cottonseed meal fed to hens up to 35%.

TABLE 2. Effect of feeding rations containing different levels of cotton-seed meal on average monthly egg production, average eggweight, feed efficiency, mortality, fertility and hatchability

Item	B.W. layers				R.I.R. layers			
	Level of U.D. C.S.M. in the rations				Level of D. C.S.M. in the rations			
	0%	10%	20%	30%	0%	10%	20%	30%
Average monthly egg yield per hen . . .	9.93	11.02	11.7	12.85	9.72	9.63	9.67	10.04
Average egg weight (g) . . . . .	43.64	44.99	44.67	44.97	50.19	51.68	51.13	52.08
Feed efficiency . . . . .	5.11	4.81	4.13	3.83	5.71	6.22	5.50	5.66
Mortality, % . . . . .	4.35	8.80	6.53	4.55	9.53	7.14	9.53	21.43
Total number of incubated eggs . . . . .	683	816	867	999	839	565	833	809
Fertility, % . . . . .	84.08	86.67	87.72	86.65	82.40	76.70	82.51	68.78
Hatchability, % . . . . .	74.19	72.14	65.35	63.19	74.81	71.57	63.96	59.92
	±	±	±	±	±	±	±	±
	1.92	2.25	0.96	2.39	0.58	2.23	1.85	3.06

6. *Hatchability*

With the B.W. breed analysis of variance showed that there was significant difference between treatments at 0.01 level. Conducting "t" test showed that there was significant difference between the control and the treatments which were fed rations containing 20 and 30% U.D. D.S.M. respectively, and insignificant difference between the control and the treatment which was fed the ration contained 10% U.D. C.S.M. (Table 2).

Analysis of variance for the data obtained with the R.I.R. breed showed that there was significant difference between treatments at 0.01 level. Conducting "t" test showed that there was significant difference between the control and the treatments which were fed rations containing 20 and 30% D. C. S.M. respectively, and insignificant difference between the control and the treatment which was fed the ration contained 10% D.C.S.M.

It can be concluded that the level of 10% U.D. C.S.M. (0.009% free gossypol of the ration) in B.W. hen rations did not depress hatchability while the levels of 20 and 30% had significantly depressed it. With the R.I.R. hen rations 10% D.C.S.M. (0.011% free gossypol of the ration) did not depress hatchability, while the levels 20 and 30% had significantly depressed it. This result is in agreement with that obtained by Heywang *et al.* (1950), Heywang and Bird (1952) and Kratzer *et al.* (1955). On the other hand, Heywang and Vavich (1965) showed that 16.5% cottonseed meal did not depress hatchability. Abou El-Ela (1964) found that increasing the level of undecorticated cottonseed meal up to 35% did not depress hatchability.

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## دراسة تأثير التغذية بمستويات مختلفة من كسب بذرة القطن على الصفات الانتاجية للدجاج

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أجريت هذه الدراسة على ١٨٠ دجاجة بلدى أبيض ، ١٦٨ دجاجة رود أيلاند أحمر كانت طيور كل نوع متماثلة العمر والوزن عند بداية التجربة . وقد قسم دجاج كل نوع الى أربع مجاميع متماثلة ، أشيف الى كل مجموعة ٦ ذبوك من نفس النوع وضعت كل مجموعة في حظيرة مستقلة . غذيت مجاميع الدجاج البلدى الأبيض على علائق متماثلة في قيمتها الغذائية ولكنها اختلفت في مستويات كسب بذرة القطن غير المشور حيث كان للمجاميع الأربعة على الترتيب صفر ، ١٠ ، ٢٠ ، ٣٠ ٪ وعلى نفس النمط كونت أربعة علائق لتغذية مجاميع الدجاج الرود أيلاند الأحمر ، متماثلة في قيمتها الغذائية ولكنها اختلفت في مستويات كسب بذرة القطن المشور حيث بلغ على الترتيب للمجاميع الأربعة صفر ، ١٠ ، ٢٠ ، ٣٠ ٪ . ولقد استمرت التجربة لمدة ستة شهور ( ديسمبر ١٩٦٧ - مايو ١٩٦٨ ) لدراسة الصفات الانتاجية للدجاج .

ولقد ظهرت نتائج التجربة ان زيادة كسب بذرة القطن غير المشور في علائق الدجاج البلدى الأبيض ، كسب بذرة القطن المشور مع الدجاج الرود أيلاند الأحمر حتى مستوى ٣٠ ٪ ( ٢٧.٠ ، ٣٢.٠ ٪ من العليقة جوسيبول حر ) ليس له تأثير ضار على انتاج البيض أو متوسط وزن البيضة أو كفاءة تحويل الغذاء . لم يسبب استعمال كسب بذرة القطن غير المشور في عليقة الدجاج البلدى الأبيض بمستوى ٣٠ ٪ أو كسب بذرة القطن المشور بمستوى ٢٠ ٪ في تغذية الدجاج الرود أيلاند الأحمر ، أى تأثير على زيادة نسبة النفوق . ولكن لوحظ زيادة نسبة النفوق في الدجاج الرود أيلاند الأحمر في المجموعة التي غذيت على عليقة بها ٣٠ ٪ كسب بذرة قطن مشور . بزيادة كسب بذرة القطن غير المشور في علائق الدجاج البلدى حتى مستوى ٣٠ ٪ لم يحدث انخفاضاً في نسبة الخصب ، كما وجد ان مستوى ٢٠ ٪ من كسب بذرة القطن المشور .

( ٢٢.٠ ٪ من العليقة جوسيبول حر ) مع الدجاج الرود أيلاند الأحمر لم يقلل من نسبة الخصب . غير أن استعمال مستوى ٣٠ ٪ من هذا الكسب قد سبب انخفاضاً في هذه النسبة . استعمال كسب بذرة القطن غير المشور بمستوى ١٠ ٪ في علائق الدجاج البلدى الأبيض ، كسب بذرة القطن المشور بنفس المستوى في علائق الرود أيلاند الأحمر ( ٩.٠٠ ، ١١.٠ ٪ من العليقة جوسيبول حر ) لم يؤثر في نسبة الفقس ولكن زيادة مستوى كسب بذرة القطن في العلائق الى ٢٠ ٪ أو ٣٠ ٪ قد سبب انخفاضاً مؤكداً لنسبة الفقس لكل من النوعين .