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EGG PRODUCTION FROM IRAQI HYBRIDS

B.A. AL-RAWI[1] *AND M. FIKRY AMER*[2]

(Revised MS. received 29 October 1972)

SUMMARY

At the Poultry Farm, College of Agriculture, Baghdad, egg production during the first 90 days of production was recorded is six hybrid groups including 127 pullets. The hybrids which were combinations of standard breeds namely, White Leghorn (Leg) and New Hampshire (NH) and Iraqi chicken (Irq) were compared.

The cross NH X Irq x NH matured earlier and weighed heavier than other groups at sexual maturity. It recorded the highest score in this rank.

Highest egg number during the first 90 days of production was recorded by the crosses of (Irq) and (Leg) when mated with the latter, while the heaviest eggs were laid by the cross NH X Irq x NH.

Simple correlations were estimated between characters related to egg production. Most of them lacked significance, except those between weight of the first ten eggs and the weight of the first 90 eggs produced were positive and highly significant in the five groups.

Highly significant differences were found among groups with respect to all characters studied.

(1) Demonstrator, College of Agriculture, Baghdad University.

(2) Assistant Professor, Faculty of Agriculture, Ain Shams University, U.A.R.

الخلاصـــة

اجريت دراسة في حقل الدواجن بكلية الزراعة في ابي غريب على ١٢٧ مـن الفروج الهجين الناتج من تزاوج اللكهورن (Leg) والنيو همبشـير (NH) والدجاج العـراقي (Irq) موزعة على الشكل التالي :

(NHXIrq x NH), (Leg X Leg x Irq), (Leg X Irq x Leg), (NH X NH x Irq), (Irq X NH x Leg), (Irq X Leg x NH). وتنـــاولت الدراسة كل من العمر والوزن عند النضج الجنسي وعدد البيض خلال اول تسعون يوما ووزن البيضة خلال اول تسعون يوما ، طول الفترة لوضع اول عشرة بيضات وزن اول عشرة بيضات ٠

تفوقت المجموعة (NH X Irq x NH) عـلى بقية المجاميـع بالنسبة للعمـر والوزن عند النضج الجنسي ووزن البيضة ٠ وتفوقت المجاميع الهجينة الحاصلة من تزاوج الافراد الحاملة لكل من (Leg), (Irq) باللكهورن على بقية المجاميع وذلك بالنسبة لعدد البيض الناتج خلال اول ٩٠ يوما ٠

كان الارتباط بين الصفات المدروسة غير معنويا ما عدا ذلك بين وزن اول عشرة بيضات ووزن اول تسعون بيضه حيث كان موجبا ومعنويا لدى خمس من المجاميـــع ٠

كانت الفروق بين المجاميع بالنسبة لكل من الصفات المدروسة معنوية ٠

INTRODUCTION

Many poultry men have tried to improve egg production from chicken by selection, crossing and creating new breeds (King and Bruckner, 1952; Mohammed and El-Ibiary, 1963; Sabalina, 1964; Amer, 1965; Al-Rawi, 1969 and Al-Jebouri, 1970). The aim of this research was to study egg production (number and weight) and to estimate some simple correlations in Iraqi hybrids.

MATERIALS AND METHODS

This work included six progenies resulting from mating W. Leghorn (Leg), New Hampshire (NH) and Iraqi (Irq) with all their possible combinations at the Poultry Farm, College of Agriculture, Baghdad University. All birds were hatched on the same day during December 1969, brooded and reared under the same managerial conditions till sexual maturity. At that age, they were leg-banded, trapnested, and

weighed. Eggs were weighed and recorded daily during the first 90 days. All the groups were raised in houses with yards and fed *ad lib* rations containing 17.5% crude protein and 4.0% of both fat and fiber. Green fodder was chopped and added. Statistical analysis was carried out according to Snedecor (1956).

Groups were ranked by giving them grades according to their superiority in the characters studied. The first one was given 10 grades, while the sixth (last in grade) was given zero.

RESULTS AND DISCUSSION

Age and Weight at Sexual Maturity.

The earliest cross in sexual maturity was NH X Irq x NH, which occurred at 130.8 days (Table 1). The second cross in this respect was NH X NH x Irq which matured at 141.6 days. The third one was the cross Irq X Leg x NH, while the two crosses Leg X Irq and reciprocal when mated with Leghorn males produced progenies that matured at 147.8 and 150.7 days respectively. The latest one was Irq X NH x Leg which matured at 151.0 days. Small numbers and lack of hereditary information made it impossible to discuss these results on genetical basis. However, Table 2 shows highly significant differences among groups with regard to weight at sexual maturity; the hybrid NH X NH x Irq being the heaviest one. This may be due to the increase of the NH blood in the hybrid concerned.

Number of eggs during the first 90 days of production ranged between 46.3-36.1. It it of interest to notice that the hybrid of Irq and Leg in any combination laid the highest number, being 46.3 and 45.0 eggs. This may be due to those progenies comprising high percentages of Leghorn blood which is a heavy-producer. The cross Irq X NH and its reciprocal when mated with NH males gave progenies which were poor in production namely, 39.5 and 36.1 eggs during the same period. This may be due to the result of the combination of Irq which is a poor producer, and NH which is not an egg breed.

TABLE 1. Some productive and reproductive characters in New Hampshire, Leghorn and Iraqi Crosses.

Hybrids	Sexual maturity		Egg production (90 days)		First ten eggs laid	
	Age days	Body weight g	Number	Egg weight g	Period days	Egg weight g
NH* X Irq x NH	130.8	1897.8	36.1	46.5	16.4	45.3
NH X NH x Irq	141.6	1881.2	39.5	45.4	23.7	45.7
Leg X Irq x Leg	150.7	1629.5	46.3	45.4	17.9	44.3
Leg X Leg x Irq	147.8	1645.1	45.0	46.2	18.9	44.8
Irq X NH x Leg	151.0	1714.0	42.3	45.3	21.7	44.0
Irq X Leg x NH	145.2	1562.9	40.6	45.2	21.6	43.8

* The first breed in each hybrid group is the male.
NH = New Hampshire, Leg = Leghorn, Irq = Iraqi.

TABLE 2. Analysis of variance for data in Table 1.

Characters Studied	Source of variation: Breed (D.F. 5)	Error (D.F. 756)	
	Mean Sum Squares		F. Value
Sexual Maturity			
Age	1222.2		26.2**
Body Weight	876301.0		318.5**
Egg Production (90 days)			
Number	499.0		22.8**
Egg Weight	5.88		3.1**
First Ten Eggs Laid			
Period (days)	177.8		12.5**
Egg Weight	1150.8		5.7**

** $P < 0.01$.

With regard to egg weight, the variations among hybrids were small and ranged between 46.5 and 45.2 g (Table 2). The heaviest eggs were laid by NH X Irq x NH. The table also shows highly significant differences among groups with respect to egg number and weight and all other characters related to egg production. Order of Merit.

Order of Merit.

On the basis of ranking the progenies, the hybrid NH X Irq x NH was the best with a record of 48 grades. The cross Leg X Irq x Leg recorded 36 grades. The hybrids which were of combinations between standard breeds and Irq recorded the lowest grade namely 18. Therefore selection may be carried out among individuals of the two high scoring hybrids to choose one of them for further selection towards a new breed.

Simple Correlations.

Coefficients of correlation between characters studied are given in Table 3. Correlations between the number of eggs produced during the first 90 days and the period in which the first ten eggs were laid were negative. It is of interest to notice that the correlation between the number of eggs laid during the first 90 days and the average of their weight followed the same trend. The correlation between the weight of the first egg on one hand and weight or age at sexual maturity was positive in most cases. This holds true with those found by Al-Jebouri (1970).

Correlation between age and body weight at sexual maturity was positive in most cases. This agrees with those obtained by Al-Rawi (1969) and Al-Jebouri (1970).

Correlations between average weight of first ten eggs laid and those laid during the first 90 days were found to be positive and highly significant in most cases except in the cross NH X NH x Irq. This may be due to the difference in egg weight between NH males used to mate the Irq females of the cross in consideration.

TABLE 3. Coefficients of correlations for the characters studied.

Hybrids	No.	Number of eggs during 90 days & period for first 10 eggs	Number of eggs and egg weight during 90 days	Weight of first egg and weight at sexual maturity	Weight of first egg and age at sexual maturity	Age and Weight at sexual maturity	Weight of first 10 eggs and those of 90 days
NH X Irq x NH	22	-0.439*	-0.455*	0.292	0.385	0.428*	0.560**
NH XNH x Irq	28	-0.563**	-0.075	0.175	0.485**	0.349	0.083
Leg X Irq x Leg	24	-0.375	-0.373	-0.047	-0.140	0.117	0.709**
Leg X Leg x Irq	26	-0.419*	-0.149	0.544**	0.113	0.054	0.834**
Irq X NH x Leg	13	-0.032	-0.734**	0.610*	0.548	0.422	0.693**
Irq X Leg x NH	14	-0.569*	-0.514	0.424	0.271	-0.009	0.880**

** $P<0.01$.

* $P<0.05$.

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EVIDENCE OF RESISTANCE TO NEWCASTLE DISEASE IN CHICKENS NATIVE TO IRAQ

KHALID A. AL-SOUDI[1] AND IBRAHIM M.H. SOKKAR[2]

(Revised MS received 30 November 1972)

SUMMARY

Iraqi indigenous breed of chickens was able to maintain egg production after four successive inoculations, containing each 1000 lethal doses and higher of the Newcastle disease virus. Percent egg production varied from 3- to sometimes 5-fold that of Leghorns and New Hampshires injected with similar doses. It was superior with respect to hatchability of the fertile eggs as well.

الخلاصة

استعملت ١٤٠ دجاجة بعمر سنة واحدة في التجربة لغرض دراسة مقاومة اربعة انواع مختلفة من الدجاج المتوفر في حقل كلية الزراعة / ابو غريب وهي الدجاج المحلي والليكهورن والنيوهمشاير والخليط فيما بينهما ـ واعتبر انتاج البيض كدليل لمعرفة هذه المقاومة بعد اعطاء الفيروس بجرعات مختلفة ٠

واوضحت النتائج بان الدجاج العراقي كان اعلى مقاومة من الدجاج المستورد والخليط يقارب الدجاج العراقي في المقاومة ٠

واقترح تزاوج الدجاج العراقي مع الدجاج الاجنبي واستعمال الانتخاب كوسيلة للحصول على نوع جديد يمكن ان يصبح اكثر صلاحية للبيئة المحلية ٠

(1) Department of Animal Production, College of Agriculture, University of Baghdad, Abu-Ghraib, Iraq.

(2) College of Veterinary Medicine, Abu-Ghraib, Iraq.

INTRODUCTION

It has been known and supported by data collected in various parts of the world that native stock of chickens are often hardier than imported types (Hutt, 1958). This is also true of large animals (Lecky, 1950). Rosenberg and Tanaka (1951) reported that New Hampshire chicks reared for many generations on wire in Hawaii had a much lower incidence of perosis after 12 weeks in wire cages than those imported from the United States.

The genetic nature of this type of resistance is apparent in the ability to achieve selection progress in the case of leukosis (Biely *et al.*, 1933; and Bearse *et al.*, 1961, 1963) as well as Newcastle disease (Francis and Kish, 1955; and Cole and Hutt, 1961). Such evidence provides an encouraging basis to tackle the problem of Newcastle disease in Iraq where it has ravaged flocks with deadly regularity (*Turki et al.*, 1967). Iraqi indigenous breeds may well provide a clue to adapting imported breeds to such lethal environment (Al-Soudi, 1971).

Knox (1955) found incrossbreds and crossbreds dropped in egg production from an expected 60 to 40 and 34%, respectively, upon exposure to Newcastle disease, whereas standardbred Rhode Island Reds dropped from 60 to 17%. Maintaining egg production has been used as a criterion of resistance to disease in prior studies (Lerner *et. al.*, 1950) along with fertility and hatchability. In the light of this, it was desirable to investigate egg production, fertility and hatchability of the native strain and the extent of its superiority to imported and crossbreds when exposed to Newcastle disease virus.

MATERIALS AND METHODS

Indigenous (IRQ), Single Comb White Leghorn (LG), New Hampshire (NH) and crossbreds (CRS), each numbering 35 hens and 5 cocks, one year old, were subjected to four challenge tests of a virulent strain of Newcastle disease virus. Another four groups were used as controls and were left without inoculation during the whole period of the experiment. All groups had been previously exposed to this disease

through vaccination with the drinking water vaccine at 6 weeks of age. Therefore, blood samples were taken from all birds before beginning the experiment and the sera were subjected to the serological test (hemagglutination-inhibition test, HI).

Hygienic conditions prevailed throughout the trials which spread over a period of 9 months. At the Experimental Farm at the College of Agriculture in Abu-Ghraib, all birds were housed in the same buildings. The four groups were in separate pens and were treated as nearly alike as possible, therefore it is assumed they were affected approximately equally by environmental influences.

The strain of Newcastle disease virus, designated F_4H_4, was highly virulent and was isolated from an outbreak of the disease on 3 November 1970 at Muradia Poultry Farm (Farm 4, house 4) of the General Poultry Company in Iraq.

The material usel for the initial challenge test was obtained from a virus which showed an LD_{50} of 10^9/ml when titrated in embryonated chicken eggs and an LD_{50} 10^6/ml when titrated in susceptible chickens.

One ml virus suspension containing 10^3 LD_{50} for chickens was injected I/M into each chicken on 4 April 1971. All birds were kept under observation for one month for the purpose of recording symptoms and mortalities. During June, September and November the birds were injected with a 1 ml dose of the virus containing 10^2 LD_{50}.

Thorughout the experiment all birds were fed a ration containing 17.8% protein, 3.6% fat, 3.4% fiber, 3.2% Ca, 0.85% P and 2790 Kcal of metabolizable energy.

RESULT AND DISCUSSION

Results of the HI test were negative indicating absence of antibodies in the sera of non-inoculated birds prior to the test.

However, upon inoculation blood samples were taken at monthly intervals from all birds including controls. HI titers varied as follows:

Breeds	Average HI titers Treated	Control
IRQ	1/160-1/5120	negative-1/5
LG	1/ 40-1/ 640	negative-1/5
NH	1/ 80--1/ 320	negative-1/10
CRS	1/ 20-1/1280	negative-1/10

This indicated that birds were externally exposed to the virus as evidenced by the presence of specific immune antibodies in their sera. IRQ had the highest of all indicating higher immunological response (humoral immunity) and accounting in great part for their overall performance.

The effect of Newcastle disease virus in reducing the egg production rate as well as the ability of the chickens to continue laying without total cessation of production were considered criteria in judging the relative resistance to this disease of the different breeds between April and December. Thus, the birds which were able to maintain production despite one or several inoculations with the virus were considered to possess resistance to the disease.

Figure 1 indicates the trend of egg production of test groups in percent for each monthly period beginning in April and ending in November. The egg production of IRQ and the CRS coincided quite closely.

The effect of the virus of Newcastle disease in each group is apparent with the first inoculation as compared to the control group. The overall production, however, was low due to the effect of the onset of summer in Iraq, which is accompanied by elevated temperatures as high as 45°C.

The results in Table 1 clearly show the behaviour of all four groups with respect to percent egg production which shows a marked decrease after each inoculation of the virus. Leghorns and New Hampshires.

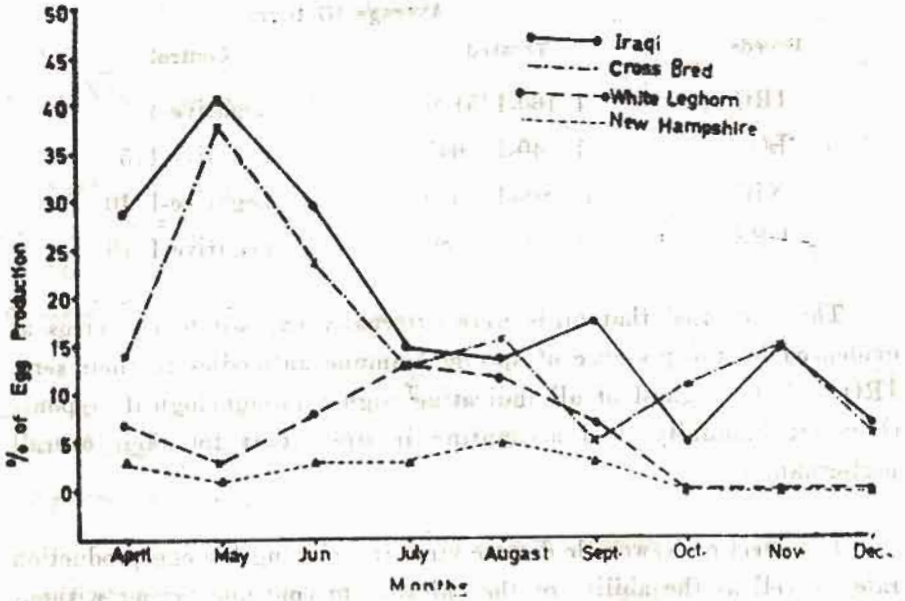

Fig. 1. Monthly egg production in Iraqi, White Leghorn, New Hampshire and crossbred.

were able to continue laying only for six months when the third inoculation was administered whereas the native breed continued laying for nine months even afer a fourth dose of the virus.

Mortality rates were indicated in Table 1 by listing the number of surviving birds in each month. After August, mortality ceased and starting with September the survivors in each group numbered 33, 26, 26 and 26 for LH, NH, CRS and IRQ, respectively. Thus, although Iraqi chickens could not boast of the lowest mortality figures, but they showed an overall lead in egg production starting with the first month of inoculation. Post mortem autopsies of all dead birds indicated mainly congestion of the brain, petechial hemorraghes in the cecal tonsils and intestinal tract, and congestion of the lungs and tracheitis. The brain and bone marrow were taken from dead birds and trials for isolating the virus in 9-10 day old chicken embroys were conducted. The virus was isolated and identified by using the Hemagglutination (HA) and HI tests.

TABLE 1. Egg production during the entire study (Hen/day, %).

Month		(LG)	(NH)	(CRS)	(IRQ)
April*	Treated	7.0	3.0	14.0	29.0
	Control	35.0	40.0	54.0	54.0
May	Treated	3.0	1.0(5)	38.0(5)	41.0(4)
	Control	40.0	50.0	44.0	39.0
June*	Treated	8.0	3.0(2)	24.0(1)	30.0(1)
	Control	39.0	36.0	45.0	46.0
July	Treated	13.0(2)	3.0	13.0	15.0(1)
	Control	27.0	23.0	35.0	38.0
August	Treated	12.0	5.0(1)	16.0(1)	14.0
	Control	24.0	27.0	36.0	35.0
September*	Treated	7.0	3.0(1)	5.0(2)	18.0(3)
	Control	24.0	23.0	29.0	32.0
October	Treated	0.0	0.0	11.0	5.0
	Control	28.0	25.0	30.0	33.0
November*	Treated	0.0	0.0	15.0	15.0
	Control	35.0	34.0	38.0	39.0
December	Treated	0.0	0.0	6.0	7.0
	Control	46.0	43.0	51.0	54.0

* Inoculation took place in this month.

( ) Number in parenthesis represents the number of mortalities in preceding month. Original number of birds was 35 for each group.

TABLE 2. Fertility, Hatchability and Embryo Mortality in Eggs Incubated after the Second Inoculation of the Chickens with the Virus (%).

		Fertility	Hatchability of fertile eggs	D_1*	D_2*	D_3*	No. of eggs set
LG*	Treated	44	15	57	—	28	59
	Control	91	44	33	14	8	157
NH*	Treated	66	22	61	—	17	27
	Control	93	50	28	14	7	143
CRS*	Treated	59	17	26	1	27	205
	Control	93	42	22	7	24	158
IRQ*	Treated	48	26	26	4	51	122
	Control	88	45	17	3	36	96

* LG = White Leghorn.
NH = New Hampshire.
CRS. = Crossbred.
IRQ = Iraqi.
D_1 = Number of dead embryos in the first week.
D_2 = Number of dead embryos in the second week.
D_3 = Number of dead embryos in the third week.

Fertility and hatchability percentages obtained are given in Table 2. The virus was effective in decreasing the fertility and hatchability by almost 50% as compared to the controls. The dead ebryos were examined and almost all of them showed congestion of the skin and hemorraghes in the skull.

Random samples from the nonfertile and dead embryos were taken for trials in order to isolate the virus. Nine ten-day old chicken embryos

were inoculated with these samples using the allantoic route. The virus was successfully isolated and identified through using HA and HI tests particularly from those embryos dead within the first week.

I wish to express my appreciation to Dr. Kays Juma of the Animal Production Department for his valuable suggestions during the reading of the manuscript. My thanks also to Mr. Jasim Abed for his help in caring for the experimental birds.

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SELECTION FOR GROWTH IN *COTURNIX COTURNIX JAPONICA* ON A LOW PROTEIN RATION[1]

KHALID A. AL-SOUDI[2] *AND PAUL E. BERNIER*[3]

(Received 10 May 1973)

SUMMARY

Several experiments were carried out on *Coturnix coturnix japonica* to investigate the effect of selection for growth on a protein deficient ration. A level of 27% protein was found to be optimum for three different strains and 17.8% was the lowest protein level used that allowed for growth and acordingly this latter level was chosen as that on which to carry out selection. Despite the fact that a statistical analysis showed no difference between three strains, strain 908 was chosen on the basis of the slightly better two-week body weight on the deficient diet as well as for the fact that management facilities did not permit continuing selection with all three strains. The apparent lack of response to mass or individual selection led to the adoption of progency testing as basis for selection. Two weeks on the deficient diet immediately upon hatching was not found to be significantly different from a selection standpoint from one week on the normal diet followed by two weeks on the deficient diet. Notwithstanding the lack of difference, the former was chosen because it allowed economy of time and also a lower incidence of a crop disorder observed in the course of the investigations.

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(1) This paper is part of a thesis submitted to the Graduate School, Oregon State University, in partial fulfillment for the Ph.D. degree.

(2) Present address: Department of Animal Production, College of Agriculture, University of Baghdad, Iraq.

(3) Department of Poultry Science, Oregon State University, Corvallis, Oregon 97331.

A maximum response for two-week body weight of 7.6 g was observed after six series of matings over the control line. Heritability estimates for growth on a dificient diet based on full-sib analysis were 0.17, 0.62 and 0.39 for sire, dam and combined components, respectively, and 0.18 from parent-offspring regression in the selected line. Realized heritability was 0.16. Maternal and non-additive genetic effects were deemed to be important factors of variation in growth. Egg weight increased by two grams as a correlated response to selection for two-week body weight.

الخلاصـــة

اجريت عدة تجارب لدراسة تأثير الانتخاب على نمو السلوى (المريعي) (*Coturnix coturnix japonica*) عـلى عليقة ينقصها البروتين · كان المسـتوى الملائم للبروتين في علائق الضروب الثلاث المستعملة من السلوى ٢٧٪ · وكان ادنى مستوى للبروتين الذي نتج عنه نموا لدى هذه الطيور ١٧ر٨٪ · واعتبر المستوى الاخـير اساسا للانتخاب · ولـم يكن هناك فرقا احصائيا معنويا بين الضروب الثلاث لكن الضـرب ٩٠٨ كان متفوقا جزئيا بالنسبة للـوزن بعمـر اسبوعين بالرغم من نقص البروتين في عليقته · ولعـدم الاستجابة (Response) لكل من الانتخاب الجماعي (Mass selection) والفـردي (Individual selection) استعمل الاختبـار بالنسل (Progency testing) كطريقة اسـاسية للانتخـاب الوراثي · لم يكن هناك فرقا معنويا بين الوزن عند اسبوعين ما بعد التفقيس والناتج من عليقة ينقصها البروتين والوزن بعد اسبوع من التغذية على عليقة اعتيادية يتبعها اسبوعان على عليقة ينقصها البروتين · وكانت المعاملة الاولى هي المفضلة بسبب قصر الفترة الزمنية وقلة الاصابة بمشاكل الحوصلة ·

كانت اعلى استجابة بالنسبة للوزن عند اسبوعين قدرها ٧ر٦ غم وقـد لوحظ ذلك بعد سلسلة من ستة تزاوجات · كانت تقديرات القيمة الوراثية (Heritability) لصفة القدرة على النمو عـلى عليقة ينقصها البروتين بطريقـة (Full-sib analysis) ١٧ر٠ و٦٢ و٣٩ر٠ وللأب والأم وللأب والأم بصورة مجتمعة على التناظر ، وبطريقة(Parent-offspring regression)في السلالة المنتخبة ١٨ر٠ · وكانت القيمة الوراثية (Realized heritability)١٦ر٠ · وكان تأثير كل من الأم والعوامل الوراثية ذات الاثر غير التجمعي (non-additive genes) من العوامـل الهامة المسببة للتغاير في النمو · وقد قابل الاستجابة للانتخاب على اساس الوزن عند اسبوعين زيادة في وزن البيضة قدرها غرامان ·

INTRODUCTION

Although genotype-environment interactions govern the response of animals and birds to a number of factors among them disease resistance, lighting, animal and bird density as well as management, varying an essential nutrient is the means chosen by a large number of workers to study this phenomenon not only because it offers the greatest variety, but because feed efficiency is of major concern in the raising of all poultry and livestock and lowering the requirements of these for any single or combined nutrient is of great economic importance. The large variety in the field of genotype-nutrient interaction is exemplified in the studies of Hess and Jull (1948) and Miller and Quisenberry (1959) in the area of efficiency of feed utilization, Christensen *et al.* (1964) concerning differences in mineral requirements, Ahmad and Moreng (1964) with vitamin requirements, Godfrey (1969) with amino acid utilization, Arscott and Bernier (1968) and Begin (1968) with dietary protein levels. Proudfood and Gowe (1967) with general nutritional stresses and Dunson and Buss (1968) with water metabolism, as well as Arthur (1968) with resistance to drugs.

Protein was the essential nutrient varied in the present study and in attempting to obtain optimum selection response in developing a line of *Coturnix coturnix japonica* resistant to a protein deficiency were confronted with two problems in the choice of environment and of selection methods.

A brief glance at the literature shows that a great deal of controversy surrounds this problem. That environment has a great effect on the success of selection has been known for sometime and since the disagreement between Falconer and Latyszewski (1952) and Hammond (1947) the trend has been to use an unfavorable environment in order to achieve maximum selection response and a great deal of evidence has been compiled supporting the theory of Falconer, namely Becker (1958) with chickens, Fowler and Ensminger (1960) with pigs, Dalton (1967)

with mice and Hardin and Bell (1967) with *Tribolium*. Still other data has been obtained by Park *et al.* (1966) indicating that a selected line gives optimum performance in the environment in which selection was carried out, favorable or unfavorable, rather than in any other in which it may subsequently be tested.

In choosing the best means of selection one is also confronted by a mass of contradictory evidence and uncertainty of success as witnessed by the results of Lerner and Bird (1948) who obtained a line of chicken exhibiting an overall superior growth rate rather than specific resistance to riboflavin deficiency. Pairing of 8-week body weights by Hess *et al.* (1962) and progeny testing by Lamoreux and Hutt (1948), on the other hand, yielded successful results in producing two lines differing only in their ability to utilize methionine for the former and two lines differing in their ability to utilize riboflavin for the latter workers.

MATERIALS AND METHODS

Three strains of *Coturnix coturnix japonica* were employed within this study: 908, White Shell (WS) and Oregon State University (OSU).

Three types of batteries were used. Upon hatching, the chicks were placed into electrically heated batteries with raised wire floors especially constructed by the Department of Poultry Science, OSU. The cages measured 25×21×18 cm (h×l×w) constructed from 1.5 × 1.5 cm wire mesh. Heat was supplied from an infrared lamp 23 cm above the cages and registered a uniform temperature of 95-100°F. Room temperature was 75-80°F. Water was supplied from Hart water caps. Feed was supplied by gravity flow self-feeders attached to the sides.

From two weeks of age to sexual maturity the chicks were housed in electrical chick battery brooders manufactured by Oakes Mfg. Co., Tipton, Indiana. They were provided with electric hovers and Hart waterers. There were four compartments per deck each having the dimensions 89×41×36 cm (l×w×h) housing 40-50 birds each. The temperature was 80°F.

Breeding cages were designed for individual birds and had the dimensions 17×20×15 cm (h×w×d) constructed from 0.6 × 2.5 cm wire mesh. The temperature was 60-70°F.

Light was left on for 24 hours except for the breeders where it was left on for only 14 hours.

Feeding consisted of Chick broiler ration after testing as presented in Table 1.

Procedure of selection involved mass selection as well as progeny testing. The latter has been thoroughly described and illustrated by Al-Soudi (1970).

RESULTS

The first experiment was carried out to determine an optimum level of protein for growth. The chicks were fed diets containing 17.8, 22.4, 27, 31.6 and 36.2% protein. The composition of the basal diets is summarized in Table 1. The results in Table 2 agree with those obtained by Arscott (1967) and confirmed the level of 17.8% protein as being low enough to differ significantly from the optimum level of 27% and yet enough to support growth. Subsequently 17.8% protein level was chosen as a suitable environment in which to select a line resistant to protein deficiency.

The second experiment was to decide on the basis of two-week body weight on a 17.8% protein diet which of three strains of Japanese quail were to be used for continuing selection on the protein deficient diet, with the end view of developing a strain resistant to a deficiency of protein in the diet. Individual selection was practiced on the basis of the deviation from the mean two-week body weight on a 17.8% protein diet within each strain. Accordingly three hatches of chicks from each of the strains were tested both on high (27%) and low (17.8%) protein diets along with a control or unselected population from each of the three strains fed the same two rations as the selected birds. It can be

TABLE 1. Composition of Experimental Diets.

Ingredients	Testing A	Testing B	Broiler
Corn, yellow			68.8
Glucose monohydrate[1]	50.9	30.9	
Soybean meal, 44% protein	39.0	59.0	
Corn oil[2]	4.0	4.0	
Fish meal, herring (70% protein)			5.0
Meat and bone meal (50% protein)			6.0
Alfalfa meal, dehyd. (20% protein)			2.0
Limestone flour			1.0
Salt, iodized			0.3
Salts, N[3]	6.0	6.0	
Salts N, supplemented[4]	0.1	0.1	
Vitamin-trace mineral mix[5]			0.25
Vitamin, anti-oxidant, amino acid mix[6]	+	+	
MHA (80%)[7]			0.15
Coccidiostat[8]			+
Total	100.0	100.0	100.0
Calculated analysis:			
Protein, %	17.9	27.0	20.9
Metabolizable energy kcal/kg	3069.0	2790.0	3014.0

1. Cerelose 2001, Corn Products Co., N.Y.
2. Mazola oil, Corn Products Co., N.Y.
3. Salts N supplies as % of diet: Ca, 1.24; P, 0.8; K, 0.37; Na, 0.384; Cl, 0.58; Mg, 0.06; Fl, 0.00334; Mn, 0.00813; I, 0.0006; Zn, 0.00728 and Cu, 0.004 (Nntritional Biochemicals Corp., Cleveland, Ohio), Spivey Fox and Briggs (1960).
4. Salts N supplemental as mg/kg of diet: Mo, 2; Se, 0.01, Spivey Fox and Briggs (1960).
5. Supplies/g of premix: Vit. A, 1320 U.S.P.U.; Vit. D_3, 440 I.C.U.; Vit. E, 0.44 I.U.; Vit. K, 0.22 mg; riboflavin, 1.32 mg; d-pantothenic acid, 2.2 mg; niacin, 8.8 mg; choline cl, 88 mg; Vit. B_{12}, 2.2 mcg;

Zn bacitracin, 1.76 mg; butylated hydroxy toluene, 50 mg; Mn, 24 mg; Fe, 8 mg; Cu, 0.8 mg; Co, 88 mcg; I, 0.48 mg; Zn, 11 mg.

6. B-complex, Vit. K mix. added at 6 g/kg of diet and suppies in mg/g of pre-mix: thiamine HCl, 1.6; d-biotin, 0.06; riboflavin, 1.6; d-Ca pantothenate, 4.0; Niacin, 20.0; pyridoxine HCl, 1.6; folacin, 0.6; Vit. B_{12}; 0.004; menadione, 0.02 (Nutritional Biochemicals Corp., Cleveland, Ohio), Gordon and Sizer (1955) plus g/kg diet: Vit. A (30,000 U.S.P.U./g), 0.333; Vit. E (Myvamix, 44 I.U./g, Distillation Products Industries, Rochester, N.Y.), 0.938; Choline Cl (25%), 12.0; Vit. D_3 (1500 I.C.U./g), 1.333; Butylated hydroxy toluene, 0.125; dl-methionine (98%), 5.0; glycine, 2.
7. Methionine hydroxy analogue (80%), Monsanto Chemical Co., St. Louis, Mo.
8. Zoamix, 25% Zoalene, included at 0.05% of diet, Dow Chemical Co., Midland, Mich.

TABLE 2: Effect of Varying Levels of Protein on Growth of the Coturnix Chick to Two Weeks of Age.

STRAIN	PROTEIN LEVEL (%)				
	17.8	22.4	27.0	31.6	36.2
	BODY WEIGHT (gms)				
OSU	32.30[c]	43.15[b]	46.7[a]	49.05[a]	46.50[a]
908	34.25[c]	45.90[b]	50.1[a]	50.25[a]	52.05[a]
WS	36.60[c]	44.80[b]	49.2[a]	50.60[a]	50.10[a]
AVERAGE	34.38	44.62	48.66	49.96	49.55
	FEED CONSUMPTION (gms)				
OSU	62.0	72.0	77.0	85.0	84.0
908	58.0	76.0	82.0	83.0	89.0
WS	61.0	69.0	75.0	81.0	86.0
AVERAGE	60.0	72.3	78.0	83.0	86.3
	FEED CONVERSION (gms feed/gm body weight)				
OSU	2.40	2.25	2.30	2.50	2.50
908	2.40	2.25	2.15	2.50	2.35
WS	2.20	2.05	2.05	2.00	2.40
AVERAGE	2.26	2.23	2.16	2.26	2.63

a, b, and c = The means which have the same letter are not significantly different ($P<0.01$).

seen from the results in Table 3 that strain 908 gave the best performance compared to the control. However the analysis of variance indicated that this difference in body weight was not significant. Nevertheless strain 908 was chosen on the basis of its slightly better actual figures. Thus mass selection was continued through the following generation using the 908 strain. The results did not show a significant difference between the control and the selected line. Therefore the lack of an apparent response from two generations of mass selection resulted in a switch to family and progeny testing as a basis of selection for the remainder of the investigation. However, it cannot be categorically be stated that mass selection was truly ineffective since, unfortunately, the selection differentials were not available.

The third experiment was conducted to determine the feeding regime that would give optimum selection response under progeny testing and two methods were tested. With the first method the birds were kept on a protein deficient diet (17.8%) for the first two weeks following hatching and two-week body weight was used as a selection criterion. The second method was initiated in an attempt to remove a large segment of the variation in growth on the deficient diet not attributable to the diet under test. This was done by feeding a normal diet at one week following hatching then switching to a protein deficient diet for a period of two weeks. Criterion of selection was the body weight at the end of three weeks. Heritability of body weight was estimated in the first generation (Table 4). It shows that the estimate of heritability was a little high at three weeks of age, but the difference was not significant. Thus the normal diet given to the birds during their first week did not help to reduce the environmental variation.

In addition keeping the birds on a protein deficient diet through the third week resulted in a noticeable incidence of a crop disorder (edema), the details of which form the subject of a paper in the process of publication. These findings together with the space and management limitations led to continue the experiment only with the first procedure of keeping the chicks on the protein deficient diet from hatching to two weeks of age.

TABLE 3. Effect of Deficient and Normal Diets on Body Weight of Three Strains of Coturnix Chicks, Selected and Unselected, at Two Weeks of Age in Experiment II.

		AVERAGE BODY WEIGHT (gms)					
		908		WS		OSU	
Protein Level		17.8%(A)	27.0%(C)	17.8%(A)	27.0%(C)	17.8%(A)	27.0%(C)
	Sample						
				SELECTED			
	1	37.77	46.57	27.50	40.00	36.00	44.62
	2	36.25	49.64	38.66	51.28	37.25	47.14
	3	39.38	49.00	37.77	50.00	34.81	44.66
Average		37.65(23)	48.40(23)	34.64(24)	47.10(20)	36.00(30)	45.47(33)
				UNSELECTED			
	1	37.30	46.50	32.50	42.85	29.33	40.33
	2	35.66	48.77	39.62	——*	40.08	38.00
	3	32.43	42.10	32.86	45.31	33.00	45.00
Average		35.13(30)	45.80(26)	35.26(21)	44.10(23)	34.13(26)	41.10(20)

( ) Indicates the number of birds at the end of the test.

* All died due to managemental difficulty.

TABLE 4. Variance and Heritability of Two-Week Body Weight (Two Weeks on a Deficient Diet After Hatching) and Three-Week Body Weight (One Week After Hatching on a Normal Diet Followed by Two Weeks on a Deficient Diet) in *Coturnix coturnix japonica*.

Sources of Variance	TWO WEEKS OF AGE		THREE WEEKS OF AGE	
	Variance	% Variance	Variance	% Variance
Hatch or Sample	9.69	14.80	9.50	10.60
Sire	-3.52	0.00	0.58	0.65
Dam	12.34	18.80	15.99	17.80
Progeny	43.47	66.40	63.83	71.00
Estimate of Heritability Based on	**Heritability**	**Standard Error**	**Heritability**	**Standar Error**
Sire Component	-0.27	0.24	0.03	0.41
Dam Component	0.94	0.39	0.79	0.55
Sire and Dam Component	0.34	0.08	0.41	0.17

DISCUSSION

Heritability Estimates:

Wide fluctuations in the heritability of body weight at two weeks of age in the selected line, as estimated from sire and dam variance components as well as from the combined sire and dam variance components were observed in the successive series of matings (Table 5). A possible explanation for these fluctuations could be the small number of series, dams or progeny singly or in combination, employed in this study (Robertson, 1959). Heritability estimates computed from dam components were higher than those from sire components, which might be interpreted as evidence for non-additive genetic effects apparently playing a vital role in selecting for body weight (Siegel, 1962; Kinney and Shaffner, 1965). An alternate method of estimating heritability, based on regression of offspring on parent, theoretically excludes non-additive genetic effects despite the fact that the different types of regression contain varying amounts of maternal and sex-linked effects (Falconer, 1967). Great variation for the various series was observed in these values as well (Table 6).

Comparing the estimates of the heritability of actual body weight with those obtained on the basis of deviation of body weight in the selected line from the control, one observes that generally they did not show large differences as was also true for the pooled heritability estimate, which indicated that environmental conditions varied little in the series of matings.

The average heritability estimate of two-week body weight obtained from full-sib correlation in the selected population was 0.38. This estimate is in good agreement with the values reported in the literature. The average heritability estimate computed from parent-offspring regression was 0.18. The difference of 0.21 between the two estimates provides a measure of the non-additive effect and probably of some maternal and sex-linkage effects.

TABLE 5. Heritability (h^2) Estimates at Two Weeks of Age, Estimated from Half and Full Sib Intraclass Correlation and by Sex, in Series of Matings of Japanese Quail Selected for Body Weight. Estimates are in Terms of (A) Absolute Values, (B) Deviations from the Control Groups on a Deficient Diet and (C) Deviations from the Control Groups on a Normal Diet.

Series No.	Component*	1	2	3	4	5	6	Pooled
		A — (Body Weight in Absolute Terms)						
	S	0.00	0.00	0.24	0.20	0.00	1.00	0.14
Males	D	0.87	0.66	0.99	0.24	0.32	0.00	0.53
	S+D	0.34	0.33	0.62	0.22	0.16	0.52	0.34
	S	0.00	0.00	0.56	0.75	0.16	0.00	1.12
Females	D	0.93	1.00	0.00	0.42	0.00	1.00	0.62
	S+D	0.47	0.53	0.28	0.59	0.08	0.67	0.37
	S	0.00	0.00	0.44	0.47	0.13	0.45	0.17
Combined	D	0.86	0.74	0.41	0.47	0.25	0.67	0.62
	S+D	0.43	0.37	0.43	0.47	0.19	0.56	0.39
		B — (Deviation of Selected Line from the Control on the Deficient Diet)						
	S	0.00	0.00	0.38	0.29	0.18	1.00	0.13
Males	D	0.96	0.67	0.73	0.26	0.13	0.00	0.52
	S+D	0.49	0.34	0.56	0.27	0.15	0.51	0.33
	S	0.00	0.00	0.45	0.77	0.11	0.00	0.12
Females	D	1.00	1.00	0.00	0.38	0.00	1.00	0.62
	S+D	0.56	0.53	0.23	0.58	0.05	0.66	0.37
	S	0.00	0.00	0.41	0.44	0.20	0.37	0.11
Combined	D	0.87	0.66	0.29	0.53	0.08	0.77	0.62
	S+D	0.43	0.33	0.35	0.49	0.14	0.57	0.36

TABLE 5 (Cont.).

Series No.	Components*	C — (Deviation of Selected Line from the Control on the Normal Diet)						
	S	0.00	0.00	0.40	0.18	0.00	1.00	0.13
Males	D	1.00	0.84	1.00	0.36	0.32	0.00	0.70
	S+D	0.56	0.42	0.83	0.27	0.16	0.65	0.42
	S	0.00	0.00	0.58	0.86	0.29	0.00	0.15
Females	D	0.90	1.00	0.01	0.22	0.00	1.00	0.59
	S+D	0.45	0.53	0.29	0.54	0.14	0.67	0.37
	S	0.00	0.00	0.50	0.52	0.18	0.39	0.16
Combined	D	0.88	0.93	0.47	0.43	0.34	0.80	0.67
	S+D	0.44	0.47	0.48	0.48	0.26	0.59	0.41

*S = Sire
D = Dam
S+D = Sire+Dam

TABLE 6. Heritability Estimates Obtained from Regression of Offspring on Parents of Sex in Six Series of Japanese Quail Selected for Body Weight at Two Weeks of Age in Terms of Absolute Values and as Deviations from the Control Groups.

Series No.	Absolute Terms	Deviations of Selected Line from the Control on the Deficient Diet	Normal Diet
	Regression of Offspring on Sire		
1	0.57	0.12	0.31
2	0.00	0.24	0.00
3	0.40	0.40	0.53
4	0.02	0.00	0.07
5	0.25	0.17	0.19
6	0.20	0.31	0.00
Pooled	0.00	0.08	0.00
	Regression of Offspring on Dam		
1	0.61	0.67	0.85
2	0.00	0.00	0.00
3	0.15	0.13	0.25
4	0.00	0.03	0.04
5	0.60	0.54	0.55
6	0.59	0.68	0.44
Pooled	0.32	0.32	0.38

The realized heritability estimate of body weight on the deficient diet was calculated from the ratio of the selection response to the selection differential ($h^2 = R/S$; Falconer, 1967). The estimates were not uniform, the reasons having been tentatively explained previously for similar variations in the case of estimates of heritability from half and full-sib interclass correlation (Table 7). The negative values were considered zero since the limits of heritability are zero and one. The average realized heritability estimate, therefore, for combined sexes was 0.16 which is almost the same as that, 0.14, obtained by Collins and Abplanalp (1965).

Response to Selection:

The accuracy and progress of the selection response, as measured by the change of the mean in the selected line, is a function of the genetic stability and the deviation from the mean of the control population. Thus, accuracy was arrived at by using a genetically uniform control, both on the deficient and the normal diet.

Table 8 shows the average two-week body weight of the selected parents and of the progeny along with the corresponding control values in the six series of matings. It indicated an overall response of 7.6 grams. Although this response to selection was lower than could have been expected judging from the results obtained in selection studies for growth with quail as carried out by Collins and Abplanalp (1968) a limited response is not unique and could possibly be attributed to a greater or lesser degree of inbreeding which had been attained in the foundation line (Godfrey, 1968) as well as genotype-environment interaction.

The effect of selection on growth performance:

In order to determine if any difference in growth existed between the control and the selected birds after six series of matings, chicks from the progeny of the sixth series as well as from the control were tested on the control and on the protein deficient diets. The data in

TABLE 7. Selection Differentials, Responses and Realized Heritability Calculated from Actual Body Weight at Two Weeks of Age.

Series No.	Mean Body Weight (gms) Selected Parents			Selection Differentials			Mean Body Weight (gms) Progeny			Selection Response			Realized h^2			Cumulative Realized h^2		
	M	F	C	M	F	C	M	F	C	M	F	C	M	F	C	M	F	C
1	51.2	49.3	49.9	—	—	6.9	31.6	31.3	31.5	—	—	—6.8	—	—	0.00	—	—	—
2	48.4	48.7	48.6	10.4	11.2	9.0	38.5	34.3	33.9	1.9	3.0	2.4	0.18	0.27	0.27	0.28	0.27	0.27
3	48.4	48.6	48.6	8.4	7.5	8.1	30.1	31.5	30.9	—3.4	—2.8	—3.0	0.00	0.00	0.00	0.00	0.10	0.00
4	42.8	43.4	43.2	9.2	9.0	9.3	37.0	36.6	36.9	6.9	5.3	6.0	0.75	0.59	0.65	0.20	0.20	0.20
5	47.6	46.7	47.1	11.6	9.7	10.4	37.3	37.4	37.3	0.3	0.6	0.4	0.03	0.06	0.04	0.24	0.16	0·19
6	46.8	45.2	45.8	9.2	7.9	8.5	38.2	40.0	39.1	0.9	2.6	1.8	0.10	0.33	0.21	0.14	0.14	0.17

TABLE 8. Average Body Weight (grams) and Response of the Progeny at Two Weeks of Age of Japanese Quail in the Six Series of Matings in Absolute Terms and as Deviations from the Control Groups on Both Deficient Normal Diets.

	Progency of Selected Line								Control Line				Selected Line as deviation from theControl					
	deficient diet			Standard Error	deficient diet			Standard Error	normal diet			Standard Error	deficient diet			normal diet		
	M	F	C		M	F	C		M	F	C		M	F	C	M	F	C
1	31.6	31.8	31.5	0.8	32.4	30.1	31.2	1.7	42.4	41.3	41.8	1.4	—0.8	+ 1.2	+ 0.3	—10.8	—10.0	—10.3
2	33.5	34.3	33.9	0.8	33.6	36.6	35.1	1.4	46.5	46.1	46.3	1.2	—0.1	—2.3	—1.2	—12.0	—11.8	—12.4
3	30.1	31.5	30.9	1.0	34.0	34.0	34.0	2.3	44.3	45.6	44.9	2.6	—3.9	—2.5	—3.1	—14.2	—14.1	—14.0
4	37.0	36.8	36.9	0.6	35.0	36.4	35.8	2.1	46.2	47.2	46.7	1.5	+ 2.0	+ 0.4	+ 1.1	—9.2	—10.4	—9.8
5	37.3	37.4	37.3	0.6	31.8	32.8	32.3	2.1	44.9	45.3	45.1	1.3	+ 5.5	—4.6	+ 5.0	—7.6	—7.9	—7.8
6	38.2	40.0	39.1	0.8	35.6	34.9	35.3	1.4	45.3	46.5	45.9	1.1	: 2.5	+ 5.0	+ 3.8	—7.2	—6.5	—6.8

M = Male

F = Female

C = Combined or Unweighted

Table 7 can be assessed in two ways, namely (1) comparing the two lines to each other on both types of diets and (2) comparing the lines with themselves when subjected to a diet change. Accordingly in the first instance (a) chicks from the selected line on a deficient diet showed 15% greater body weight than the control line on the same deficient diet and (b) the chicks from the control line on a normal diet were 17% smaller than those from the selected line on the same normal diet. The second method of comparison yielded the following information: (a) the selected line showed a 24% weight increase when placed on a normal diet and (b) the control suffered a 15% decrease in weight when placed on a deficient diet. Thus the selected line did better than the control on both diets and an analysis of variance showed that the differences between the selected line and the control line on the deficient and normal diets were significant. Furthermore, since the selected line was superior to the control line, irrespective of the diet, this indicated that selection was not so much for a specific resistance to protein deficiency as for an overall superior growth rate (Lerner and Bird, 1948). This was unlike the results obtained by Lamoreux and Hutt (1948) who were able to demonstrate the success of their experiment by displaying the superiority of the selected line over the control only on the deficient diet indicating that the difference between it and the control line was concerned specifically with a resistance to a nutrient deficiency.

The apparent lack of resistance to a protein deficiency even after six series of matings might well be accounted for by the small size of the population used in our study which limited the number of genotypes and in turn lowered the chances of altering the gene frequency of the desired trait, a necessary prerequisite for the success of selection. The superior growth rate of the selected line not only on the deficient diet, but on the control diet as well might be accounted for by two possibilities: higher efficiency of feed utilization or a better appetite (Lepore, 1965).

It seems that since the selection methods used in this study and that of Lerner and Bird (1948) were as painstaking and time consuming as those of Lamoreux and Hutt (1948) and Hess *et al.* (1962), the

success of the latter two studies and failure of the former can possibly be ascribed largely to chance. Similar differences in results of selection were also reported by Falconer (1960). Upon closer examination, the factor common to all these selection experiments was the criterion used to judge the success of selection, namely body weight gain on a given diet. Perhaps a more refined and precise criterion, such as one of a biochemical nature, would be more appropriate in evaluating resistance to a given deficiency in the diet. Evidence to this effect can be found in the research of a number of workers, although none of them used it as a basis of their selection. In 1959 Bogart noted that slower gaining and less efficient beef calves draw nitrogenous substances at a slower rate from the blood stream, thus causing an accumulation of amino acids in the latter, since these are not used as rapidly in building body tissues as those of fast gaining calves. Then in 1967, studying high and low arginine strains of chickens, Nesheim *et al.* found that analysis of liver, muscle and plasma revealed high levels of lysine in the tissues of the high arginine strain no matter what the arginine content of the diet, providing a possible way of identifying the high line not based on body weight. Another method of identifying the two lines in a biochemical fashion was provided in 1968 when Nesheim noted that the level of kidney arginase activity for the high arginine requirement strain rose to 3 or 4 times the levels of the low arginine requirement strain following several days on a low arginine diet. And finally Sahib and Murt (1969) noted a marked relationship between hepatic histidine ammonia lyase and growth showing a rise in activity with growth and responding to protein level of the diet consumed by the animal.

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THE EFFECT OF CONFINEMENT ON CALCITONIN CONTENT OF ULTIMOBRANCHIAL GLANDS IN LAYING PULLETS[1]

A. K. AL-KHAZRAJI[2], H. V. SHIRLEY[3], and O. E. GOFF[4]

(Received 14 May 1973)

SUMMARY

In two trials, confinement of laying pullets to small cages, 6 x 8 inches, resulted in three significant changes in the ultimobranchial glands: (1) increased weight, (2) hypertrophy of cells and (3) a decrease in calcitonin content.

الخلاصـــة

لقد وجدت بأن تربية الدجاج البيوض (الكهورن الابيض) في اقفاص صغيرة الحجم (٦ × ٨ × ١٨ انج) سبب ما يلي :- (١) زيادة وزن غدة ال (Ultimobranchial) (٢) كبر خلايا الغدة المنتجة للهورمون (Calcitonin) ، (٣) قلة كمية الهورمون (Calcitonin) المنتج من هذه الغدة .

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(1) Portion of a Ph.D. disertation.

(2) Present adress: Department of Physiology, College of Veterinary Medicine, Baghdad, Iraq.

(3) Present address: Department of Animal Science, College of Agriculture, University of Tennessee.

(4) Former Head, Poultry Department, College of Agriculture, University of Tennessee, Deceased.

INTRODUCTION

The ultimobranchial glands of chickens are small structures located in the chest cavity near the bifurcation of the common carotid and axillary arteries, posterior to the thyroid and parathyroid glands. During embryological development, the glands arise from the ventral floor of the last branchial pouch in a similar manner to the origin of the parathyroids from the floor of the third and fourth branchial pouches.

The blood comes to the ultimobranchial glands by branches of the common carotid arteries and leaves by branches to the jugular (Dudley, 1942).

The ultimobranchial body of chickens is a source of calcitoin, whereas in mammals, the hormone is secreted by the ultimobranchial cells (C cells) within the thyroids (Hirsch *et al.*, 1964; MacIntyre, 1967 and Copp, 1969).

The ultimobranchial glands of chickens contain very high concentrations of calcitonin when compared with the mammalian thyroids (Copp *et al.*, 1968).

Calcitonin plays an active role in the normal calcium metabolism of birds. Urist (1967) reported hypertrophy of the ultimobranchial gland in the hen. Copp *et al.* (1968) observed a discharge of secretary granules from the cells during hypercalcemia in young cockerels. Similar findings have been obtained by feeding young chicks a diet rich in calcium (Chan *et al.*, 1969).

Recently there is growing evidence suggesting the involvement of calcitonin in osteoporosis (bone disorder) of mammals. Foster *et al.* (1968) found that porcine calcitonin prevented osteoporosis from developing in rats receiving a toxic dose of Vitamin A.

Very little information is available pertaining to the significance of this hormone in bone metabolism of chickens.

As it has been shown that confinement of layers can result in osteoporosis (King, 1965) and that calcitonin influences calcium metabolism, there exists the possibility that stress of close confinement influences the function of ultimobranchial glands, either directly or indirectly.

The objective of the experiment reported here was to investigate the effect of close confinement on calcitonin content of the ultimobranchial glands of laying pullets.

MATERIALS AND METHODS

In two trials, a total of 37 Single Comb White Leghorn type pullets*, 20 weeks of age, were housed in individual laying cages, one bird per cage, and in the floor pens. The floor areas of the laying cages were 6 × 8 inches. All cages were 18 inches high with slanting wire floors. Feed and water troughs were in front of the laying cages. The floor pens and laying cages were in 8 × 10 feet ventilated rooms allowing 14 hours of artificial light per day. The experimental groups were fed a standard laying diet containing 17.2 per cent crude protein, 3.0 per cent calcium, and 0.6 per cent phosphorus. Feed and water were available to the pullets *ad libitum*.

In each trial, at 40 weeks of age, three laying pullets from the floor pen groups and three pullets from the small cages, 6 × 8 inches, were sacrificed and the ultimobranchial glands of each pullet were immediately removed, trimmed of adherent tissue, and weighed on a torsion balance. The ultimobranchial glands were extracted according to the method of Copp *et al.* (1967). The ultimobranchial extracts were injected intraperitoneally into a total of 54 female rats 50 days of age, weighing 185 to 200 grams each. The dose levels given were 0.25, 0.5, 1.0 milligrams of fresh wet extract. Three rats were employed for each dose level and were fasted 24 hours prior to injection of the extracts. Six rats were used to serve as controls and were injected interperitoneally with 0.5 ml. of

* Were sham-operated used for other experimental purposes.

saline. Samples of blood obtained by heart puncture were collected at 0, 1, 3 and 6 hours post injection and analyzed for calcium using atomic absorption spectrophotometer.

The ultimobranchial glands from the remaining laying pullets, in each trial, were removed, trimmed of adherent tissues and fixed with AFA fixitive and dehydrated in a graded series of alcohol solutions and embedded in paraffin. Tissue sections 10 microns thick were prepared for a detailed microscopic study.

RESULTS AND DISCUSSION

In trial 1, the effect of housing conditions upon the hypocalcemic potency of ultimobranchial glands of laying pullets is presented in Table 1.

Ultimobranchial extract taken from pullets kept in floor pens produced significant hypocalcemia ($P \leq 0.05$) in assay at 0.5 mg and 1.0 mg dose levels when compared to that from birds maintained in 6 × 8 inch cages at similar dose levels.

No significant difference in hypocalcemic response was found between the extract from glands secured from pullets kept in small cages and those from pullets kept in large cages at 0.25 mg dose level.

In trial 2, the effect of housing on the calcitonin content of the ultimobranchial glands is presented in Table 2.

As in trial 1, the ultimobranchial glands of the laying pullets in 6 × 8 inch cages evidenced a lesser calcitonin content than those pullets kept in floor pens. Differences between the two treatment groups were statistically different at 1.0 mg dose level.

The log-dose response in Figures 1 and 2 for trial 1 and trial 2 show a linear relationship between doses of fresh ultimobranchial and plasma calcium changes. As the dose level increased, the fall in plasma calcium doubled. The response, however, was dose dependent.

TABLE 1. The effect of housing upon the hypocalcemic potency of ultimobranchial glands of laying pullets, trial 1.

Preparation and dose level	No. of rats[2]	Plasma Ca (mg./100 ml.)[1]		
		Initial	One hour post injection	Change[3]
Saline (0.5 ml.)	6	9.14±0.51	9.20±0.41	+0.06±0.20[a]
Ultimobranchial glands (6 × 8 inch cages)				
0.25 mg.	9	9.18±0.15	8.85±0.21	−0.33±0.11[b]
0.50 mg.	9	9.36±0.17	8.75±0.21	−0.61±0.17[b]
1.00 mg.	9	9.51±0.18	8.33±0.21	−1.18±0.26[c]
Ultimobranchial glands (floor pens)				
0.25 mg.	9	9.08±0.17	8.51±0.15	−0.57±0.14[b]
0.50 mg.	9	9.19±0.15	8.01±0.14	−1.18±0.25[c]
1.00 mg.	9	9.85±0.41	7.21±0.21	−2.64±0.26[d]

[1]Mean±S. E.

[2]The extract was injectel at three dose levels with three rats per dose level.

[3]Means with different superscripts within a column differ significantly ($P \leq 0.05$).

TABLE 2. The effects of housing upon the hypocalcemic potency of ultimobranchial glands of laying pullets, trial 2.

Preparation and dose level	No. of rats[2]	Plasma Ca (mg./100 ml.)[1]		
		Initial	One hour post injection	Change[3]
Saline (0.5 ml.)	6	9.36±0.12	9.38±0.13	+0.02±0.11[a]
Ultimobranchial glands (6 × 8 inch cages)				
0.25 mg.	9	9.36±0.32	9.00±0.26	−0.36±0.31[b]
0.50 mg.	9	9.92±0.28	9.20±0.23	−0.72±0.28[bc]
1.00 mg.	9	9.61±0.28	8.36±0.28	−1.25±0.28[d]
Ultimobranchial glands (floor pens)				
0.25 mg.	9	9.05±0.20	8.53±0.28	−0.52±0.32[b]
0.50 gm.	9	8.21±0.40	7.14±0.37	−1.07±0.28[cd]
1.00 mg.	9	9.06±0.37	6.97±0.42	−2.09±0.37[e]

[1]Mean±S. E.

[2]The extract was injectel at three dose levels with three rats per dose level.

[3]Means with different superscripts within a column differ significantly ($P \leq 0.05$).

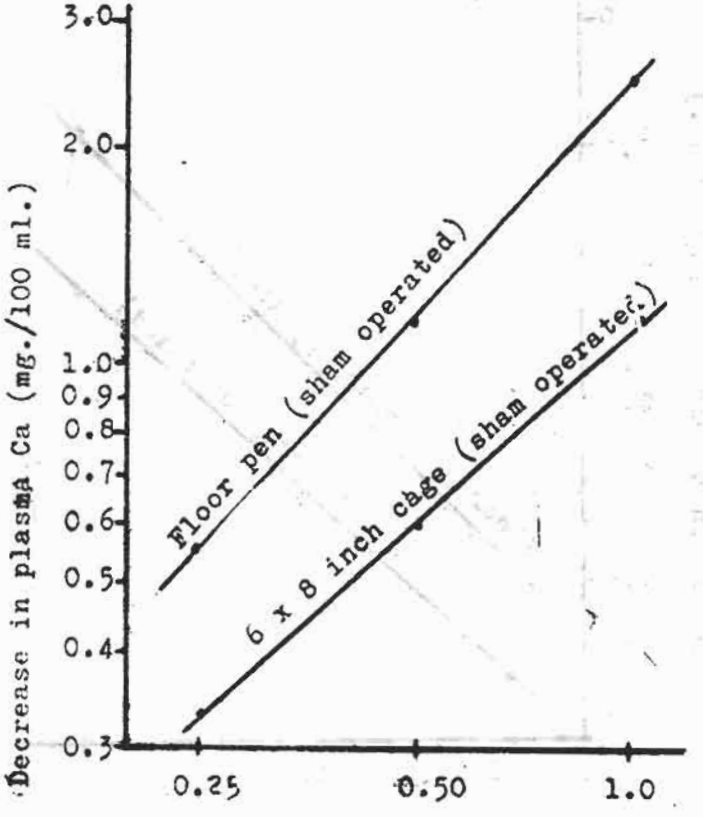

Fig. 1. Log-dose response one hour following the injection of acid extracts of ultimobranchial glands of sham operated pullets kept in 6×8 inch cages and in floor pens, Trial 1. Each point represents the mean of 9 rats at each dose level.

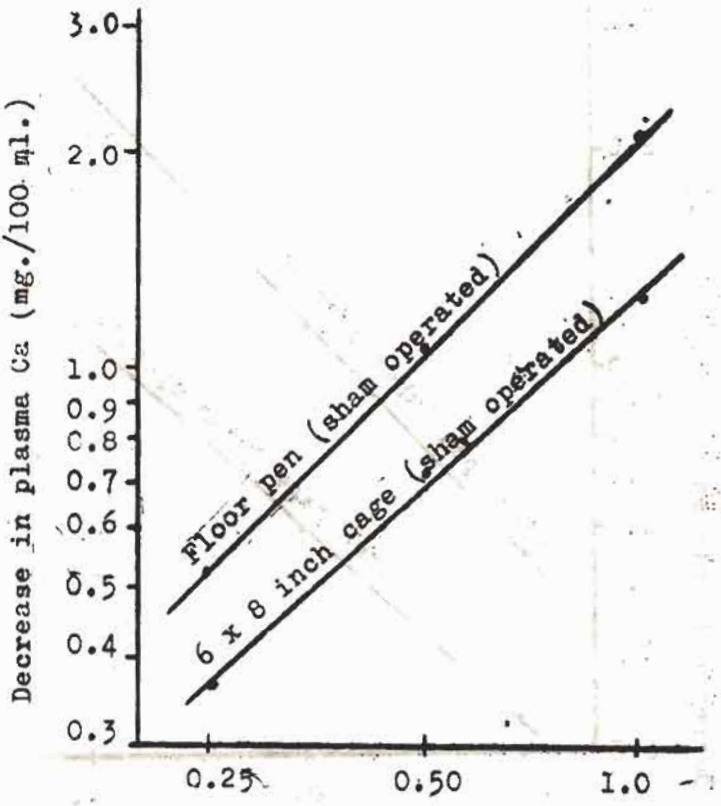

Fig. 2. Log-dose response one hour following the injection of acid extracts of ultimobranchial glands of sham operated pullets kept in 6 x 8 inch cages and in floor pens, Trial 2. Each point represents mean of 9 rats at each dose level.

In both trials, glands from pullets maintained in 6 × 8 inch cages were significantly greater in weight than those of the pullets maintained in the floor pens (Table 3).

TABLE 3. The effect of confinement on ultimobranchial weights of laying pullets, Trials 1 and 2.

Treatments	Average weights (mgs.)[1,2,3] Trial 1	Trial 2
6 × 8 inch cages	8.7 ± 0.3[a](7)[4]	8.9 ± 0.4[a](6)[4]
Floor pens	7.3 ± 0.4[b](14)[4]	6.9 ± 0.2[b](10)[4]

[1]Mean ± S. E.

[2]Combined weight of left and right glands.

[3]Means with different superscripts within a column differ significantly ($P \leq 0.05$).

[4]Number of birds.

Ultimobranchial cells of pullets maintained in floor pens, in both trials, showed hyperplasia. On the other hand, sections of glands taken from small cage laying pullets showed several hypertrophic cells.

Considering the data obtained in these two trials along with that reported in the literature on the influence of calcitonin in calcium metabolism it is concluded that close confinement of pullets results in a reduction in the function of ultimobranchial glands by lowered calcitonin content and a change in size and histology of these glands.

It is postulated that the stress of confinement results in an increase in corticoid production by the adrenal glands which in turn increases calcium mobilization from bone and augments the plasma calcium. When the plasma calcium rises, calcitonin from ultimobranchial glands is released. The release of calcitonin is a physiological effort to inhibit further calcium mobilization resulting from the action of corticoids and

to indirectly prevent the elevation of plasma calcium. However, if the stress of confinement persists, ultimobranchial glands can not produce calcitonin sufficient to inhibit calcium resorption.

As a result, ultimobranchial glands increase in weight, calcitonin content declines and the ultimobranchial cells increase in size and show signs of secretory exhaustion.

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THE EFFECT OF FEEDING TIME[1] AND FREQUENCY OF FEEDING ON FEED CONSUMPTION OF LAYING HENS

A.K. AL-KHAZRAJI[2] AND H.V. SHIRLEY[3]

(Received 12 July 1973)

SUMMARY

Two short period experiments were conducted involving 300 Single Comb White Leghorn type hens to determine the effect of feeding time and frequency of feeding on feed consumption.

In the first experiment, feed consumption was measured hourly during the day and the results indicated that a peak of feed intake is reached by hens during the period between 4:00 p.m. and 5:00 p.m.

In the second experiment, the relatoinship of the length of feeding time and frequency of feeding to feed intake was determined. It was found that the length of feeding period and frequency of feeding influenced the amount of feed consumed per hen.

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(1) The results of these two short period experiments were utilized in selecting treatment levels of the succeeding main experiments designed to study the effect of feed restriction on the performance of laying hens, (M.S. Thesis).

(2) Present address: Department of Physiology, College of Veterinary Medicine, Baghdad, Iraq.

(3) Present adress: Department of Animal Science, College of Agriculture, University of Tennessee, Knoxville, Tennessee, U.S.A.

الخلاصـــة

لقد وجد نتيجة احدى التجارب القصيرة الامد والتي اجريت على (١٥٠) دجاجة بيوضة (الكهرون الابيض) بأن استهلاك الدجاجة الواحدة من العلف يختلف من ساعة الى اخرى اثناء النهار وسجل اعلى معدل استهلاك العلف للدجاجة الواحدة هو ما بين الساعة الرابعة والخامسة مساء ٠

ان نتائج التجربتين القصيرين الامد استخدمت في اجراء تجارب عديدة (الكهورن الابيض) وجد بان طول فترات اعطاء العلف اثناء النهار وكذلك تقارب هذه الفترات او تباعدها يؤثر في معدل استهلاك العلف لكل دجاجة بيوضة ٠

وفي تجربة اخرى قصيرة الامد اجريت على (١٥٠) دجاجة بيوضة اخرى وطويلة الامد لمعرفة تأثير قطع العلف او تقليص مدة اعطائه للدجاج البيوض على الانتاج ٠

INTRODUCTION

Several reports based on experimental results have been published on the practice of feed restriction during the laying period. A number of studies have been conducted with layers in both cages and the floor in which the amount of feed and feeding time were reduced. The results of these studies indicated that the restricted feed intake and limited feeding time resulted in lower egg production and reduction in feed consumption (Goodling *et al.*, 1963; McGinnis and Dronawat, 1967; and Patel and McGinnis, 1970).

The two short period experiments reported herein were conducted to determine: (1) the relationship of time of day to the amount of feed consumed and (2) the effect of restricting the availability of feed on the amount of feed consumed.

MATERIALS AND METHODS

Experiment I. Four groups of Single Comb White Leghorn type laying hens, twelve months of age, each containing fifteen birds, were used to determine the amount of feed consumed hourly during the day (6:00 a.m. to 8:00 p.m.) and the feed consumption during the dark period (8:00 p.m. to 6:00 a.m.).

At 6:00 a.m. a given amount of feed was weighed and placed in each trough. At the end of each hour feed was collected and reweighed to determine the feed consumed. This procedure was repeated each hour for fourteen hours. A weighed amount of feed was left in the trough at 8:00 p.m. and the amount remaining at 6:00 a.m. was weighed back to determine consumption during the dark period. This trial was repeated the following day.

Experiment II. Twelve-month-old hens were divided into sixteen groups of fifteen hens each and assigned to the following treatments:

Group 1. Five minutes of feeding time every hour.
Group 2. Ten minutes of feeding time every hour.
Group 3. Fifteen minutes of feeding time every hour.
Group 4. Five minutes of feeding time every two hours.
Group 5. Ten minutes of feeding time every two hours.
Group 6. Fifteen minutes of feeding time every two hours.
Group 7. Thirty minutes of feeding time every two hours.
Group 8. Sixty minutes of feeding time every two hours.
Group 9. Ten minutes of feeding time every three hours.
Group 10. Fifteen minutes of feeding time every three hours.
Group 11. Fifteen minutes of feeding time every four hours.
Group 12. Thirty minutes of feeding time every four hours.
Group 13. Sixty minutes of feeding time every six hours.
Group 14. Thirty minutes of feeding time every six hours.
Group 15. Sixty minutes of feeding time every eight hours.
Group 16. The control group (full-fed).

The feed of each group was weighed before the start of the experiment and placed in the feed troughs the evening prior to the start of the experiment the next morning. At 6:00 a.m. the feed troughs were opened and all birds were allowed to eat. At the end of each feeding period, the troughs were closed and feed was collected and weighed. At the beginning of the next feeding period, troughs were opened and

feed was replaced in order to determine the amount of feed consumed in the next feeding period. These procedures were repeated for fourteen hours and this experiment was again repeated the next day using the same procedures.

In both experiments laying hens were fed a corn-soybean oil meal-fish-meal-type diet. It was calculated to contain 16.75 per cent crude protein and 916 Calories of productive energy per pound. The diet was considered to meet the nutritive requirements of laying hens as given by the National Research Council, U.S.A.

RESULTS AND DISCUSSION

The average feed consumption per bird per hour for the first and second tests in Experiment I is shown in Table 1 and Figure 1. Feed consumption per bird varied from hour to hour during the day. The average feed consumption per bird between 4:00-5:00 p.m. was greater than any other hour of the day. Feed consumption per bird during the day time, 6:00 a.m. to 8:00 p.m. and during the dark period, 8:00 p.m. to 6:00 a.m. is given in Table 1. The average feed consumption per bird during the light period was 122.8 grams and 12.6 grams during the period of darkness, or a total of 135.4 grams per day. These results show that the birds consumed some feed during the dark period, but hours of consumption were unknown.

In Experiment II, laying hens were subjected to various limited feeding times (Table 2, Figure 2). Among the treatment groups, hens permitted 5 minutes of feeding time per hour and 60 minutes per two hours consumed more feed per hen than any other groups. A reduction in feeding 60 minutes per two hours permitted the laying hens to consume as much feed as the full-fed groups. Groups permitted 15 minutes per four hours decreased feed consumption by approximately 54 per cent. It was concluded from the results of this experiment that frequency of feeding (availability of the feed) and length of feeding time (time of the day) influenced the amount of feed consumed.

TABLE 1. Hourly feed consumption, Experiment I.

Hours of the day	Feed consumption per bird[1] grams		
	First test[2]	Second test[2]	Average
6:00-7:00 a.m.	8.28	7.10	7.7
7:00-8:00	9.57	7.12	8.3
8:00-9:00	8.48	5.98	7.2
9:00-10:00	9.56	7.43	8.5
10:00-11:00	8.43	7.49	8.0
11:00-12:00	8.18	6.58	7.4
12:00-1:00 p.m.	8.89	6.98	7.9
1:00-2:00	8.98	10.05	9.5
2:00-3:00	8.31	9.13	8.7
3.00-4:00	7.87	9.25	8.6
4:00-5:00[3]	12.49	11.80	12.1
5:00-6:00	9.89	11.34	10.6
6:00-7:00	11.29	11.21	11.3
7:00-8:00	7.23	6.71	7.0
Total			
6:00 a.m.-8:00 p.m.	127.6	118.2	122.8
8:00 p.m.-6:00 a.m.	15.2	10.1	12.6

[1]Continuously fed.

[2]Average of four groups of fifteen birds each.

[3]The period of highest feed consumption.

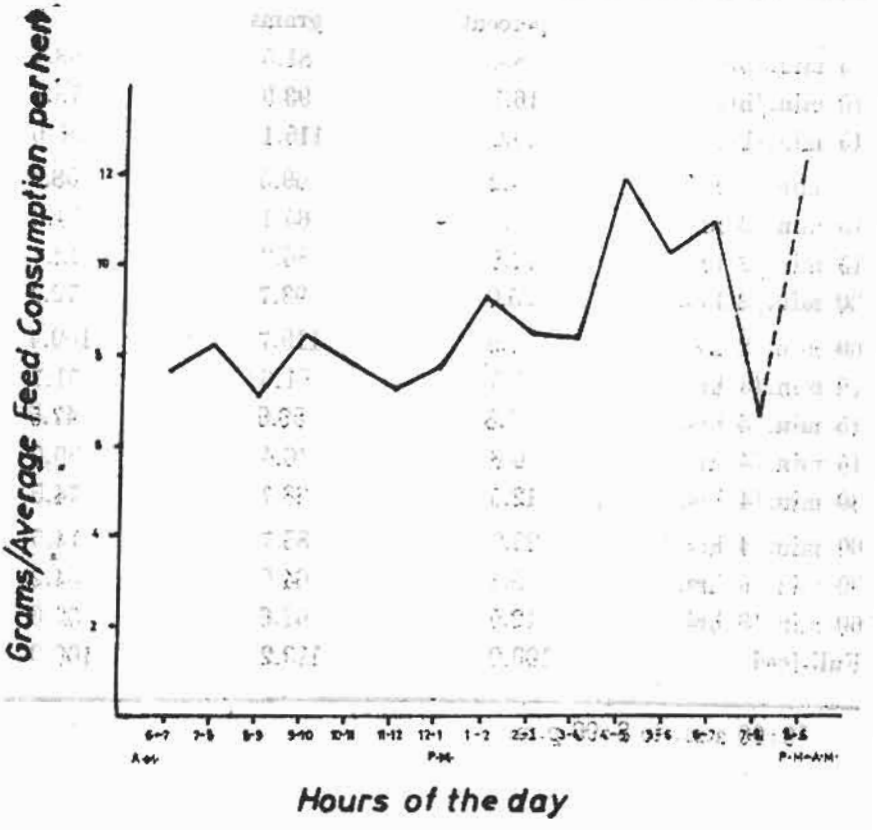

Fig.1 Hourly Feed Consumption

TABLE 2. The effect of the restriction of feed consumption, Experiment II.

Availability of feed[1]	Time feed available	Total feed consumed per hen	Percenttage of full feed
	percent	grams	
5 min./hr.	8.3	81.5	68.4
10 min./hr.	16.7	93.9	78.8
15 min./hr.	25.0	115.1	96.6
5 min./2 hrs.	4.2	69.5	58.3
10 min./2 hrs.	8.3	65.1	54.6
15 min./2 hrs.	12.5	86.3	72.4
30 min./2 hrs.	25.0	93.7	72.4
60 min./2 hrs.	50.0	119.7	100.4
10 min./3 hrs.	5.5	61.6	51.7
15 min./3 hrs.	8.3	56.6	47.5
15 min./4 hrs.	6.3	46.4	39.0
30 min./4 hrs.	12.5	88.7	74.5
60 min./4 hrs.	25.0	88.7	74.5
30 min./6 hrs.	8.3	64.6	54.2
60 min./8 hrs.	12.5	62.6	52.6
Full-feed	100.0	119.2	100.0

[1]6:00 a.m. to 8:00 p.m.

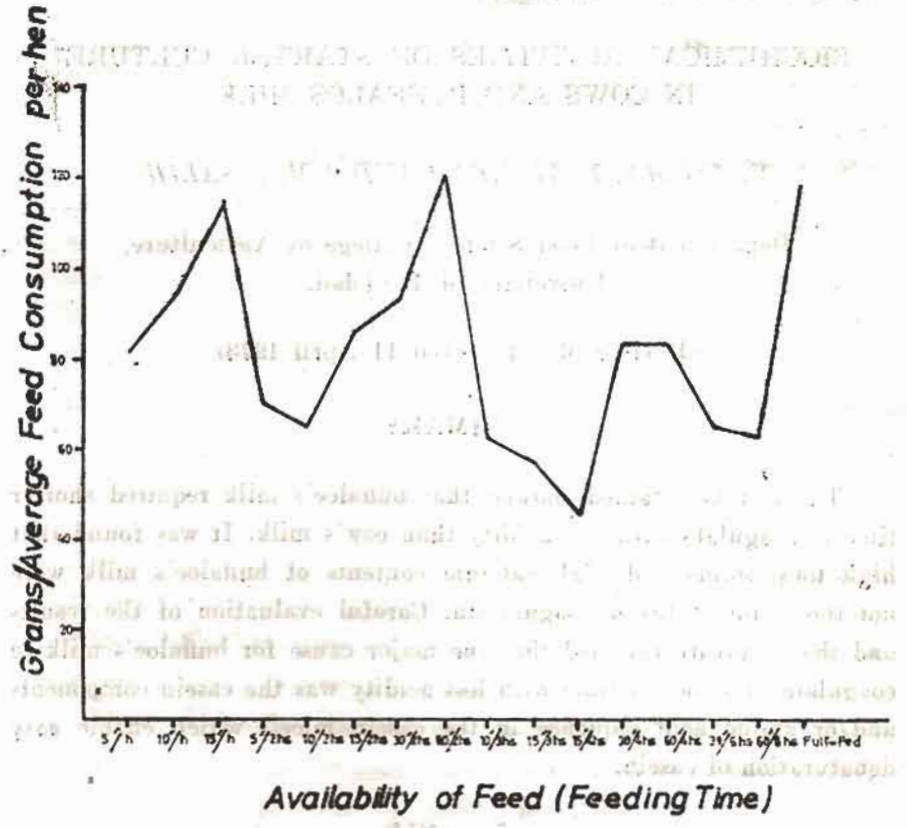

Fig 2. The Effect of Time Restriction on Feed Consumption

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BIOCHEMICAL ACTIVITIES OF STARTER CULTURE IN COWS AND BUFFALOS MILK

Y. AZUMA, T. ALSAFAR AND A.M.A. SALIH

Department of Food Science, College of Agriculture,
University of Baghdad.

(Revised MS. Received 11 April 1973)

SUMMARY

The results obtained showed that buffaloe's milk required shorter time to coagulate with less acidity than cow's milk. It was found that high total solids and high calcium contents of buffaloe's milk were not the cause of faster coagulation. Careful evaluation of the results and the literature revealed that the major cause for buffaloe's milk to coagulate in a shorter time with less acidity was the casein components and/or amino acid sequence in the casein micell which enable easy denaturation of casein.

الخلاصـــة

يلاحظ وجود بعض الصعوبات في صناعة الجبن الجاف من حليب الجاموس. وهذه الصعوبات تتعلق بنوعيـة الجبن وقوامه ورداءة تكوين الطعم والنكهـة المفضلة اثناء فترة النضوج ٠

يعتقد البعض بان ارتفاع نسبة المواد الصلبة غير الدهنية وارتفاع نسبة الكالسيوم في حليب الجاموس قد تكـون من ضمن الاسباب المؤديـة الى بعض الصعوبات في صناعة الجبن من حليب الجاموس٠ تشير النتائج التي حصل عليها في هذا البحث الى ان الزيادة في نسبة المواد الصلبة غير الدهنية والزيادة في نسبة الكالسيوم في حليب الجاموس ليست من الاسباب المؤدية الى الصعوبات بل تعود الاسباب الى طبيعة الكازين الموجود في حليب الجاموس من حيث تسلسل الحوامض الامينية المكونة للكازين ٠ لقد وجد بان حليب الجاموس يستغرق وقتا اقل ونسبة اقل من حامض اللاكتيك عند التجبن من حليب الابقار ٠

INTRODUCTION

Slow acid production, formation of rubbery curd, crumbly texture and poorly developed flavor during ripening are some of the difficulties found with cheese made from buffaloe's milk (Akhundov, 1959; Czulak, 1964 and Ramanathan, 1964).

The use of 50:50 mixture of buffaloe's and cow's milk was recommended by Akhundov (1959). Czulak (1964) believed that the high level of calicum and total solids found in buffaloe's milk are the reasons for poor quality of cheese made from buffaloe's milk. He recommended the dilution of buffaloe's milk with 10% water when it is used for cheese making. He explained that excess calcium found in buffaloe's milk combines with casein forming a complex which may slow acid formation.

This research was conducted to evaluate the work of some previous investigators and to gain further explanation to the problem.

MATERIALS AND METHODS

1. Milk:

Weekly samples of five liters of cow's and five liters of buffaloe's milk were collected from the college herd. The collected samples were skimmed to contain less than 0.01% fat, using a conventional cream separator. Unless otherwise stated, the skim milk portions were pasteurrized in flasks at 63°C for 30 minutes and cooled immediately in ice water to 10°C. Sterilization of milk was carried out, when necessary, by autoclaving at 121°C (15 p. s. i.) for 15 minutes and cooling rapidly. All samples were prepared in triplicate.

2. Culture:

Commercial mixed strains of *Streptococcus lactis* from Chris Hansen (Denmark) were used in this investigation. The lyophilized culture was propagated in nutrient broth, fortified with 1% (w/v) lactose. A small

amount of sterilized calcium carbonate was added before inoculation to compensate for the acid production. One ml of the grown culture was transfered into 9 ml of the freshly made medium and kept frozen at −60°C for future use. Upon use, the frozen culture was thawed under running tap water and incubated at 22°C for 18-20 hours. The thawed and incubated culture was transfered into 200 ml medium consisting of 1% (w/v) peptone, 1% tryptone, 1% glucose and 0.5% beef extract. The mixture was incubated at 22°C for 16 hours. Bacterial cells were obtained by centrifugation and washing twice with sterile saline solution. The cells obtained were adjusted to contain approximately 1×10^8 cells/ml using a saline solution.

Seven hundred ml triplicate samples of cow's and buffaloe's milk were inoculated with 7 ml of the cell preparation and incubated at 30°C until coagulation.

3. Adjustment of Solid-Not-Fat and Calcium Contents:

The total solid content of buffaloe's skim milk (sample C) was adjusted to that of the control sample of cow's skim milk (Sample B), by the addition of 16.7% distilled water.

Total solid content of cow's skim milk (sample D) was adjusted to that of the control buffaloe's skim (sample A) by careful dispersion of skim powder. The total solid of the sample was estimated according to American Public Health Association (1953).On average, cow's skim milk contained 8.6% solid-not-fat and 0.01% fat, while buffaloe's skim milk contained 10.6% solid-not-fat and 0.01% fat. All samples were pasteurized at 63°C for 30 minutes after adjustment.

The calcium content in both cow's and buffaloe's milk was adjusted to the following values by using calcium chloride dissolved in distilled water and expressed as CaO:

Samples	Ca content (as CaO)
A buffaloe's skim milk control	0.2375%
B cow's skim milk-control	0.1619%
C cow's skim milk with $CaCl_2$	0.2375%
D buffaloe's skim milk with water	0.1619%
E cow's skim milk with $CaCl_2$	0.2850% (120% of sample A)
F buffaloe's skim milk with water	0.1295% (80% of sample B)

The amount of distilled water used to bring the calcium content in samples D and F to that of cow's skim milk were 32.0 and 45.8% of the samples respectively. The amount of total solid of cow's skim milk were either unchanged (sample B) or increased slightly (samples C and E). Measurements of calcium chloride were in accordance with the method of Ling (1956).

4. The Isoelectric Point and Acid Production:

Electrophoretic mobility for determining the isoelectric point was not used because the apparatus was not available. The following technique based on minimum solubility of protein at the isoelectric point was used. Ten per cent HCl was slowly added to buffaloe's skim milk of whose pH was adjusted to around 4.7 after cooling. The cooled sample was warmed in a water bath to 37°C for 10 minutes for casein coagulation. The samples were centrifuged at approximately 10,000 x g for 5 minutes. The supernatant (whey) was decanted and the precipitate was dried at 105°C and weighed. The acid production was measured, using 17.6 ml sample, titrated against N/10 NaOH solution. The acidity found was converted to percentage by converting the amount of the sample and the strength of the alkali used.

RESULTS AND DISCUSSION

1. Effect of Heat Treatment:

Figure (1) shows that the heat treatment of milk had no significant effect on the amount of acidity produced in buffaloe's or cow's milk.

However, both pasteurized and sterilized buffaloe's milk coagulated at a shorter incubation period. This may indicate that the time of coagulation is correlated with the total milk solids content.

2. Effect of Total Milk Solids:

Figue (2) shows that the overall pattern of the titratable acidity did not change with the addition of dehydrated skim milk. There was no effect of the dilution of buffaloe's milk on the coagulation time. Furthermore, the addition of dehydrated skim milk to cow's milk did not cause any changes with respect to coagulation time. .

The differences between the initial titratable acidity of buffaloe's and cow's milk and the standardized samples could be explained by the fact that both the addition of water or dehydrated skim milk brings about great changes in the mineral content of the standardized milk. In addition to that, the total protein content can cause an increase in the titratable acidity.

This may indicate that total milk solids is not the chief factor in explaining the fact of shorter coagulation time of buffaloe's milk Calcium, and other polyvalent ions might be involved in causing the coagulation.

3. Effect of different calcium levels:

Figure (3) shows that buffaloe's milk requires shorter coagulation period regardless of the calcium levels.

The former results indicate that buffaloe's milk coagulated at higher pH level than that of cow's milk. This may be due to a higher isoelectric point for buffaloe's milk casein in comparison to that of cow's milk.

However, Table (1) shows that the greater amount of precipitated casein was at pH 4.6, which indicates that the isoelectric point of buffaloe's milk casein is identical to that of cow's. This is in an agreement with the results reported by Raj and Joshi (1956) and Prodanski and Petrov (1962).

The mixing of 50:50 of buffaloe's and cow's milk as suggested by Akhundov (1959) and Ramanathan (1964), and the addition of 10-15% water to buffaloe's milk suggested by Czulak (1964) did not appear to be linked to the high calcium content or high total solids content, but rather to the effect of such treatments on the casein where it is coagulated at a lower acidity. The poor development of cheese flavor in the cured cheese made from buffaloe's milk is related to the enzymatic action which is slow when acidity is not fully developed during the manufacturing process.

Careful evalution of the results obtained and the literature reveals that the major cause for buffaloe's casein to coagulate at lower acidity and shorter time is the difference in the components of casein, and or amino acid sequence of the caseins, which enable buffaloe's casein to be denatured easily.

Quantitative and qualitative investigation of the buffaloe's casein compared with cow's milk casein will clarify some of the problems involved in cheese made from buffaloe's milk.

TABLE 1. Amount of buffaloe's casein precipitated at various pH.

Sample No.	Final pH of milk with HCl	Net casein weight per 30.0 ml milk
1	5.02	1.30626
2	4.90	1.32056
3	4.72	1.36360
4	4.60	1.39743
5	4.53	1.35498

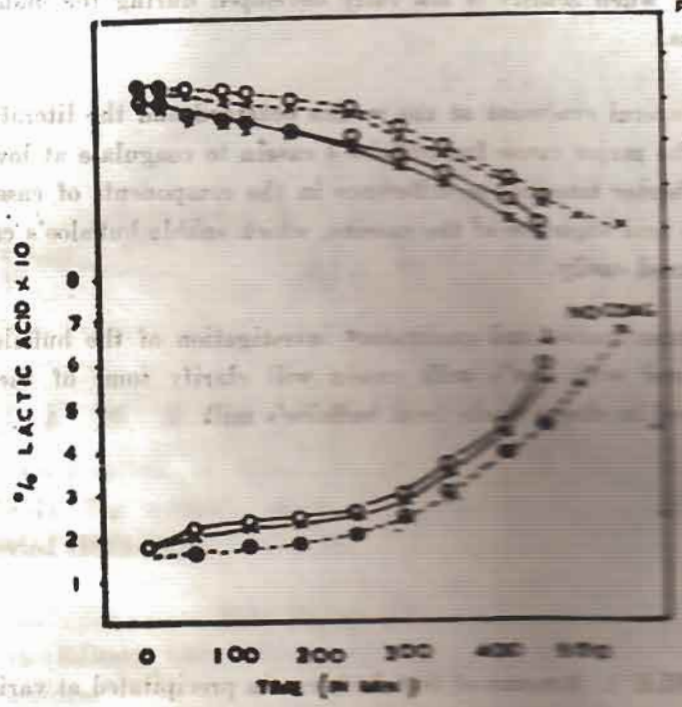

Fig. 1. Activity of *S. lactis* in milk at different heat treatments. circles = buffaloe's milk; crosses = cow's milk; solid lines = milk sterilized at 121°C for 15 minutes; dotted lines = milk pasteurized at 63°C for 30 minutes.

Arrows indicate the milk coagulated.

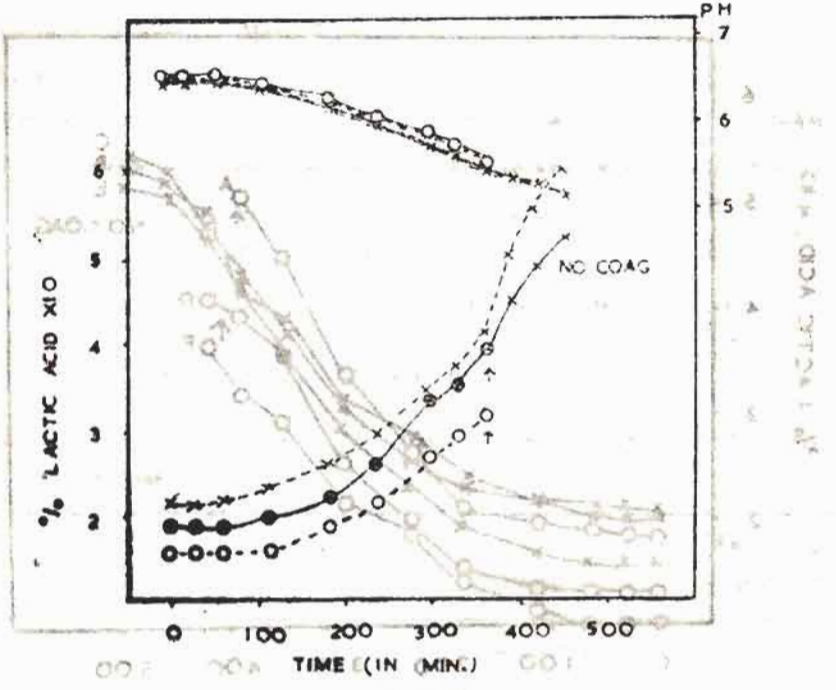

Fig. 2. Effect of total solid contents on the activity of *S. lactis*.

Sample A — buffalo control; solid circles.

Sample B — cow control; solid crosses.

Sample C — buffalo with water (total solids content equals to sample B); dotted circles.

Sample D — cow milk with dry skim milk powder (total solid content equals to sample A); dotted crosses.

Arrows indicate the milk coagulated.

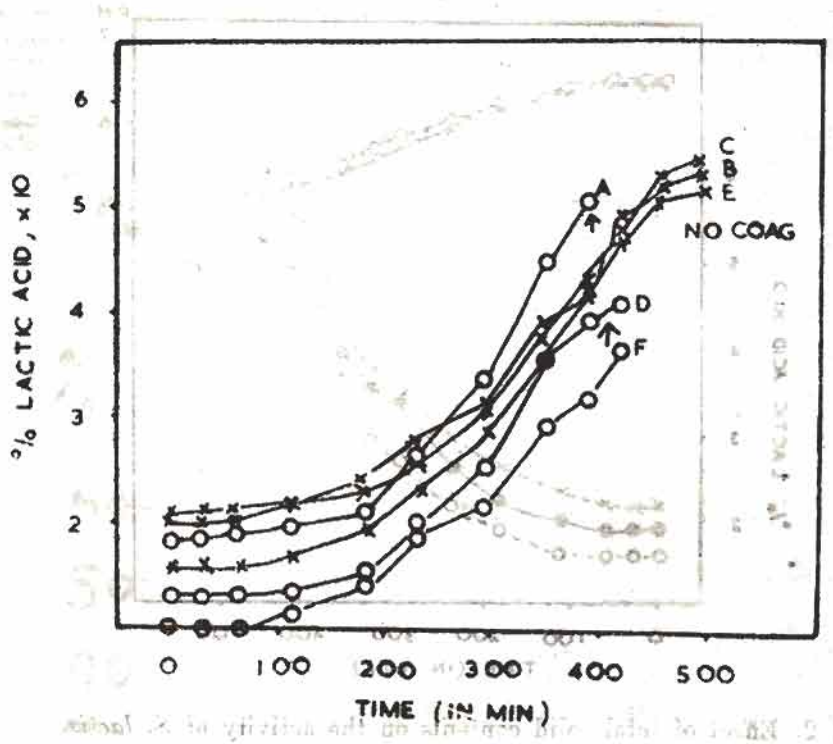

Fig. 3. Effect of different calcium contents on the activity of *S. lactis*, particularly on acid production.

Designation on each sample, refer to the text. Arrows show the milk coagulated.

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SEASONAL CHANGES IN THE PLANT BEHAVIOUR OF FALLUJA AND ISKANDERIYA GYPSUM DESERT FLORA

HIKMAT A. AL-ANI AND SHARIF Y. HADDAD
Plant Protection Department, College of Agriculture,
University of Baghdad.

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SUMMARY

A study was conducted to explain the seasonal changes in the flora of Falluja and Iskanderiya gypsum desert, and to describe the morpho-ecologic and pheno-ecologic behaviours of the plants with respect to the climate of their habitat.

Plants were identified to the species level and the Biological Spectrum showed that Therophytes constitute the highest percentage of the species (57%) and very low percentage of Phanerophytes (7%).

The plants were divided according to their flowering behaviour into: Unipotential, Bipotential and Pluripotential.

The practical significance of the study has been discussed.

الخلاصـــة

تشمل هذه الدراسة التغير الموسمي في السلوك النباتي للانواع النباتية في صحراء الفلوجة والاسكندرية الجبسية · لقد تضمنت تشخيص الانواع النباتية والتعرف على مواعيد ازهارها وعلاقة ذلك بالمناخ · كما قسمت اشكال الحياة حسب المنظـور الحياتي (Biological Spectrum) فكانت اعـلى نسبة للنباتات الحولية ٥٧٪ بينما الشجيرات كانت قليلة جدا ٧٪ · واوضحت الدراسة بان نباتات هذه المنطقة تزهر وفق ما يلي :

١ ـ نباتات لها القابلية على الازهار في فصل واحد ·
٢ ـ نباتات لها القابلية على الازهار في فصلين ·
٣ ـ نباتات لها القابلية على الازهار في اكثر من فصلين ·

كما نوقشت الاهمية التطبيقية لهذه الدراسة ·

INTRODUCTION

Gypsum deserts compose a relatively large proportion of Iraqi deserts. Falluja and Iskanderiya deserts are considered a part of the Jazirah, and both are used extensively for producing gypsum "JUSS". The flora in such areas has been exposed to the smoke and by-products of many gypsum factories, and has suffered a considerable modfication, partly because of these factories as well as by other practices i.e., over grazing, collection of plants for fuel, traffic, and ploughing etc.

Natural vegetation and flora composition are usually used as good parameters for many applied purposes. Therefore, the study of the biology of our native plants is a prerequisite for planning agricultural projects. Unfortunately, such studies are very much limited in Iraq.

The seasonal changes in the flora of the studied gypsum desert are described here according to morpho-ecologic and pheno-ecologic behaviours, that is, the plant body changes during the climatic year. The biological spectrum of the flora has been discussed with the relationships of the climatic conditions of the habitat.

MATERIALS AND METHODS

This study is a result of field trips taken during two years (1970-1972) to gypsum deserts located nearby Falluja and Iskanderiya. Samples of flowering plants were collected seasonally and were pressed in the field by a metal press. The pressed specimens were dried by means of an electric dryer, mounted on herbarium standard sheets, and were identified in our Iraqi herbaria by using taxonomic literature and by comparing with herbarium materials. The identified specimens were deposited in the College of Agriculture herbarium. Nomenclature of the species is according to Rechinger (1964).

RESULTS

The changes in the plant body have been followed for each species throughout the two years of study. Adaptive species for each season

were recorded when they were in the reproductive stage. The life form of the flora is shown according to Raunkiaer's system (1934).

1. THEROPHYTES.

These are plants which complete their life-cycle from germination to seed ripening within a single limited vegetative period. They are subdivided here due to their seasonal growth time as follows:

(a) Winter-spring annuals which complete their life-cycle during spring or earlier. However, some of the species were also found blooming during other favourable seasons (Table 1).

(b) Summer-autumn annuals which complete their life-cycle during the very severe climatic seasons (Table 2).

2. GEOPHYTES.

Plants which pass the drought seasons by keeping their perennating buds underground as corms, bulbs, tubers or rhizommes. These plants resemble the annuals since their aerial shoots die at the end of their growing season (Table 3).

3. HEMICRYPTOPHYTES (Diminutive perennial herbs).

The aerial shoots die after flowering period and their renewal buds are located near the soil surface (Table 4).

4. CHAMAEPHYTES.

These are perennial herbs and some under shrubs with renewal buds located between ground surface and a height of 25 cm (Table 5).

5. PHANEROPHYTES.

Are plants having their renewal buds exposed on upright shoots above 25 cm (Table 6).

DISCUSSION

The biological spectrum of the flora of the studied area is given in Table 7. It is shown that Therophytes constitute 57% of the species, while Phanerophytes comprise only 7%. In the Death Valley Desert,

TABLE 1. List of Therophytes (winter-spring annuals), their flowering period and family names.

No.	Species	Family	Flowering period
1.	*Aizoon hispanicum* L.	Aizoaceae	Sp.
2.	*Atractylis flava* Desf.	Asteracae	Sp.
3.	*Calendula persica* C.A. Mey.	,,	W-Sp.
4.	*Carthamus oxyacantha* M.B.	,,	W-Sp.
5.	*Centaurea iberica* Trev. ex Spreng.	,,	Sp.
6.	*Crepis sancta* (L.) Babc. s. l.	,,	Sp.
7.	*Filago spathulata* Presl.	,,	Sp.
8.	*Gymnarrhena micrantha* Desf.	,,	Sp.
9.	*Iflago spicata* (Forssk.) Sch.-Bip.	,,	W-Sp.
10.	*Koelpinia linearis* Pall.	,,	Sp.
11.	*Launaea mucronata* (Forssk.) Muschl.	,,	Sp.
12.	*Leontodon laciniatus* (Bertol.) Widd.	,,	Sp.
13.	*Onopordon heteracanthum* C.A. MEY.	,,	Sp.
14.	*Reichardia orientalis* (L.) Hochr.	,,	Sp.
15.	*Vicoa pentanema* Aitch. et Hemsl.	,,	Sp.
16.	*Arnebia decumbens* (*Vent.*) Coss et Kral.	Boraginaceae	W-Sp.
17.	*Diplotaxis erucoides* (L.) DC.	Brassicaceae	Sp.
18.	*Malcolmia exacoides* (DC.) SPRENG.	,,	Sp.
19.	*Savignya parviflora* (DEL.) WEBB.	,,	Sp.
20.	*Schimpera arabica* Hochst. et Steud.	,,	Sp.
21.	*Sisymbrium irio* L.	,,	W-Sp.

TABLE 1. (Cont.)

22. *Cleome arabica* L.	Capparidaceae	Sp.
23. *Gypsophilla capillaris* Freyn and Sint.	Caryophllaceae	Sp.
24. *Scabiosa olivieri* Coult.	Dipsacaceae	W-Sp.
25. *Astragalus Hamosus* L.	Fabaceae	Sp.
26. *Astragalus tribuloides* Del.	,,	Sp.
27. *Erodium deserti* (Eig.) Eig.	Geraniaceae	W-Sp.
28. *Malva parviflora* L.	Malvaceae	Sp.
29. *Paronychia arabica* (L.) Del.	Paronycheaceae	Sp.
30. *Plantago boissieri* Hausskm. et Bornm.	Plantagineceae	Sp.
31. *Plantago ovata* Forssk.	,,	Sp.
32. *Hordeum glaucum* Steud.	Poaceae	Sp.
33. *Polypogon monspeliensis* (L.) Dtsf.	,,	Sp.
34. *Schismus barbatus* (L.) Thell.	,,	Sp-Au.
35. *Adonis dentatus* Del.	Ranunculaceae	Sp.
36. *Reseda decursiva* Forssk.	Resedaceae	Sp.
37. *Galium tricornutum* Dandy.	Rubiaceae	Sp.
38. *Hyoscyamus cylindrocalyx* Rech. f.	Solanaceae	Sp.

Sp = spring, Au = autumn, W = winter.

TABLE 2. List of Therophytes (Summer-autumn annuals), their flowering period and family names.

No.	Species	Family	Flowering period
1.	*Bassia eriophora* (SCHRAD.) ASCHERS.	Chenopodiaceae	Su.
2.	*Salsola inermis* Forssk.	,,	Au.
3.	*Salsola incanescens* C.A. MEY.	,,	Au.
4.	*Salsola jordanicola* Eig.	,,	Au.
5.	*Salsola Volkensii* Schw. et Aschers.	,,	Au.
6.	*Schanginia aegyptiaca* (Hasselq) Aellen.	,,	Su.
7.	*Chrozophora hierosolymitana* SPR.	Euphorbiaceae	Su.
8.	*Euphorbia chamaesyce* L.	,,	Su.
9.	*Euphorbia petiolata* BANKS et SOLAND.	,,	Au.
10.	*Frankenia pulverulenta* L.	Frankeniaceae	Au.
11.	*Tribulus terrestris* L.	Zygophyllceae	Su-Au.

Su = summer Au = autumn.

TABLE 3. List of Geophytes, their flowering period and family names.

No.	Species	Family	Flowering period
1.	*Allium desertorum* Forssk.	Alliaceae	Sp.
2.	*Iris sisyrinchium* L.	Iridaceae	Sp.
3.	*Colchicum deserti-syriaci* Feinbr.	Liliaceae	Sp.
4.	*Gagea reticulata* (Pall.) Schult.	,,	Sp.

Sp = spring.

TABLE 4. List of Hemicryptyophytes, their flowering period and family names.

No.	Species	Family	Flowering period
1.	*Achillea fragrantissima* (Forssk.) Sch.-Bip.	Asteraceae	W.
2.	*Artemisia scoparia* W. et K.	,,	Au.
3.	*Heliotropium bacciferum* Forssk.	Boraginaceae	Sp.Au.
4.	*Diplotaxis harra* (Forssk.) Boiss.	Brassicaceae	Sp.
5.	*Citrullus colocynthis* (L.) Schrad.	Cucurbitaceae	Sp.
6.	*Andrachne telephioides* L.	Euphorbiaceae	Sp-Au.
7.	*Onobrychis bicolor* Hausskn. et Bornm.	Fabaceae	Sp.
8.	*Erodium glaucophyllum* (L.) L'HER.	Geraniaceae	Sp.
9.	*Salvia lanigera* POIR.	Laminaceae	Sp-Su-Au.
10.	*Teucrium polium* L.	,,	Sp.
11.	*Herniaria hemistemon* J. GAY.	Paronychiaceae	Sp.
12.	*Poa sinaica* Steud.	Poaceae	Sp.
13.	*Stipagrostis plumesa* (L.) MUNRO ex ANDERS.	,,	Sp.
14.	*Haplophyllum tuberculatum* (Forssk.) ADR.-Juss.	Rutaceae	Sp.
15.	*Serophularia deserti* DEL.	Scrophulariaceae	Sp-Au.
16.	Ducrosia anethifolia (DC.) BOISS.	Umbelliferae	Au.
17.	*Fagonia Bruguieri* Dc.	Zygophyllaceae	W-Sp-Au.
18.	*Fagonia glutinosa* Del.	,,	Sp-Su.
19.	*Fagonia olivieri* Dc.	,,	Sp.
20.	*Peganum harmala* L.	,,	Sp.

Sp = spring, Su = summer, Au-autumn, W = winter.

TABLE 5. List of Chamaephytes, their flowering period and family names.

No.	Species	Family	Flowering period
1.	*Cornulaca monacantha* Del.	Chenopodiaceae	Su-Au.
2.	*Salsola canescens* (Mod.-Tand) Boiss.	,,	Au.
3.	*Helianthemum lippii* (L.) Pers.	Cistaceae	Sp-Su-Au.
4.	*Convolvulus oxyphyllus* Boiss.	Convolvulaceae	Sp-Su-Au.
5.	*Alhagi mannifera* Desv.	Fabaceae	Sp-Su-Au.
6.	*Astragalus Baghdadensis* Rech. f.	,,	Sp.
7.	*Zygophyllum coccineum* L.	Zygophyllaceae	Au.

Sp = spring, Su = summer, Au = autumn.

TABLE 6. List of Phanerophytes, their flowering period and family names.

No.	Species	Family	Flowering period
1.	*Haloxylon salicornicum* Moq.	Chenopodiaceae	Au.
2.	*Ephedra alata* Decne.	Ephedraceae	Sp.
3.	*Astragalus spinosus* (Forssk.) MUSCHL.	Fabaceae	W-Sp.
4.	*Lagonychium farctum* (Banks et Soland.) Bober.	,,	Sp-Su.
5.	*Calligonum tetrapterum* Jaub. et Spach.	Polygonaceae	Sp.
6.	*Zizyphus nummularia* (Burm.) Walk.	Rhamnaceae	Sp.

Sp = spring, Su = summer, Au-autumn, W = winter.

TABLE 7. Biological spectrum of Falluja-Iskanderiya gypsum desert and Death Valley Desert (U.S.A.).

Locality	Number of Species	Life forms (%)[1] Thero-phytes	Geo-phytes	Hemicryptophytes	Chamaephytes	Phanerophytes
Gypsum desert	86	57	5	23	8	7
Death Valley	294	42	7	18	7	26

(1) The percentages of life forms are based on total number of species found in them.

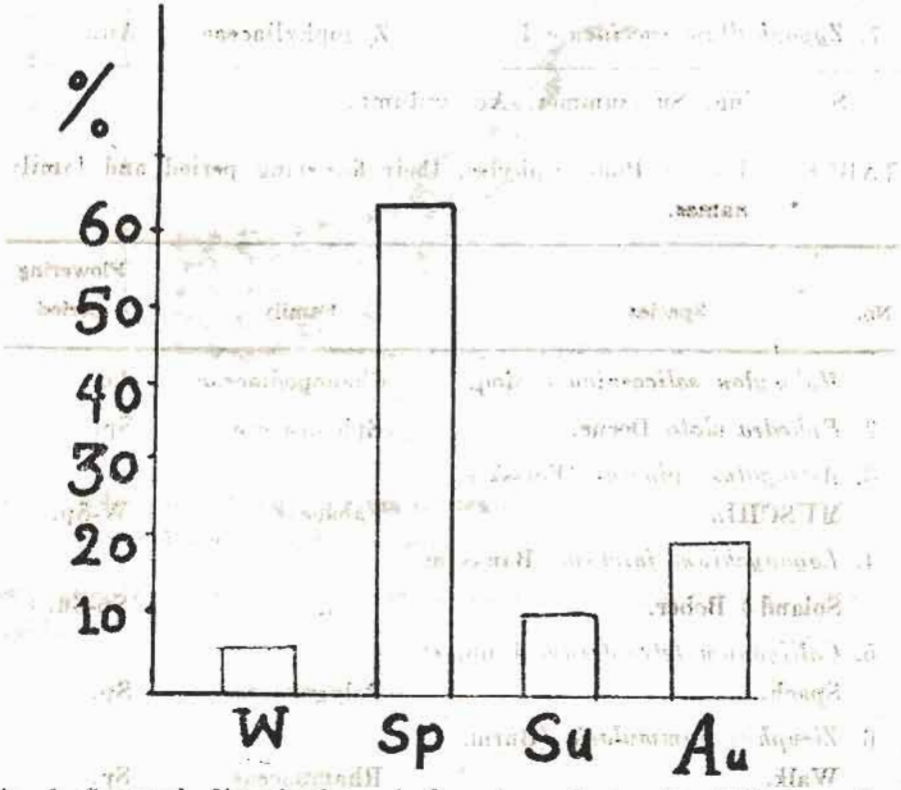

Fig. 1. Seasonal distrubution of flowering plants. In Falluja and Iskanderiya gypsum desert.

U.S.A. (Table 7), Therophytes and Phanerophytes constitute 42 and 26% of the spectrum respectively (Oosting, 1956). This low ratio of Phanerophytes clearly shows that considerable destructive forces have been inflicted on the shrubby plants in the studied gypsum desert.

With respect to seasonal plant behaviour 92% of Therophytes bloom during winter-spring seasons, the rest bloom during other seasons. However, all Geophytes bloom during spring. With regard to other life forms blooming occurs mostly during spring. The plant behaviour of the flora (Fig. 1) shows that 65% of them bloom during spring which is characterized by a rainy mild temperature condition (Fig. 2). Whereas, 20% bloom during autumn, 10% bloom during summer and the remaining 5% during winter. The relatively high ratios of autumn-summer flowering plants are very interesting and important in keeping the desert in bloom in spite of very severe climatic conditions. Haines (1957) discussed this phenomenon with regard to autumn-flowering plants. He mentioned that the behaviour of such plants depends, at least in some species, on reduced water loss when the days become shorter and cooler, while grazing pressure is usually severe. However, more research is needed in the field of eco-physiology in order to explain the behaviour of these plants.

The flowering period of the plants may be divided into the following potentialities:

1. Unipotential plants which bloom during particular season such as spring flowering plants e.g. *Aizoon hispanicum* L. and *Cleome arabica* L.
2. Bipotential plants which may bloom during two seasons such as spring-autumn flowering plants e.g. *Heliotropium bacciferum* (L.) Mill and *Scrophularia deserti* Del.
3. Pluripotential plants which bloom during three seasons or the year around such as: *Helianthemum lippii* (L.) Pers. and *Convolvulus oxyphyllus* Boiss.

From these potentialities one could notice that desert productivity could be continuous and applicable to many practical purposes. Therefore, the conservation of our desert flora is very much needed.

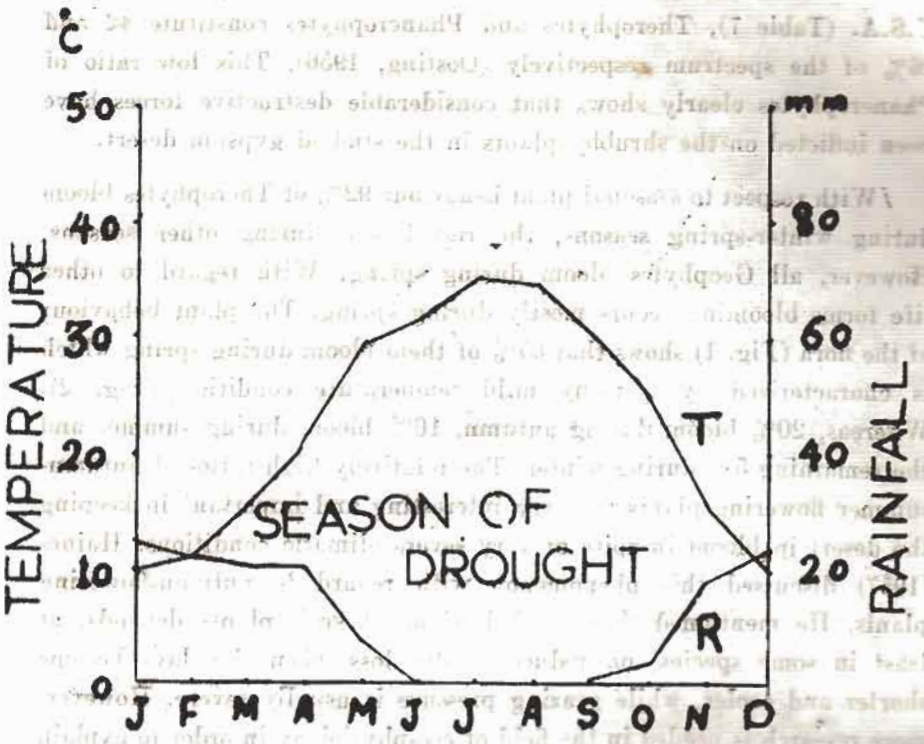

Fig. 2. Clima-diagram of Baghdad prepared according to Walter (1957). The monthly means temperature and rainfall for the period (1941-1972).

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EFFECT OF NITROGEN FERTILIZATION ON YIELD AND YIELD COMPONENTS OF WHEAT (*TRITICUM AESTIVUM* L.) VARIETIES

W.S. EL-SHAMMA

Field Crops Division, College of Agriculture,
University of Baghdad
(Received 11 April 1973)

SUMMARY

Three wheat (*Triticum aestivum* L.) varieties, Ajeba 210 (local), Kenya-Gular and Mexipak which are adapted to the middle and southern irrigated regions of Iraq were given 40 and 80 kg N/ha by applying the split plot design. The grain yield and components of yield were studied and analysed statistically.

Kenya-Gular was significantly the highest in grain yield, number of heads per one foot length and 1,000 seed weight, while Mexipak was significantly the highest in number of seeds per head.

The 80 kg N/ha gave significantly highest grain yield and number of seeds per head and the 40 kg N/ha gave significantly highest number of heads per one foot length.

Ajeba 210 and Kenya-Gular produced the highest grain yield and number of seeds per head by using 80 kg N/ha, while Mexipak produced the highest grain yield and number of seeds per head by using 40 kg N/ha.

The increase in grain yield resulted from the increase in each of the components of yield.

The yield and components of yield varied significantly according to variation in years.

It is recommended to use 80 kg N/ha for Kenya-Gular and 40 kg N/ha for each of Ajeba and Mexipak wheat varieties, since it leads to an increase in grain yield with 4/000, 3/500 and 2/500 I.D. net profit per donum (one hectar=4 donums), respectively plus higher protein content in the grain in comparison to no N fertilizer.

الخلاصـــة

اعطيت ثلاثة اصناف مـن الحنطة ، عجيبة ٢١٠ (محليـة) ، كيناكولار ومكسيباك الملائمتين للمنطقتين الاروائيتين الوسطى والجنوبية في العراق ، صفر ، ٤٠ ، ٨٠ كلغم نتروجين للهكتار بتطبيق تصميم الالواح المنشقة · درس حاصل الحبوب ومكونات الحاصل وحلل احصائيا ·

كانت كيناكولار الاعلى معنويا في حاصل الحبوب ، عدد السنابل لمسافة قدم واحد طولا ، ووزن ١٠٠٠ بذرة ، بينما كانت المكسيباك الاعلى معنويا في عدد البذور للسنبلة ·

كان استعمال ٨٠ كغم نتروجين للهكتار هو الاعلى في حاصل الحبوب وعدد البذور للسنبلة وكان استعمال ٤٠ كغم نتروجين للهكتار هو الاعلى في عدد السنابل في مسافة قدم واحد طولا ·

انتجت العجيبة وكيناكولار اعلى حاصل حبوب وعدد بذور للسنبلة باستعمال ٨٠ كغم نتروجين للهكتار ، بينما انتجت مكسيباك اعلى حاصل حبوب وعـدد سنابل للقدم الواحد طولا باستعمال ٤٠كم نتروجين للهكتار على التوالي ·

نتجت زيادة حاصل الحبوب بسبب زيادة كل من مكونات الحاصل ·

اختلف حاصل الحبوب ومكونات الحاصل معنويا حسب اختلاف السنين ·

يوصى باستعمال ٨٠ كغم نتروجين للهكتار (٢٠ كغم ونتروجين للدونم) للحطنة كيناكولار و ٤٠ كغم نتروجين للهكتار (١٠ كغم نتروجين للدونم) للعجيبة ومكسيباك ، حيث انها تؤدي الى زيادة في حاصل الحبوب بصافي ربح قدره ٤/- ، ٣/٥٠٠ ، ٢/٥٠٠ ديناراً للدونم على التوالي (الهكتار = ٤ دونمات) مع زيادة في المحتوى البروتيني في الحبوب بالمقارنة بدون سماد نتروجين ·

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the major winter grain corp in Iraq. Previous study showed a significant increase in grain yield of local wheat Ajeba 210 in the middle and southern irrigated regions due to the use of N fertilizer at 40 and 80 kg/ha (El-Shamma, 1966).

This study was conducted to find the optimum amount of N fertilizer required for Kenya-Gular and Mexipak wheat varieties planted recently by the farmers in the middle and southern irrigated regions in comparison to local Ajeba 210 and to investigate its effect on grain yield and yield components of these varieties.

A significant increase in wheat yield by using 100 kg N/ha under irrigation was reported by several workers (Richardson and Curney, 1933; Bains, 1949; Long and Serbakoff, 1955; McNeal and Davis, 1954; Wahhab and Hussain, 1957; Russel *et al.* 1958; and Stikler and Panli, 1964). Rhode (1963) found an increase in wheat yield by applying about 50 kg N/ha under dry farming.

The yield components appear to be related to N fertilization. Bayfield (1963) and Wahhab and Hussain (1957) showed that nitrogenous fertilizer increased weight of grain, contrarily, Hobbs (1953) and McNeal and Davis (1954) and Robins and Domingo (1962) found that nitrogen increased the number of heads per plant. McNeal and Davis (1954) also showed that nitrogenous fertilizer increased the number of kernels per head, while Wahhab and Hussain (1957) concluded that nitrogenous fertilizer did not affect the number of kernels per head. Bains (1949), Hobbs (1953), McNeal and Davis (1954), Wahhab and Hussain (1957), Russel *et al.* (1958) and El-Shamma (1964) stated that nitrogenous fertilizer increased the protein content of the grain.

MATERIALS AND METHODS

This research was applied at a clay loam soil by using the split plot design with four replications in 1969, 1970 and 1971 at Abu-Ghraib, Irrigated Station, College of Agriculture, University of Baghdad. The

wheat varieties Kenya-Gular, Mexipak and local Ajeba 210 were planted as main plots, while 40 and 80 kg N/ha as ammonium sulphate 21% N was used as sub plots. Half of the N was added before seeding and the other half when the plants were about 20 cm high. The rate of seeding was 80 kg/ha and the date of seeding was during the first week of November yearly. The trials had been conducted in the same field in different years with each replicate or block occupying the same area during each year.

Each treatment was applied in a plot (2 × 6) m, by using six rows, 5 m long and 30 cm apart. The plots were irrigated 3 times during the vegetation period and 2-3 times during the heading and maturation periods. Weeding was done by hand implements 3 times at monthly intervals during the vegetation period. The grain yield was harvested from the central rows during the second week of May each year. The components of yield namely, number of heads per one foot length, number of seeds per head and 1,000 seed weight in g were calculated from one foot length of any central row randomly picked as described by LeClerg *et al.* (1962). The grain yield and components of yield were analysed statistically.

RESULTS AND DISCUSSION

The values of soil analysis before experimentation in 1968 and after experimentation with and without N application in 1971 are presented in Table 1. The data showed an obvious decrease in soil phosphorus after experimentation with and without N application with a slight increase in soil N when N fertilizer was added at 40 and 80 kgs/ha and a slight decrease in the non-nitrogenous treatment. The soil reaction, potassium and organic matter contents were cosistent in the soil before and after experimentation. But the electrical conductivity increased slightly in the nitrogenous treatments.

The yield and each of the yield components of the wheat varieties differed significantly (Table 2). Kenya-Gular was the leading in grain yield, number of heads per one foot length and 1,000 seed weight, while

TABLE 1. Soil analysis before and after the application of N fertilizer in 1968 and 1971, respectively.

Treatment	pH	E.C.	Ext. K meg/100 gm	P(ppm) $NaHCO_3$ Ext.	Total N%	O.M.%
Before experimentation in 1968 ...	7.60	2.10	0.80	11.50	0.0710	1.5
After experimentation without N in 1971	7.90	2.08	0.80	2.40	0.0540	1.3
After experimentation with 40 kgs N/ha	7.80	2.30	0.75	3.00	0.0860	1.4
After experimentation with 80 kgs N/ha	7.85	2.60	0.70	2.68	0.0935	1.4

TABLE 2. Seed yield and yield components of wheat varieties with 40 and 80 kgs N/ha (average 1969, 1970 and 1971).

Characters	Varieties			L S D		Nitrogen rates			L S D	
	Ajeba	210 Kenya-Gular	Mexipak	5%	1%	0	40	80	5%	1%
Grain yield (Kg/ha)	1632.05	2105.60 *	1983.72	487.10	657.78	1711.19	1977.63	2032.55 **	241.26	321.32
No. of heads per one foot length	32.58	38.28 **	22.22	9.26	12.50	28.42	33.50 *	31.17	3.91	5.21
No. of seeds per head	22.54	23.28	36.95 **	5.73	7.73	25.61	28.12 **	29.05 **	1.31	1.67
1,000 seed weight (g)	32.82	38.48 **	24.26	3.49	4.71	34.87	35.01	35.63	N.S.	

N.S. No significant difference.

* P<0.05.

** P<0.01.

TABLE 3. Seed yield and components of yield of the wheat varieties with 40 and 80 kgs N/ha (average 1969, 1970 and 1971).

Variety	Nitrogenous fertilizer rates kgs/ha 0	40	80	LDS 5%	1%
		Grain yield kg/ha			
Ajeba 210	1358.91	1739.83	1797.41	585.41	779.19
Kenya-Gular	1895.66	2018.58	2402.28		
Mexipak	1879.00	2174.50	1897.66		
LSD 5%	717.87				
1%	556.54				
		No. of heads per one foot length			
Ajeba 210	28.67	36.08	33.00	N.S.	
Kenya-Gular	36.75	41.50	36.58		
Mexipak	19.83	22.92	23.92		
LSD 5%	N.S.				
1%					
		No. of Seeds per head			
Ajeba 210	20.62	22.99	24.02	5.87	7.82
Kenya-Gular	22.27	21.82	25.76		
Mexipak	33.94	39.55	37.37		
LSD 5%	2.16				
1%	2.88				
		1,000 seed weight (g)			
Ajeba 210	32.04	33.05	33.36	N.S.	
Kenya-Gular	38.66	37.47	39.17		
Mexipak	33.90	34.50	34.38		
LSD 5%	N.S.				
1%					

N.S. No significant difference.

TABLE 4. Mean square values for the yield and yield components of the various sources of variation.

Source of variation	D.F.	Grain yield kg/ha	No. of heads per one foot length	No. of seeds per head	1,000 seed weight (g)
Year	2	43309542.40**	2443.00**	698.69**	150.27**
Variety	2	2176687.26**	2385.36**	2370.11**	305.99**
Year x variety	4	419195.84	341.74*	28.33	33.27
Error	27	338094.72	121.85	46.85	17.32
N rates	2	1063688.68**	233.90**	114.07**	6.09
Year x N rates	4	34208.76	109.58	18.48**	5.19
Variety x N rates	4	392685.66**	40.70	37.01**	5.02
Year x variety x N rates	8	116216.68	18.65	54.78**	3.78
Error	54	86960.88	22.90	2.34	8.99

* Significant at .05 level.

** Significant at .01 level.

Mexipak was the leading in number of seeds per head. Kenya-Gular was 29.02 and 6.41% higher in grain yield; 17.49 and 72.28% higher in number of heads per one foot length; 17.09 and 11.91% higher in 1,000 seed weight in comparison to Ajeba 210 and Mexipak, respectively. But Mexipak was 63.93 and 58.72% higher in number of seeds per head in comparison to Ajeba 210 and Keyna-Gular in the same order. The 29.02% increase in grain yield of Kenya-Gular over Ajeba 210 was due to 17.49, 5.21 and 17.09% increase in number of heads per one foot length, number of seeds per head and 1,000 seed weight, respectively.

The grain yield and number of heads per one foot length and number of seeds per head resulted from applying introgenous fertilizer were significant, while 1,000 seed weight was not significant (Table 3). The use of 80 kg N/ha produced 2.78, 18.78% and 3.31, 13.43% increase in grain yield and number of seeds per head in comparison to 40 kg N/ha and no N, respectively. But the use of 40 kg N/ha produced 5.44, 17.87% increase in number of heads per one foot length in comparison to 80 kg N/ha and no N in the same order. Several workers found almost similar trend by using different wheat varieties (LeClerg *et al.* 1962; Rhode, 1963. and El-Shamma, 1966).

The N fertilizer applied to wheat varieties Ajeba 210, Kenya-Gular and Mexipak gave significant differences in grain yield and number of seeds per head only. Both Kenya-Gular and Ajeba 210 gave the highest grain yield and number of seeds per head by using 80 kg N/ha.

The application of 80 kg N/ha to both Kenya-Gular and Ajeba produced 19.02, 26.76% and 3.31, 32.27% increase in grain yield, 18.06, 15.76% and 4.48, 16.49% increase in number of seeds per head in comparison to both 40 kg N/ha and no N in the same order. While the application of 40 kg N/ha to Mexipak resulted in 14.59, 15.73% higher grain yield 5.83, 16.53% higher number of seeds per head in comparison to both 80 kg N/ha and no N in the same order.

Table 4 shows that the grain yield and the components of yield varied significantly according to variation in years. The number of heads

TABLE 5. Correlation and regression coefficients for each of the components of yield.

Characters	r	b
Yield and number of heads per one foot length	0.540**	43.97
Yield and number of seeds per head	0.360**	41.11
Yield and weight per 1,000 seeds (g)	0.525**	121.39

** $P<0.01$.

per one foot length of the wheat varieties and the number of seeds per head from using different N rates responded differently in different years. The number of seeds per head resulted from applying N fertilizer to the wheat varieties varied significantly each year. Almost similar findings were reported by Rhode (1963) using different wheat varieties.

The positive values of each of the correlation and the regression coefficients in Table 5 indicate that the increase in grain yield was due to increase in each of the components of yield.

It is recommended to apply 80 kg N/ha to Kenya Gular and 40 kg N/ha to Ajeba 210 and Mexipak wheat varieties, because it leads to 26.76, 28.96 and 15.73% increase in grain yield with I.D. 4/087, 3/512, 2/444 net profit, respectively and an increase in protein content as reported by several workers (Bains, 1949; Hobbs, 1953; McNeal and Davis, 1954; Wahab and Hussain, 1957; Russel *et al.* 1958; and El-Shamma, 1964).

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STUDY ON SCLEROTIUM BATATICOLA THE CAUSE OF CHARCOAL ROT DISEASE OF SESAME

KHALIL K. AL-HASSAN, SADIC A. AL-HASSAN[1] *AND HAMED A. RADHY*

Plant Pathology Division, Ministry of Agriculture,
Abu-Ghraib, Baghdad, Iraq.

(Received 23 July 1973)

SUMMARY

Temperature study on *Sclerotium bataticola* Taub, showed that vegetative growth occurred at 10-40°C, but sclerotia formed only at 20-35°C. However, the optimum level for vegetative growth and sclerotium production ranged from 25-35°C.

The effect of different fungicides on this fungus indicated that Granesan was much more effective on mycelial growth and sclerotium production than other fungicides tested. Growth and sclerotium production were affected by the lowest tested concentration (5 ppm.).

S. bataticola growth was inhibited by the addition of NaCl to PDA medium. The degree of inhibition increased with the salt concentration. At lower concentration (10 g/L) mycelial growth and sclerotium production were only slightly affected but were strongly inhibited when the concentration was raised above 30 g/L. At 50 g/L, sclerotium production was completely prevented.

Greenhouse test showed that all twenty-two sesame varieties tested were susceptible to this organism; the degree of susceptibility depended on the variety and time of planting. 'American 48', 'American 71' and 'Giza 24' however, exhibited relatively high tolerance when inoculated

(1) College of Agriculture, University of Baghdad, Abu-Ghraib.

in May but exhibited little tolerance when inoculated in June. 'Local 8'; 'Local Tikreate' and 'Indian 39' showed moderate tolerance whereas 'American 72', 'American 70' and 'Mosul 28' were very susceptible.

INTRODUCTION

Although the need for oil crops in Iraq has increased rapidly during recent years, the area devoted to sesame (*Sesamum indicum* L.) is still limited. The reason for this could be attributed, in part, to the susceptibility of sesame to some diseases, namely charcoal rot caused by *Sclerotium bataticola* Taub. In addition to sesame, the fungus was found to attack many plants of economic importance in various countries (Cook, 1953; and Thirumalachar, 1953). Charcoal rot has been observed in Iraq by several workers (Adhami, 1953, Allison, 1953; Mustafa, 1965 and Mathur, 1968). Al-Ani *et al.* (1970) studied the pathogenicity of this fungus on 22 sesame varieties and found that the organism was very pathogenic attacking all stages of plant growth. They also found that no degree of resistance, among the twenty-two varieties.

This study was conducted in an attempt to screen available sesame varieties for resistance of *S. bataticola* and to learn more about the ecology of this fungus.

MATERIALS AND METHODS

Laboratory tests:

The fungus used in this investigation was originally isolated from diseased sesame plants from a field at Abu-Ghraib Experiment Station. The stock cultures were grown on PDA in 9 cm petri dishes at 25°C and maintained by transfer every ten days.

To study the effect of temperature on mycelial growth and sclerotium production, the fungus was grown on PDA, corn meal agar, oak wilt agar, and nutrient agar. Three dishes containing about 25 ml of each medium were inoculated by placing in the center a 5 mm disk of mycelium and agar and incubated at different temperatures. Because of the rapid growth of this fungus the mycelial development was recorded after three days as diameter of the colony.

Sclerotium production was determined after 7 days by counting all sclerotia in each of three low power (100 X) microscope fields per dish. Counts were taken 3 cm apart from the inoculation points. In this procedure the bottom of the petri dish was first brought into focus and as the plane of observation was changed, all sclerotia were counted.

The effect of some fungicides listed in Table 2 on growth and sclerotium production of *S. bataticola* was tested. Various concentrations of each fungicide were prepared and added to autoclaved PDA. The medium was mixed thoroughly, poured into petri dishes (25 ml per dish) and then inoculated with mycelium — agar disks.

Field observations have shown that this organism can attack sesame planted in soil containing considerable amount of NaCl. Therefore, the effect of various concentrations of this salt upon the growth and sclerotium production was also tested following the same procedure described above.

Greenhouse test:

Tests on the resistance of different sesame varieties, against charcoal rot disease were conducted in 1969 and 1970. Twenty-two sesame varieties obtained from different sources were sown each in three 9-inch pots containing sterilized sandy loam at two different times. About 100 seeds were plated in each pot after which the soil was inoculated with one-week old plate culture of *S. bataticola* ground in 500 ml of sterile water.

The pots were kept in greenhouse at temperature range of about 25-40°C and irrigated daily. Seedlings were reduced to approximately 50 seedlings per pot when they were in the four-leaf stage. The percentage of infected plants was recorded one and two months after inoculation.

RESULTS AND DISCUSSION

The first symptom of infcetion was observed 20 days after inoculation. The above-ground symptoms were characterized by sudden wilting of the plants after which the stem at or above the ground level drying

up and becoming discolored (Fig. 1). The discoloration usually started from the maip roots and extended upward as far as the primary raceme (iFg. 2). Examination of the roots or stems of infected plants showed abundant tiny black sclerotia beneath the epidermis.

S. bataticola was found to grow and form sclerotia over a wide range of temperature (Table 1). Vegetative growth occurred at 10-40°C, whereas sclerotia formed at 20-35°C. At 15 and 40°C very slight growth was observed, but no sclerotia were formed. At 20°C growth was still poor on putrient agar and corn meal agar media, but it was rather abundant on PDA and oak wilt agar. The optimum development for hyphal occurred at the temperature range of 25°C on all media used.

Maximum sclerotium production occurred at 25-35°C on PDA and oak wilt agar, but at 25-30°C on nutrient agar and corn meal agar media. In general sclerotium production on PDA and oak wilt agar was higher than that on nutrient agar or corn meal agar at all temperatures.

The effect of different fungicides on *S. bataticola* is recorded in Table 2. The results show that Granosan had a much more toxic effect on mycelial growth and sclerotium production than the other fungicides. Growth and sclerotium production were affected by the lowest tested concentration (5 ppm).

Tuzet and Dithane M-45 inhibited growth and considerably decreased sclerotiem production at the concentration of 50 ppm. At lowest concentration toxic effect was still detectable on both growth and sclerotium production.

Antracol ranked forth in order of effectiveness. It affected the fungus only slightly at concentration of 50 ppm, but completely inhibited the growth at concentration of 500 ppm.

Lonacol and Zineb had no effect on the fungus when the concentration was less than 100 ppm. At concentration of 500 ppm both mycelial growth and sclerotium production were slightly affected by Zineb, but strongly inhibited by Lonacol.

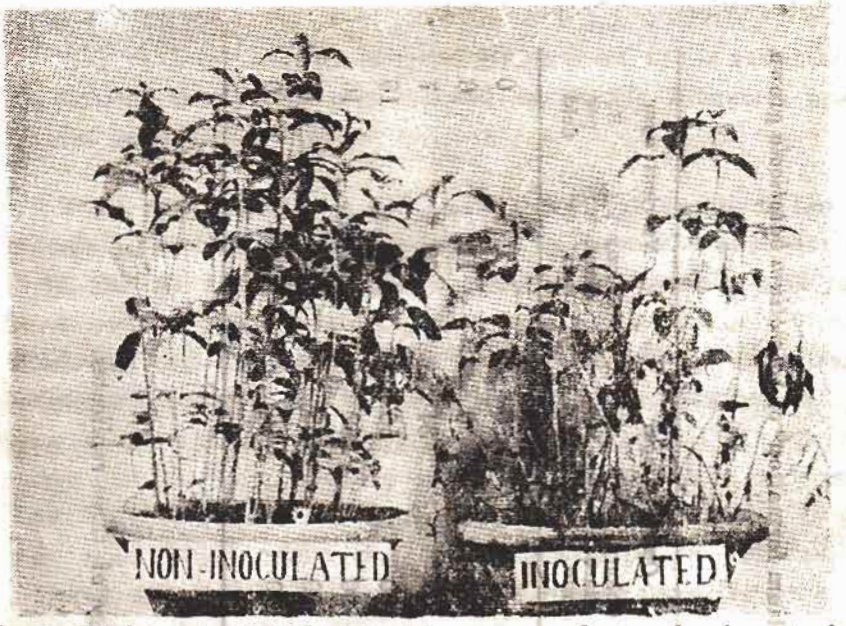

Fig. 1. Right: Artificially-infected sesame plants showing typical sudden wilting of charcoal rot disease, left: Healthy plants.

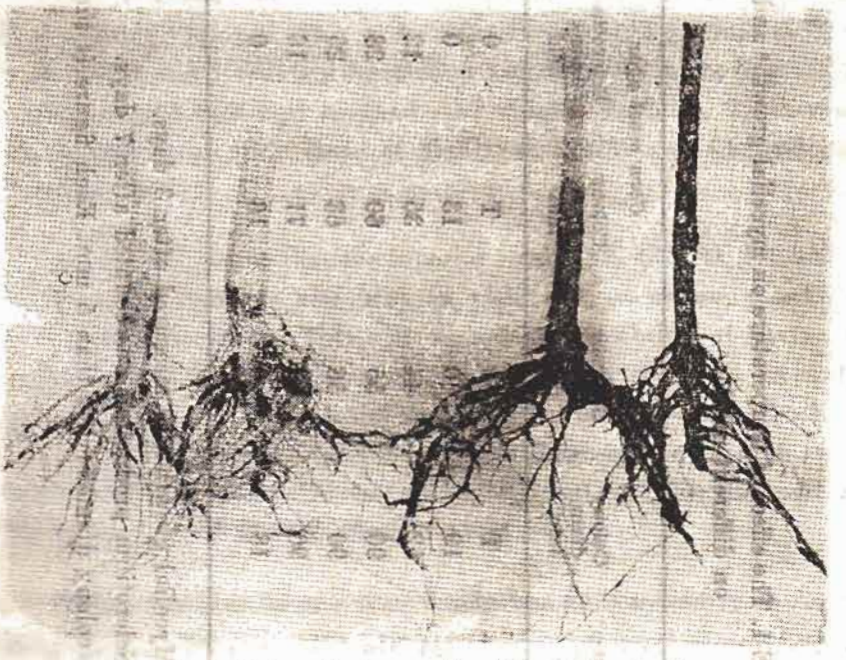

Fig. 2. Right: Typical stem lesion producel in the bark of young sesame plants by inoculation with *S. bataticola*, Left: Healthy stems of young sesame plants.

TABLE 1. The effect of temperature on mycelial growth[a] and Sclerotium formation[b] of *Sclerotium bataticola* grown on different media.

Temperature C	*PDA*		*Corn meal agar*		*Oak wilt agar*		*Nutrient agar*	
	Colony diam. mm	Sclerotia per field	Colony diam. mm	Sclerotia per field	Colony diam. mm	S. per field	Colony diam. mm	S. per field
10	T	0	T	0	T	0	T	0
15	19	0	13	0	15	0	11	0
20	52	44	35	12	37	34	20	7
25	90	55	60	28	90	56	52	16
30	90	56	63	25	90	52	55	16
35	90	58	71	16	90	55	64	14
40	18	0	16	0	0	16	16	0

[a] Mycelial growth was measured after 3 days.

[b] Sclerotium production was counted after 7 days.

T = colony diameter less than 5 mm. Each figure is the average of three replicates.

TABLE 2. The effect of different fungicides on mycelial growth[a] and Sclerotium formation[b] of *S. bataticola* incubated at 35°C.

Fungicide	Concentration ppm	Colony diameter mm	Number of Sclerotia per field
Control	0	90	55
Tuzet	5	64	40
(Zn dimethyl dithiocarbamate + Methyl arsinebis-dimethyl dithiocarbamate)	10	60	28
	50	30	20
	100	0	0
Dithane M-45	10	80	45
(Manganese ethylene bis-thiocarbamate)	50	14	15
	100	0	0
Granosan	5	53	50
(Ethyl Mercury p-Toluene sulfonanilide)	10	14	3
	50	0	0
Lonacol	50	90	58
(Zn ethylene bis-dithiocarbamate)	100	12	52
	500	*T*	39
Antracol	10	90	56
(Zn-N, N-propylene-1, 2 bis-dithiocarbamate)	30	68	43
	100	13	32
	500	0	0
Zinbe Z-78	50	90	54
(Zn ethylene bis-dithiocarbamate)	100	81	50
	500	53	40

[a] Mycelial growth measured after 3 days.

[b] Sclerotium prodection counted after 7 days.

T = colony diameter less than 5 mm.

TABLE 3. The effect of NaCl concentration upon mycelial growth[a] and Sclerotium formation[b] of *S. bataticola* incubated at 35°C.

NaCl concentration gram/litre	Colony diameter mm	Sclerotia per field
0	90	35
10	88	45
20	86	35
30	72	22
40	62	9
50	30	0
60	17	0
70	16	0
80	12	0
90	7	0
100	5	0

[a] Mycelial growth measured after 3 days.

[b] Scleratia production after 7 days.

TABLE 4. Percentage of infected plants of different sesame varieties grown at two different times[a] in pots inoculated with *Sclerotium bataticola*.

Sesame	Percent of infected plants inoculated in May		Percent of infected plants inoculated in June	
	1 month after inoculation	2 months after inoculation	1 month after inoculation	2 months after inoculation
'American 76'	11	80	30	58
'American 56'	31	84	29	89
'American 70'	12	91	22	84
'American 50'	14	60	31	75
'American 47'	13	48	26	67
'American 69'	16	70	31	55
'American 72'	20	87	19	83
'American 44'	14	48	34	78
'American 48'	3	22	24	53
'American 71'	10	25	27	58
'American 73'	7	56	20	82
'American 54'	10	85	31	86
'Russian 37'	24	60	35	92
'Russian 29'	23	66	27	57
'Giza white 10'	13	82	21	46
'Giza white 92'	12	83	20	57
'Giza 24'	14	30	16	63
'Giza 23'	8	68	16	67
'Local Tikreate'	5	44	25	37
'Local 7'	20	56	28	51
'Mosul 28'	32	87	25	89
'Indian 39'	15	66	19	42

[a] Planted in May and June respectively.

Each figure is the average of three replicates.

Table 3 shows the effect of the addition of NaCl to PDA medium on the growth of mycelia and sclerotium formation. At lower concentration (10 g/l) mycelial growth and sclerotium production were slightly affected but were strongly inhibited when the concentration was raised above 30 g/l. At higher level of NaCl concentration (above 50 g/l), mycelial growth was greatly depressed, but was not completely inhibited at any concentration used. On the other hand, sclerotium production considerably decreased at concentration of 30 g/l and was entirely prevented at concentration of 50 g/l.

Experiment on the resistance of sesame varieties to *S. bataticola* indicated that all varieties tested were susceptible to this fungus. The degree of susceptibility apparently depended on the varieties and time of planting. 'American 48', 'American 71', and 'Giza 24' showed relatively high tolerance when planted and inoculated in May, but little tolerance when planted and inoculated in June. 'Local 8', 'Local Tikreate' and 'Indian 39' exhibited moderate tolerance to this organism when planted and inoculated in either May or June. 'American 70', 'American 79' and 'Mosul 28 were very susceptible. In general, percentages of infection were higher in plants inoculated in May compared with those inoculated in June. This may be due to the effect of temperature upon the fungus during the period of growth. Greenhouse temperature was about 35°C in June whereas it was about 40°C during August.

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PERFORMANCE OF TWELVE COTTON STRAINS AT ABU-GHRAIB

MAJID MUHSEN AL-ANSARY

College of Agriculture, University of Baghdad,
Abu-Ghraib, Iraq

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SUMMARY

Twelve strains of cotton selected in the previous two years from Coker 100 wilt were compared with Coker 100 wilt in replicated experiments for two years (1964-1965). The yield of cotton and lint percentage were studied and analyzed.

There was a significant increase in lint percentage for five strains over Coker 100 wilt.

Although no significant increase in yield of seed cotton was found over the check, few strains were apparently higher in yield than Coker 100 wilt.

The strains which were high in lint percentage compared to Coker 100 wilt were also high in yield of seed cotton which suggest the possibility of selecting useful strains.

To confirm these findings, it is recommended to grow the superior strains Nos. 12, 139, 89, 142 and 150 for two more years in different localities and on large scales.

الخلاصـــة

قورنت اثنتا عشرة سلاله منتخبة في السنتين السابقتين من الصنف « كوكر ١٠٠ ولت » في تجربة ذات ثلاثة مكررات للسنتين ١٩٦٤-١٩٦٥ . درس في هذه التجربة حاصل القطن الزهر ونسبة صافي الحليج المئوي وحللت النتائج احصائيا بطريقة تحليل التغاير وتم الحصول على النتائج التالية :-

تم التوصل الى ايجاد زيادة احصائية محسوسة في نسبة صافي الحليج المئوي لبعض السلالات كانت هناك زيادة لخمس سلالات في حاصل القطن الزهر ولكن لم تكن هذه الزيادة احصائية .

يلاحظ ان السلالات المتفوقة في نسبة صافي الحلج المئوي كانت ايضا ذات انتاج عال ٠

ولغرض التأكد من هذه النتائج يقترح زراعة السلالات ذات نسبة صافي الحلج المئوي والانتاج العاليين وهي السلالات المرقمة ١٢ ، ١٣٩ ، ٨٩ ، ١٤٢ ، ١٥٠ بالمقارنة مع الصنف كوكر ١٠٠ ولمدة لسنتين اخريين في مساحات واسعة وفي مناطق مختلفة ٠

INTRODUCTION

Two varieties of upland cotton, Acala Rogers and Old Acala, were grown in Iraq up to the year 1948. In 1949 Old Acala production was prohibited in order to prevent mixture with Acala Rogers. In the meantime experiments on another variety of American upland cotton called Coker 100 wilt, was going on. According to Brown and Ware (1958) this variety was released for production in 1942. It has large bolls, staple length of 26 to 28 mm, and lint percentage 36 to 38. It combines fusarium wilt resistance with high yield and improved fiber quality.

In 1951, large areas in the northern Muhaffadhat plus some in the Governmental Farms were planted with seed from this variety. Six years later, all cotton areas (amounted to 259678 donums) were planted in Iraq with this variety (Agric. Statis. of Iraq, 1957).

In proper breeding work, the introduction of new types is always followed by selection and in this way the best results may be obtained, although even without selection improved varieties may prove profitable (Christidis and Harrison, 1955). There are many examples of acclimatization work with cotton which have been a success. Most striking is the example of the introduction of Egyptian varieties into irrigated valleys of southern Arizona in 1902. Few years aftes Afifi was introduced a new outstanding strain was obtained from it, designated as Yuma. This was followed by Pima, a very good variety grown in Arizona and California. From Pima which reintroduced to Egypt, a new variety was produced under the name of Maarad (Christidis and Harrison, 1955). On the other hand, many upland varieties have been tried in Greece since 1932, but without much success (Christidis, 1938 and 1949).

The objective of this study was to compare the yield of seed cotton and lint percentage of 12 strains previously selected by the author from different fields planted with Coker 100 wilt and to find out whether or not a new strain(s) superior to Coker 100 wilt could be obtained.

MATERIALS AND METHODS

Two hundred and sixty six plants were selected from the government farms of Souairah and Abu-Ghraib. Selection was based on number of bolls per plant, size of boll, the ratio of vegetative growth to the fruiting growth and the general condition of the plant. The yield of seed cotton of each plant was ginned separately and the seeds were saved for the next growing season.

Seeds of each plant were planted in 1962 in single furrow 10 m long and individual plants were arranged in such a way that Coker 100 wilt came once every two furrows for comparison. At the end of the season, 55 rows were selected of which 47 plants were selected on basis of good yield and on high ginning out-turn and 7 were selected for special purposes.

The seeds of the progenies of the selected 55 plants were replanted in season 1963 in the same manner and at the end of the season only the top 12 strains were selected for further studies. These strains were numbered: 1, 12, 73, 80, 89, 120, 122, 139, 142, 150, 207 and 233.

In this study these strains were compared with Coker 100 wilt in regard to yield of seed cotton and lint percentage in a randomized complete block design replicated three times. This experiment was repeated for two years (1964-1965) in a clay loam soil at the Abu-Ghraib Experimental Station, Ministry of Agriculture. Each cotton variety was seeded in a plot of five furrows, 10 m long, and 83 cm wide. Five seeds were placed in each hill. The distance between adjacent hills was 20 cm. Each experimental unit was isolated from each other by a distance of one meter from each side, while replicates were isolated by two meters

from each side. The direction of furrows was from east to west and planting was made on the southern side, 5 cm below the upper third of the furrow (water line). The dates of planting for two years, 1964 and 1965, were April 2, and March 28 respectively. Coker 100 wilt was used as check in both seasons. Thinning to two plants per hill was made on time and cotton plants were sprayed with Andrine and Metasystox to control spinny boll worm and red spider.

Percentage of germination, dates of first flowering and boll opening were recorded. Twenty five bolls were picked randomly from each plot to study boll size, 100 seed weights, and lint percentage. Due to technical difficulties fiber property tests were not carried out.

For estimation of yield, two pickings were taken from the three central furrows, after omitting the plants of two hills from each end of each furrow (border effect). The collected data were analyzed statistically.

RESULTS

The percentages of emergence for all strains were above 75 except for strains 80, 120, 233 and Coker 100 wilt which were below that level. The dates of first flowering and boll opening show also very little variation among strains in both seasons. The four days difference in first flower opening between the averages of the two years was due to late planting of 1964 trial. These data are presented in Table 1. There was no significant difference in these trials and therefore all strains are more or less the same from the stand-point of earliness.

Data presented in Table 2, show in grams the weights of 25 bolls and 100 seeds lots taken at random, for all the strains tested in 1964.

The yield of seed cotton, lint percentage and average for each strain for both years are listed in Table 3. Differences in yield were not significant. On the other hand, when analysis of variance was carried out for data of lint percentages, significant differences were found for six strains and only significant for one more strain in 1964 trial. These strains were all superior to the check. As for trial of 1965 there was

only one strain which was highly significant and two were significant at the 5% probability level. When analysis was run for the combined data of the two years, one strain showed highly significant difference over Coker 100 wilt and it was strain No. 12. This strain with average lint percentage of 40.8 was the best. Other strains numbered 139, 89, 142 and 150 were also higher in lint percentage than the check.

DISCUSSION AND CONCLUSION

It is more likely that significance in yield of seed cotton could not be detected, though apparent superiority of some strains to Coker 100 wilt was found, because of the fact that yield, as well as other complex characters are greatly affected by the environment.

TABLE 1. Germination percentages and dates of first flowering and boll opening for 12 strains and one variety of cotton tested during (1964-1965) years.

Strains	% Germination 1964-1965	Dates of first flowering 1964	Dates of first flowering 1965	Dates of boll opening 1964	Dates of boll opening 1965
1	80	10/6	7/6	28/7	26/7
12	81	10/6	7/6	25/7	25/7
73	87	10/6	7/6	29/7	24/7
80	71	9/6	7/6	24/7	25/7
89	86	10/6	7/6	27/7	25/7
120	72	10/6	7/6	24/7	27/7
122	91	11/6	7/6	27/7	27/7
139	82	10/6	6/6	26/7	26/7
142	88	10/6	8/6	27/7	24/7
150	78	9/6	8/6	24/7	27/7
207	82	9/6	7/6	25/7	27/7
233	71	10/6	7/6	23/7	24/7
Coker 100 wilt	74	10/6	5/6	25/7	25/7
Average	80	10/6	7/6	25-26/7	25-26/7

TABLE 2. Weight in grams for 55 bolls and 100 seeds taken at random for all the strains tested in 1964.

Strain No.	1	12	73	80	89	120	122	139	142	150	207	233	Coker 100 wilt
Weight of 25 bolls in grams	122	110	109	110	122	120	126	107	115	110	113	110	115
Weight of 100 seeds in grams	10.4	9.0	9.0	9.7	10.5	9.9	10.8	9.7	10.0	10.1	10.5	10.2	10.0

TABLE 3. Yield of seed cotton and lint percentage for 12 strains of cotton selected from Coker 100 wilt.

Strains	Yield in kilogram per donum			Ginning percentages		
	1964	1965	Average	1964	1965	Average
1	599	514	557	38.6**	35.3	36.8
12	652	638	645	42.3**	39.3**	40.8**
73	618	664	641	38.0	37.3	37.7
80	596	612	604	38.0	35.0	36.5
89	585	697	641	40.0**	38.3*	39.2*
120	555	670	613	39.3**	37.3	38.3
122	601	656	629	38.0	35.3	36.7
139	535	780	658	40.6**	38.0	39.3*
142	522	565	579	40.0**	38.3*	39.2*
150	550	706	628	40.3**	38.0	39.2*
207	586	798	692	36.7	34.0	35.3
233	516	642	579	38.0	35.7	36.8
Coker 100 wilt	486	607	546	36.6	35.7	36.2
Average	575	658	616	39.0	36.7	37.8
L.S.D. 5%	N.S.	N.S.	N.S.	1.63	2.37	2.70
1%				2.21	3.22	3.67
C.V. %	11.66	19		2.49	4.0	

* Significant at the 5% level.

** Significant at the 1% level.

Such environmental effects contribute so much to the variability of the material that a very large part of the genetic differences present remains undetected.

When comparing strain with Coker 100 wilt in regards to lint percentage, significant differences were found and a number of strains such as 12, 139, 89, 142 and 150 were superior to the check in both years. These results could be safely depended upon since it has been found at Mississippi that lint percentage in parents and progeny were strongly correlated (Christidis and Harrison, 1955). Further selection and progeny studies were not necessary according to Mason (1938) who mentioned that the first or primary selection, which should be made in the field, is far more important than a secondary selection within the progeny rows. Mason added that little improvement in yield may be expected, although the lint characters and ginning percentages are often appreciably advanced in this way.

Positive correlation could be found between lint percentage and yield of seed cotton (Table 3). This is in agreement with the findings of Griffee *et al.* (1929) and a negative correlation could also be found between lint percentage and both boll size and seed weight (Table 2). These results are in agreement with those of Dunlavey (1923) and Christidis and Harrison (1955).

As one may notice that the superior strains 12, 139, 89, 142 and 150 in line prrcentage are also high in yield of seed cotton, though not statistically significant. This will suggest the possibility of having new varieties high in lint percentage and in lint yield. The amount of increase in line for these strains in decreasing order over the check were 4.6, 3.1, 3.0 and 3.0% respectively. These increases are all high enough to place these strains in higher order than that of Coker 100 wilt with lint percentage of 36-38% (Brown, 1958).

Before reaching to any final conclusion, it it necessary to compare these strains with Coker 100 wilt further for two more years in different localities and on a large scale production.

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Short communication

CAGE LAYER FATIGUE (OSTEOPOROSIS)

A.K. AL-KHAZRAJI

Department of Physiology, College of Veterinary Medicine, Baghdad, Iraq.

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Osteoporosis is defined as an abnormal condition of the skeleton characterized by a decrease in the amount of the hard tissue without any change in volume or external configuration of the bone (Urist, 1960). It is now recognized as a hetrogenous group of disorders that may develop at any rate of bone resorption from high to low in animals as well as in man.

Osteoporosis is a significant problem of laying hens maintained in cages. Laying hens bred for heavy egg production and kept in cages may develop either a severe form of osteoporosis commonly referred to as cage layer fatigue, or a lesser form of the disorder known as avian osteoporosis.

Birds with cage layer fatigue generally show leg weakness and are unable to reach their feed and water. Sometimes, they fall on their side and are unable to regain their posture, if left in cages, the severely affected birds die. Hens with cage layer fatigue are characterized by brittle bones. The femurs show thin cortices and enlarged Haversian canals, however, the serum calcium, phosphorus, magnesium and alkaline phosphate are within normal limits (Urist, 1960; and Bell and Siller, 1962).

Cage layer fatigue has been attributed to many causes among which are disuse, confinement and nutritional deficiencies. The metabolic factors responsible for this disorder are obscure. Cage layer fatigue has been produced experimentally by confining laying hens to 6 × 10 or 6 × 8 inch cages (King, 1965 and Al-Khazraji, 1971), by feeding hens a diet low in calicum (Urist, 1959) and phosphorus (Simpson *et al.*, 1963).

Recently there is evidence suggesting the involvement of thyrocalcitonin (Calcitonin) in osteoporosis of mammals and birds. Foster *et al.* (1968) found that porcine thyrocalcitonin prevented osteoporosis from developing in rats receiving a toxic dose of vitamin A. Baud *et al.* (1969) reported that 160 MRC units daily of porcine thyrocalcitonin for one month resulted in increased bone mineralization in osteoporotic patients. Al-Khazraji (1971) found that removal of ultimobranchial glands resulted in a reduction in the efficiency of calcium utilization of laying pullets.

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