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Iraqi J. agric. Sci., Vol.XV December 1980

HERITABILITY ESTIMATE OF BIRTH WEIGHT IN DAIRY CATTLE

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Received 20 November 1979)

SUMMARY

Records from 768 calves sired by 15 bulls were used to estimate the heritability of birth weight. Data was analyzed by the least – squares technique. Sire, breeding groups, sex, parity, Year and season of calving were included in the analysis as cross classified, while gestation period (independent continuous variable) was included as a covariate. Male calves were heavier at birth than female calves.

Purebred Friesian calves exceeded both crossbred and indigenous calf's birth weights. Birth weight of sire progeny groups were significantly different, which explain the importance of sire effect on this trait. The heritability estimate of birth weight was 0.288 ± 0.12.

الخلاصة

تمت دراسة ٧٦٨ عجل مولودة من ١٥ ثور لتقدير المكافيء الوراثي لصفة الوزن عند الميلاد . اجرى تحليل المربعات الصغرى بسبب وجود اعداد مختلفة من الملاحظات للمتغايرات المستقلة . اعتبرت الثيران ، المجموعة الوراثية ، الجنس ، تسلسل الولادة ، السنة وموسم الولادة متغايرات مستقلة غير مستمرة في النموذج الاحصائي المستعمل بينما اعتبر طول فترة الحمل كمتغير مستقل مستمر . وجد من هذه الدراسة بان الذكور اكثر وزناً من الاناث عند ولادتها . كما كانت اوزان عجول الفريزيان النقية عند ولادتها اكثر من اوزان العجول المضربة والمحلية . كما وجد من هذه الدراسة تأثير معنوي للثيران على اوزان الابناء عند الولادة . قدر المكافيء الوراثي لصفة الوزن عند الميلاد بمقدار ٠,٢٨٨ ± ٠,١٢ .

INTRODUCTION

The influence of sires on birth weight of the calves were investigated by many workers (Everrett and Magee, 1965; Fisher and Williams, 1978; and Singh *et al.* 1978). No report is available on the estimate of the heritability, nor on the effect of sires on birth weight of dairy cattle in Iraq. Evaluation of sires effect on calf's birth weight has a vital and economical importance. Metwally *et al.* (1979) accounted 24.69 % of total deaths in calves born in northern Iraq. The authors explained the high mortality rate was due to the low birth weight. Ahmed and El – Barbary (1977) noticed that dead calves were in general of low birth weight and growth rate than the survived ones.

The estimated heritabilities of birth weight were 0.05 – 0.23 in Zabk (Batra and Desai 1962), 0.51 in Holstein (Fisher and Williams 1978), 0.18 in Africander (Heyns 1978) and in crosses of Hariana with Holstein – Friesian, Brown Swiss and Jersey were 0.06 ± 0.14, 0.19 ± 0.21, and -0.01 ± 0.15 respectively (Singh *et al* 1978).

This study was carried out to investigate the genetic variance associated with birth weight and to estimate the heritability of this trait. The data were also were used to assess the affect of various non – genetic factors on birth weight.

MATERIALS AND METHODS

Data used in this study were field records supplied by Musaiyib Agricultural Project. Records from 768 calves sired by 15 bulls were utilized to estimate sire variance component for birth weight. Sires had to have at least 3 progenies to be included in this analysis. Data were analyzed using a least–squares procedure (Harvey, 1960). The following statistical model was used to describe the birth weight:

$Y_{ijklmno} = \mu + B_i + S_j + P_k + G_l + C_m + E_n + bT_{ijklmno} + e_{ijklmno}$. Where $Y_{ijklmno}$ = individual observation of the dependent variable (birth weight), μ = overall mean, B_i = Effect of ith sire, S_j = effect of jth sex, P_k = effect of kth parity, G_l = effect of lth breeding group, C_m = effect of mth year of calving, E_n = effect of nth season of calving, b = a partial regression of Y on T, $T_{ijklmno}$ = independent covariate (gestation lenght), and $e_{ijklmno}$ = random error assumed to be NID (0, σ^2 e), All interactions assumed to be Zero for computational difficulties.

Heritability estimate (h^2) was calculated from the paternal half–sib intraclass correlation by use of variance components as follows:

$$h^2 = \frac{4\sigma^2 s}{\sigma^2 s + \sigma^2 e}$$

Where $\sigma^2 s$ is the sire variance component and the $\sigma^2 e$ is error variance. The estimate of sire variance component resulting from this analysis were identical with those of Henderson's (1953) and Harvey (1968).

The standard error of the heritabilities was four times the variance of the intraclass correlation (Swiger *et al.* 1964).

RESULTS AND DISCUSSION

Sex, breeding group, year of calving and gestation length were significant sources of variation for brith weight (Table 1). The least–squares constant estimates for the independent variables are presented in Table 2. Birth weights of male calves were above the least–squares mean (29.06 kg) by 0.32 kg, while female calves were below the least–squares mean by 0.32 kg. These results are also supported by those of Eliya and Christensen (1976); Fisher and Williams (1978).

Purebred Friesian exceeded significantly both crossbred and indigenous calf's birth weight. The least–squares constant estimates of birth weight expressed as deviation from least squares mean were 1.24,–0.25,–0.99 kg for purebred and crossbred Friesian and indigenous calves respectively. The difference in birth weight and the irregular pattern of the least–squares constant estimates across different years of calving indicate the variability in feeding, managing, as well as other environmental factors through out the period of this study, on the other hand, parity and season of calving showed no effect on the birth weight.

The F–value for the effect of sires on birth weight indicates that the differences among sire progeny groups were significant. This suggests an important sire influence on weight of calves at birth. The least–squares constant estimates of the different sires ranged from a low of –2.7 kg for calves sired by sire number 14 to a high of + 3.55 kg for calves sired by sire number 3. Differences among progeny groups of different sires for birth weight reported earlier by Fisher and Williams (1978.)

TABLE 1. Least–squares analysis of variance

Source of variation	d.f.	Mean squares
Sire	14	31.19**
Sex	1	72.76**
Parity	4	13.41
Breeding groups	2	151.15**
Year of calving	4	60.23**
Season of calving	3	19.04
Gestation. (linear)	1	705.53**
Remainder	738	7.36

*P<0.05, ** P<0.01

TABLE 2. Least squares constant estimates for the main effects of birth weight.

Main effect	No.	Constant estimates
Overall mean	768	29.06 – 0.32
Sire No.		
1	246	+0.39
2	159	– 0.09
3	21	+3.55
4	13	+0.11
5	103	–0.30
6	15	– 1.50
7	133	– 0.53
8	15	– 0.93
9	5	– 0.47
10	14	– 0.41
11	3	+1.53
12	3	+0.15
13	5	+2.06
14	6	– 2.70
15	27	– 0.83
Sex		
Male	389	+0.32
Female	379	– 0.32
Parity		
1	290	– 0.45
2	242	– 0.27
3	146	+0.27
4	70	+0.05
5 or later	20	+0.50
Breeding groups		
Friesian	627	+1.24
Crossbred Friesian	104	– 0.25
Indigenous	37	– 0.99
Year of calving		
1975	25	–2.54
1976	119	+0.80
1977	169	+0.52
1978	257	+0.67
1979	198	+0.55
Season		
Spring (March–May)	215	–0.26
Summer (June–Aug.)	151	+0.43
Fall (Sept.–Nov.)	131	+0.04
Winter (Dec.–Feb.)	271	–0.21

The estimate of heritability based on a paternal half sib analysis is $0.288 \pm .12$. This estimate suggest an important imfluence of additional genetic variance on birth weight and consequently a genetic change through selection is possible. A genetic change in birth weight in such a way to decrease calf loss, through subsequent performance (through selection for high birth weight) without causing dystocia is important. The estimate of heritability found in this study was higher than that reported by Singh *et al* (1978) and lower than that reported by Fisher and Williams (1978).

Grateful appreciation is extended to Directorate of Musaiyib Agricultural project for making their data available for this study. Data processing by A.A. Ahmed, J.V. Elia, and M.A. Hedar is gratefully acknowledged.

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STUDIES ON THE SHAPE OF THE LACTATION CURVE WITH SPECIAL REFERENCE TO THE REPEATABILITY ESTIMATES

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(Revised MS received 16 January 1980)

SUMMARY

The characteristics of the lactation curve was investigated on 67 cows. Time to peak influenced the shape of lactation curve but did not affect the area under this curve (Total milk yield). Total milk yield was highly correlated with the milk up to peak, milk after peak, milk at peak, lactation period, and average daily milk yield. The result of this study indicated that persistent cows had longer lactation period. Persistency was negatively related with the milk at peak. The repeatability estimates of the milk yield components were low, suggesting the importance of the non–genetic factors on the shape of lactation curve.

الخلاصة

استخدمت بيانات ٦٧ بقرة للتحري عن مواصفات شكل منحنى دورة الحليب . اتضح ان الوقت اللازم للوصول الى قمة الانتاج يلعب دور رئيسي لتحديد شكل منحنى دورة الحليب بدون ان يؤثر على المساحة الكلية تحت الخط البياني لدورة الحليب (الانتاج الكلي من الحليب) .

ان انتاج الحليب الكلي خلال دورة الحليب يعتمد على كل من كمية الحليب لحد قمة الانتاج وكمية الحليب المنتجة بعد الوصول الى قمة الانتاج وكذلك قمة الانتاج وموسم الحليب ومعدل الانتاج اليومي . ان النتائج التي حصل عليها تشير

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على ان الابقار المثابرة على انتاج الحليب بدرجة عالية تمتاز بطول موسم الحليب . كما ان المثابرة مرتبطة سلبياً مع ارتفاع قمة الانتاج .

ان المعامل التكراري للصفات المحددة لشكل منحنى دورة الحليب كانت منخفضة مما يشير الى اهمية العوامل الغير وراثية لتحديد شكل منحنى الحليب .

INTRODUCTION

Milk production generally increases for about three to six weeks of lactation, and declines slowly. Higher–producing cows usually take inoger than low–producing cows to achieve peak production (Foley et al., 1972), Maintenance of peak milk production should be every dairyman's goal, but this has never been achieved. In fact, there is a strong tendency for cows which achieve a high initial yield to be less persistent.

Persistency: Refers to the degree at which the rate of milk secretion is maintained as lactation period progresses. It is an inherited characteristic that can be strongly affected by high yield at the beginning of lactation puts a high physiological stress on the cow, often leading to reproductive disorder or metabolic disease. Al–rawi *at al.* (1979) a negative genetic correlations between both level of peak production and persistency. Wiggans and Van Vleck (1978), mentioned that the shape of the lactation curve is of interest since the projection of incomplete records depends on how milk production is distributed over the lactation A moderate initial yield combined with high persistency of lactation is preferable to high initial yield combined with rapid decrease of yield.

The peak yield of the cow is dependent on her body condition at calving, inherited potential, freedom from metabolic and infectious diseases, and the feeding regime after calving. Hamilton and Hilers (1973), and Alrawi (1979) found the heritability estimate of persistency to be .21–04, and .14–.03 respectively. Thus genetic improvement can be made for persistency by selection. It would give the producer a more even flow of milk, and the more persistent cow would be less likely to terminate her lactation early due to low production. Madsen (1975) found that the phenotypic correlation between persistency and maximum daily yield is negative (– .46 to –.52). This correlation show that a cow which has a high maximum daily yield will have a rapid decline of yield. Appleman *et al.* (1969) indicated that cow's peak milk level contribute materialy to differences in persistency. Madsen (1975) found no correlation between persistency and 305–day yield.

While Hamilton and Hillers (1973) found a negative correlation (–.11) of persistency with total 305–day yield.

The aim of the present study is to investigate the characteristics of lactation curve in Friesian cattle in central Iraq.

MATERIALS AND METHODS

Data of weekly milk yield and 119 lactation records of Friesian cattles of different grades were used in this study. Feeding and management practices at the two herds where the data were collected, and the method of securing the data were described in detail by Al-rawi *et al.* (1980).

A least–squares analysis described by Harvey (1960) was carried out to study the effect of time in weeks, to attain the peak production on the follwoing traits: 1. Persistency, 2. Milk yield up to peak, 3. Milk yield after peak, 4. Total milk yield, 5. Milk yield at peak, 5. Lactation period, 7. Average milk yield.

Each of the above seven traits were analyzed separately by the least–squares technique using the following model:

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where:
Y_{ij} is an observation of one of the seven traits,
u is the population mean,
T_i is the effect of the ith week to attain peak yield,
e_{ij} is a random error assumed to be NID (0, $\sigma^2 e$).

Repeatability estimated by the intraclass correlation for data restricted to cows with at least two records. The statistical model described by Becker (1975) used to represent each of the seven traits studied.

The model is:

$$Y_{ij} = \mu + A_i + e_{ij}$$

Where:
Y_{ij} is an observation of one of the eight traits.
μ is an overal mean
A_i is effect of the ith cow.
e_{ij} is the environmental deviation of the jth measurement within a cow assumed to be NID (0, e).
the between and within cow variance components were utilized to estimate the intraclass correlation (repeatability), as follows:

$$R = \frac{\sigma^2 c}{\sigma^2 c + \sigma^2 e},$$

where $\sigma^2 c$ is the between cow variance component and $\sigma^2 e$ is the error variance within a cow.

RESULTS AND DISCUSSION

Milk yield up to peak influenced significantly by time to attain peak duction as shown in Table 1. Least–squares means for time to peak of k yield up to peak increased as time to reach peak peoduction advanced ble 2). This result indicates the importance of the time to peak affect in ermining the shape of lactation curve. The non–significant effect of time peak on the persistency, milk after peak, total milk yield, milk at peak, ation period and average daily milk yield may suggest that this factor is ittle importance for productivity of milk. The least–squares means of se traits studied are presented in Table 2. There appeared to be no inct trend in these traits with the time to peak.

ble 1. F–Values of the effect of time to peak on the yield components

mponents	F–Values
rsistency	0.64
ilk up tp peak	33.88**
ilk after peak	1.03
tal yield	0.72
ilk at peak	0.86
ctation period	0.61
verage daily ilk yield	0.90

for time to peak 18
for error 100
($P < .01$)

Table 2. Least – squares means and standard error for the effect of time to peak

	Persistency kg / Week	Milk up to peak (kg)	milk after peak (kg)	Total milk yield (kg)	milk at peak (kg)	Lactation period (days)	average milk yield (kg)
Overall mean	–0.88 ± 0.02	578.7 ± 06.9	1478.0 ± 12.7	2057.0 ± 131.8	78.8 ± 3.9	259.5 ± 11.1	7.3 ± 0.3
Time to peak							
1 week	– 0.89 ± 0.07	0.0 ± 70.1	2678.0 ± 503.4	2678.0 ± 545.3	104.0 ± 16.1	305.7 ± 45.8	8.3 ± 1.4
2 week	– 0.84 ± 0.03	55.4 ± 27.9	1810.8 ± 200.0	1867.3 ± 216.7	80.3 ± 6.4	237.4 ± 18.2	6.8 ± 0.5
3 week	– 0.91 ± 0.03	113.3 ± 35.1	1311.1 ± 251.7	1425.5 ± 272.7	73.8 ± 8.0	212.2 ± 22.9	5.7 ± 0.7
4 week	– 0.88 ± 0.03	182.4 ± 28.6	1629.6 ± 205.5	1813.1 ± 222.6	80.6 ± 6.6	240.0 ± 18.7	6.9 ± 0.6
5 week	– 0.90 ± 0.04	306.0 ± 36.6	2045.1 ± 262.9	2324.3 ± 284.8	95.1 ± 8.4	250.4 ± 23.9	8.4 ± 0.7
6 week	– 0.89 ± 0.05	377.8 ± 54.3	2205.2 ± 390.0	2605.0 ± 422..	97.8 ± 12.4	283.2 ± 35.5	8.4 ± 0.0
7 week	– 0.91 ± 0.04	383.0 ± 40.5	1740.8 ± 290.7	2124.2 ± 314.9	68.1 ± 9.3	254.3 ± 26.5	7.8 ± 0.8
8 week	-0.85±0.04	478.1±42.9	1485.9±308.3	1964.5±333.9	88.7±9.8	220.6±28.1	8.0±0.8
9 week	0.81±0.06	475.2±60.7	1745.7±436.0	2221.0±472.3	73.0±13.9	278.5±39.7	7.2±1.2
10 week	-0.92±0.04	666.9±40.5	1685.9±290.7	2353.2±314.9	93.8±9.3	249.8±26.5	8.8±0.8
11 week	-0.87±0.05	621.4±54.3	1263.2±390.0	1885.0±422.4	75.4±12.4	218.8±35.5	7.4±1.1
12 week	-0.79±0.07	608.0±70.1	1332.0±503.4	1940.6±545.3	69.3±16.1	270.7±45.8	6.7±1.4
13 week	-0.85±0.07	630.±70.1	970.7±503.4	1602.3±543.3	61.0±16.1	261.3±45.8	5.7±1.4
14 week	-0.88±0.06	819.7±60.7	1330.5±436.0	2150±472.3	81.5±13.9	294.5±39.7	7.2±1.2
16 week	-0.91±0.08	941.5±85.9	1376.5±616.6	2318.5±667.9	79.0±19.7	308.0±56.1	7.0±1.7
19 week	-0.76±0.12	890.0±121.5	1052.0±872.0	1942.0±944.6	72.0±27.8	261.0±99.4	7.0±2.4
20 week	-0.85±0.12	948.0±12105	924.0±872.0	1873.0±944.6	61.0±27.8	286.0±79.4	6.0±2.4
21 week	-1.05±0.12	1358.0±121.5	677.0±872.0	2036.0±944.6	72.0±27.8	238.0±79.4	8.0±2.4
22 week	-0.86±0.12	2240.0±121.5	818.0±8720	1959.0±944.6	70.0±27.8	259.0±79.4	7.0±2.4

Further investigation on the effect of time to peak on reproductive effciency, and the estimate of genetic parameters of this character may be helpful to improve the reproductive inefficiency especially for high producers, where the time of insemination coincided with the stress of peak production.

Improvement of reproductive efficiency may be made through the delay of occurrence of peak production, permitting excess time for fertile insemination before the animals suffer from the stress of peak production.

Correlation coefficients for the traits studied are presented in Table 3. The correlation coefficients that have absolute values greater than 0.23 can be considered significantly different, as to 1% probability (Snedecor and Cochran, 1967). The persistency was highly correlated to lactation period (0.49), indicating that more persistent cows had longer lactation period.

Persistency was negatively related ($p \leq .05$) with milk at peak. This result is similar to that reported by Madsen (1975). The correlation coefficient between time to peak and milk up to peak was highly significant (0.94), suggesting the longer the time to peak the more milk produced up to peak.

Although, the F–Value of the effect of time to peak on milk after peak was not significant (Table 1). The time to peak was negatively correlated to milk yield after peak (– 0.34). Such conflict in the two analyses may be due to limited data used in this sustudy. The milk after peak showed a high association with total milk yield, milk at peak, lactation period and average daily milk yield. Milk at peak was highly correlated with total milk yield and average daily milk yield and being 0.57 and 0.66 respectively.

Table 3. Correlation coefficients among milk yield components

Traits	Milk up to peak	milk after peak	Total milk yield	Time to peak	milk at peak	lactation period	average daily milk yield
Persistency	–0.09	0.11	0.07	–0.06	–0.17	0.49	–0.31
Milk up to peak		–0.22	0.23	0.94	0.13	0.17	0.22
Milk after peak			0.90	–0.34	0.52	0.65	0.52
Total milk Yield				0.08	0.57	0.72	0.62
Time to peak					-0.07	0.15	0.05
Milk at peak						0.15	0.66
Lactation period							0.05

The repeatability estimates of the milk yield and its components are presented in Table 4. The repeatability estimate of average milk yield was 0.407. This value was the highest among the estimates of other traits. On the other hand, the repeatability estimate of persistency obtained was the least and being 0.153. The low repeatability estimates of the yield components suggest the imbortance of non genetic factors.

Table 4. Repeatability estimates of the milk yield and its components.

Trait	Repeatability estimate
Persistency	0.153
Time to peak	0.159
Milk at peak	0.261
Milk up tp peak	0.208
Milk after peak	0.334
Lactation period	o.184
Average milk yield	0.407
Total milk yield	0.275

* d.f. Between cows was 39
d.f. Wirhin cows was 53

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SOME FACTORS AFFECTING THE SHAPE OF LACTATION CURVE

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SUMMARY

Data on 119 lactation records of purebred and different crossbred friesian cattles were utilized in this work. The effect of herd, year and season of calving, breeding group, and Parity were investigated on components of total milk yield. Animal's genetic make-up influenced maximum on daily milk yield. Herds. year and season of calving as well as parity significatly affect the shape of lactation curve.

Cows freshened during the fall and winter seasons had the most desirable yield characteristics, where the peak production is relaively moderate and milk production is well sustained during the declining phase of the lactation.

الخلاصة

شملت هذه الدراسة على ١١٩ موسم حليب تعود الى ٦٧ بقرة فريزيان نقية ومضربة متواجدة في حقل كلية الزراعة والمعهد الزراعي الفني للفترة ١٩٧٠ الى ١٩٧٨ لغرض دراسة تأثير بعض العوامل الوراثية والبيئية والفسيولوجية على الصفات التي تحدد شكل منحنى دورة الحليب وبعض الصفات المرتبطة به .

ان اهم الصفات التي تحدد شكل منحنى موسم الحليب والتي تكون مسؤولة على الانتاج الكلي هي قمة الانتاج والوقت اللازم للوصول لها والثابرة وطول موسم

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الحليب . تبين من النتائج ان الظروف البيئية والفسيولوجية تلعب دور رئيسي في التغايرات الموجودة للصفات المدروسة . كما ان التركيب الوراثي للحيوان يؤثر على قمة الانتاج بدرجة اكثر من بقية الصفات .

ان الابقار التي تلد في الشتاء تمتاز بمنحنى موسم حليب مرغوب حيث تكون قمة الانتاج معتدلة (لتلافي حدوث الاجهاد الفسيولوجي) والمثابرة جيدة وبطول الوقت اللازم للوصول الى قمة الانتاج كما ان معدل انتاج الحليب اليومي يكون عالي . وتأتي الابقار الوالدة في الخريف في المرتبة الثانية للصفات المرغوبة في تحديد منحنى موسم الحليب . لذلك نوصي بان تكون الولادات في فصل الشتاء . وبالنسبة للقطعان الكبيرة فيفضل ان تحصر الولادات في الخريف والشتاء .

INTRODUCTION

Persistency, peak production, and lactation length are the three major factors determining the shape of the lactation curve, and consequently the total lactation yield (Ludwick and peterson, 1943). The shape of the lactation curve is of interest for many investigators. Al-Rawi (1978) Suggested that the most desirable yield characteristic of high yielding cows is the case where peak production is relatively moderate but, sustained rather than where peak yield is very high but, relatively less well sustained because of reduction of mastitis incidence. Similar suggestion for reduction of reproductive disorder was made by Madsen (1975).

A cow having a flat lactation curve needs less concentrates during the lactation, than a cow with. the same total yield and a steep lactation curve *(Madsen 1975)*. Madsen (1975) found that persistency of first lactation records was higher than later lactation records. Similarly, Wiggans and Van Vleck (1978) reported that daily production of young cows decline less during the lactation than that of older cows.

They also mentioned that older cows produce more during the entire period, and their favourable lactation yield comes largly from early lactation. Gill *et al.* (1970) reported that Hariana cattle reached its maximum peak yield in the third lactation.

Gill *et al.* (1970), reported a significant effect of years of calving on persistency and peak yield. the effect of years of calving is possibly due to changes in climate, feeding, management and genetic constitution of the herd over the years.

Balaine *et al.* (1970). reported a significant seasonal variation in persistency. Gill *et al.* (1970) found that persistency of first lactation was higher for the Hariana cows, calving in December to May, tan for those

calving in June to November. Wiggans and Van Vleck (1978) indicated that lactation curves of cows which freshened in March or April had higher peaks and declined more rapidly than curves of cows in the July–August group. Dutt and Singh (1961) observed on Hariana cattle a significant effect of season of calving on peak production. In eontrast, Gill *et al.* (1970) showed that season of calving had no significant effect on peak yield.

The objective of this study is to analyse and examine the effect of herd, breeding group, parity, year, and season of calving on persistency, peak production; and time to peak, These traits are important to determine the shape of the lactation curve and total milk yield. Knowledge of the major factors affecting these traits will indicate the managemental conditions of the dairy heds, and how to organize the management of dairy farm for maximum production of milk.

As selection for high total yield progresses, attention of components of the yield such as peak production and persistency might permit improved adjustment to meet the physiological stress of high peak yield. A genetic change of the lactation curve shape from high initial yield combined with rapid decrease of yield to moderate intial yield combined with high persistency needs evaluation of the important of different non–genetic factors effecting persistency and the peak yield for obtaining efficient estimates of genetic parameters.

MATERIALS AND METHODS

A total of 119 lactation records of purebred and different grades of crossbred Friesian cattles were obtained from the dairy herds of College of Agriculture (CA) and Technical Institute of Agriculture (TIA) at Abu–Ghraib. The data of weekly milk yield, recorded to the nearest 0. 1kg, was utilized to estimate persistency, peak production (maximum level of weekly milk yield during the lactation periodx time in weeks to attain peak production, milk yield up to peak, and milk yield after peak.

The animals were on irrigated pasture at least four hours every morning, and maintained in a loose corral houseng for the rest of the day. Additional available green alfalfa or barley straw was offered to the animals in the corral. A concentrate mixture of 4 kg was fed two times daily per cow . Milking was dome by milking machine two times daily. The records were classified according to lactation number (parity), year and season of calving, and breeding groups as shown in Table 1. Several methods were suggested to measure the persistency (Madesen, 1975). For this study, persistency was determined by the linear regression of weekly milk production (kg), on week from the peak production to termination of the 44–week or less. The linear regression coefficient gives the average weekly decline in milk production. All cows had to have fresh date and genetic group, to be included in this study.

Due to disproportion subclass numbers, least–squares technique as described by Harvey (1960) was applied. The following statistical model was assumed to describe the traits studied.

$Y_{ijklmn} = \mu + G_i + H_j + Y_k + S_l + P_m + e_{ijklmn}$

Where: Y_{ijklmn} is an observation of one of the seven traits.
μ is the overall mean
G_i is the effect of 1 th breeding group
H_j is the effect of jth herd

Y_k is the effect of Kth year of calving.
S_l is the effect of Ith season of calving.
P_m is the effect of mth parity group, and e_{ijklmn} is the random error, assumed to be NID (0, σ).

All interactions between the main effects were assumed to be zero because of compulional limitation.

RESULTS AND DISCUSSION

The Least–squares means and standard error of the traits studied, are presented in Table 1. Breeding group showed a significant effect on milk at peak as indicated by the F–values in Table 2. The other traits were not influenced by breeing group. Thus, milk level at peak may be influenced by the genetic make–up of the animal more than other components determining the pattern of the lactation shape. The least–squares means of the milk yield at peak were highest for purebred Friesian being 94.5 kg occured between week 6 and 7 after calving. The rate of milk yield reduction in the declining phase of lactation was highest for the pu–ebred Friesian (least peristent) compared to other breeding groups. However, the difference was not significant. Such characteristics revealed that physiological stress of purebred Friesian is greater then crossbreds. This could be explained by either high peak production, and/or environmental stress and/or due to early pregnancy of purebred Friesian. Appleman *et al.* (1969) and Madsen (1975) showed that cows which have high peak yield have low persistency. Asker *et al.* (1966) showed that service period of purebred Friesian was shorter than crossbreds.

The herds had a significant effect on the amount of milk after peak, milk at peak, lactation period and average milk yield. The variation in herds represent differences in management, nutrition regime, and genetic make–up of the animals.

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Where: Y_{ijklmn} is an observation of one of the seven traits.
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The herds had a significant effect on the amount of milk after peak, milk at peak, lactation period and average milk yield. The variation in herds represent differences in management, nutrition regime, and genetic make–up of the animals.

Table 1 Least squarès means and standard error of the traits.

	Persistenency (Kg/week)	Milk up to peak (Kg)*	Milk after Peak (Kg)*	Time to Peak (Kg)	Milk at Peak (Kg)	Lactation Period (days)	average Milk yield (Kg/day)
Mean	-0.87 ± 0.02	300.1 ± 58.9	1898.4 ± 133.3	5.4 ± 0.9	88.5 ± 4.2	254.0 ± 13.6	8.0 ± 0.4
Breeding groups:							
Purbred Friesian	–0.88 ± 0.02	433.4 ± 58.1	2084.1 ± 131.6	6.8 ± 0.9	94.6 ± 4.2	278.8 ± 13.4	8.5 ± 0.4
½ Friesian	–0.87 ± 0.04	191.8 ± 113.7	1753.1 ± 257.4	3.6 ± 1.8	88.6 ± 8.1	215.8 ± 26.3	8.0 ± 0.7
¾ Friesian	–0.85 ± 0.03	325.1 ± 79.4	1945.0 ± 179.7	5.6 ± 1.3	93.5 ± 5.7	261.8 ± 18.3	8.0 ± 0.5
⅞ or over	–0.86 ± 0.03	249.9 ± 77.7	1811.6 ± 175.8	5.7 ± 1.2	77.4 ± 5.6	259.4 ± 17.9	7.5 ± 0.5
Herds:							
CA	–0.89 ± 0.02	301.6 ± 48.4	1454.2 ± 110.4	5.9 ± 0.8	79.3 ± 3.5	231.2 ± 11.3	6.8 ± 0.3
TIA	–0.84 ± 0.04	298. ± 91.1	2342.6 ± 206.2	5.0 ± 1.5	97.7 ± 6.5	276.8 ± 21.0	9.3 ± 0.6
Year:							
72 or before	–0.80 ± 0.03	20.2.7 ± 78.7	2156.5 ± 178.1	4.8 ± 1.3	87.2 ± 5.6	268.8 ± 18.2	8.5 ± 0.5
73	–0.88 ± 0.04	260.8 ± 92.2	1905.9 ± 208.7	4.9 ± 1.5	88.9 ± 6.6	248.0 ± 21.3	8.2 ± 0.6
74	–0.96 ± 0.07	493.5 ± 179.8	1767.5 ± 406.9	6.6 ± 2.9	106.3 ± 12.9	230.6 ± 41.5	9.7 ± 1.1
75	–0.81 ± 0.06	283.1 ± 151.5	1881.7 ± 343.0	5.9 ± 2.4	79.7 ± 10.8	278.0 ± 35.0	7.0 ± 1.0
76	–0.86 ± 0.03	312.7 ± 65.7	2270.6 ± 148.8	5.4 ± 1.0	96.4 ± 4.7	301.9 ± 15.2	7.8 ± 0.4
77	–0.93 ± 0.02	278.0 ± 62.1	1536.5 ± 140.5	5.3 ± 1.0	74.1 ± 4.4	228.9 ± 14.3	6.8 ± 0.4
78	–0.83 ± 0.03	269.5 ± 84.1	1770.3 ± 190.3	5.1 ± 1.3	87.0 ± 6.1	221.5 ± 19.4	8.4 ± 0.5

Table 1. (cont.)

Season of calvinf :							
Winter (Dec.–Feb.)	−0.86 ± 0.03	400.5 ± 64.1	1773.2 ± 154.2	7.2 ± 1.0	84.3 ± 4.6	24.1 ± 14.8	8.4 ± 0.4
Spring	−0.88 ± 0.03	266.0 ± 69.8	1852.7 ± 158.0 (March–May)	4.5 ± 1.1	96.3 ± 5.0	247.4 ± 16.1	8.0 ± 0.4
Summwer (June–August)	−0.87 ± 0.04	183.6 ± 101.2	2424.6 ± 229.1	3.6 ± 1.6	95.9 ± 7.2	296.2 ± 23.4	8.3 ± 0.6
Fall (Sept. Nov.)	−0.87 ± 0.03	350.1 ± 84.2	1534.2 ± 190.5	6.6 ± 1.3	77.4 ± 6.0	232.1 ± 19.4	7.3 ± 0.5
Parity							
1	−0.88 ± 0.03	287.3 ± 73.1	1399.3 ± 165.4	6.4 ± 1.2	70.6 ± 5.2	221.6 ± 16.9	6.8 ± 0.5
2	−0.83 ± 0.03	325.6 ± 81.3	2006.5 ± 183.9	5.9 ± 1.3	85.1 ± 5.8	270.1 ± 18.8	8.2 ± 0.5
3	−0.89 ± 0.03	235.7 ± 83.7	2111.6 ± 198.5	4.2 ± 1.3	97.3 ± 6.0	259.0 ± 19.3	8.5 ± 0.5
4 or Later	−0.87 ± 0.03	351.6 ± 68.3	276.4 ± 154.6	5.3 ± 1.1	101.0 ± 4.9	256.2 ± 15.8	8.6 ± 0.4

* Total milk yield = milk up to peak + milk after peak

Table 2. F-Values of least-squares analysis

Source	d.f	F-Values						
		Persistency	Milk up to peak	milk after peak	Time to peak	Milk at peak	Lact. p.	average milk yeild
Breeding group	3	0.24	2.51	1.02	1.09	3.88*	1.94	1.51
Herds	1	1.73	0.00	20.58**	0.41	8.89**	5.20*	19.58**
Years	6	3.72**	0.60	3.43**	0.12	3.20**	3.34**	2.90*
Season	3	0.13	2.08	4.50**	2.71*	3.73*	2.50	1.93
Parity	3	1.39	0.75	8.49**	1.04	13.11**	3.61*	6.44**

* ($P < .05$) ** ($P < .01$)

Year of calving influenced, persistency, milk after peak, milk at peak, lactation period, and average milk yield, The year of calving least– squares means pattern were erratic across the investigated traits. This could be caused by varying managerial or climatic conditions. These findings are in agreement with the work of Gill *et al.* (1970).

The F–values for the effect of calving season on milk after peak, time to peak, and milk at peak indicate significant seasonal variations. The season of calving least–squares means showed that winter's calvers, followed by fall's calvers, appeared to be distinct and had flat lactation curve. Cows calved in winter were most persistent, took longest time to reach peak production, had moderate milk at peak, and highest average daily milk yield. These characteristics of winter's calvers are desirable. Therefore, this suggest that management should be practiced in such a way to let the cows fresh in winter. In order to make this of practical importancee, it is recommended thats fall and winter to be the calving seasons. Moreover, Eltawil *et al.* (1977) also pointed out that higher milk yield were obtained from cows freshened in winter season.

Milk after peak, milk at peak, lactation period and average daily milk were affected by parity. However, parity did not show any significant effect on persistency or time to attain peak peoduction. The milk at peak, average daily yield increased with lactation number (parity) as indicated by the least–Squares means shown in Table 2. These results are similar to those reported by Gill *et al.* (1970).

Although, the persistency not affected by parity significantly, the least–squares means indicated that younger cows were more persistent than older ones. This result is consistant with those reported by Madsen (1975) and wiggans and Van Vleck (1978). The conclusion of this study suggest that management and other environmental factors are important in determining the pattern of the lactation curve.

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GENETIC STUDIES ON EGG CHARACTERS IN JAPANESE QUAIL (Coturnix coturnix japonica)

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SUMMARY

For the purpose of studying interior and exterior egg guality traits, 1165 pedigreed *Coturnix conturnix japonica* eggs were obtained from 233 (8-week old) females of the F_1 generation, 5 eggs/ female, as well as eggs from 75 (42-week old) parents, 5 eggs/female, and genetic and phenotypic parameters were assessed thereof. Egg weight, length and width, specific gravity, yolk width, height, weight and colour, albumen height as well as egg shell weight and thickness were recorded.

Heritabilities for the characters were estimated using both regression of daughters on dam as well as the variance components. Least square means and standard error of egg quality traits and the phenotypic correlation between them were calculated for both the 8-week old progeny and their 42-week old parents, whereas combined genetic correlations were calculated only for the former.

High genetic and phenotypic correlations were found between many qualities and generally they followed a similar pattern as the egg traits of domestic chicken.

الملخص

لغرض دراسة الصفات النوعية الداخلية والخارجية لبيضة طير القطى الياباني (السمان) . درست خمسة بيضات من كل انثى والتي كان عددها ٢٣٣ وعمرها (٨) أسابيع من الجيل الاول وكذلك خمسة بيضات من كل من الامهات التي عددها ٧٥ وعمرها ٤٢ اسبوع قيمت الصفات التالية . وزن ولون وسمك القشرة للبيضة

* Part of M.S. thesis submitted by the senior author.

بالاضافة الى ارتفاع الالبومين . كما قدرت المكافئات الوراثية ± الخطأ القياسي لمعظم الصفات المدروسة وكذلك الارتباط الوراثي والمظهري بين معظم الصفات . وكانت النتائج تتبع بصورة عامة نفس الاسلوب في الدجاج .

INTRODUCTION

Egg quality traits are laborious and time consuming to assess, but are important indicators of genetic, marketing and production egg qualities. Once identified the gene frequency of a given character, it can be either increased or decreased through selection depending on the production requirements which in the case of chickens involve space, cost of feeding and time.

Coturnix coturnix japonica has an advantage over chicken of being of smaller size, less feed consuming and reaching maturity in shorter time, thus making selection studies easier, faster and more economic.

The purpose of this work was to further study egg quality traits of Japanese quail as well as to estimate some phenotypic and genetic parameters for such traits.

MATERILAS AND METHODS

Five hundred eggs from a quail population were hatched to produce the parent generation. Seventy–five females and 25 males from the parent generation were used. Each female was housed in a quail breeding cage, and each male was mated to 3 females. The male was rotated daily with one female to produce half and full–sib families.

Continuous fluorescent light was used. The temperature of the breeding house ranged from 20 to 25 C. The birds received a commercial layer ration containing 18.5% crude protein and 2900 kcal/kg M.E. Eggs were collected daily. The different egg quality traits were measured using eggs/female. The rest of the eggs were used to produce the F_1 generation.

At hatching all quail chicks were leg banded with canary leg bands to keep their pedigree. The chicks were reared in quail batteries provided with heaters and continuous light. During the rearing period the birds received a commercial ration containing 28% crude protein and 3200 Kcal/kg M.E.

At two weeks of age the leg bands were replaced by wing bands.

The female progeny used in this study were obtained from eight different hatches during a period of three months (1165 pedigreed eggs), 5 eggs from each of the 233 (8–week old) females were used to study the egg quality traits.

Methods of Measuring Egg Quality Traits

A. External Measurements

Eggs were weighed to the nearest tenth of a gram. The eggs were measured in centimeters using a vernier–caliper, to measure egg shape index. Specific gravity was determined by a series of saline solutions (Wells, 1968).

B. Internal Measurements

After obtaining the external measurements of the eggs, the eggs were broken individually on a flat surface without separating any part of the yolk or albumen while the shells were placed on filter papers.

Yolk width was measured in centimeters using a vernier–calliper. Yolk height was measured in millimeters using a tripod micrometer and also yolk index was calculated according to Funk (1948). Albumen height was measured in millimeters using the tripod–micrometer at the highest point of the thick albumen junction with the yolk (Wilgus and Van Wagenen, 1936) in order to calculate Haugh units.

Egg yolk was carefully separated from albumen and weighed immediately to the nearest tenth of a gram. Yolk colour was measured using a Roche colour fan (Wells, 1968).

Eggs shell weighed to the nearest tenth of a gram after placing it on a filter paper. Egg shell thickness was measured at mid region of the shell in microns using a micrometer before and after the removal of the shell membranes (Brant and Shrader, 1952). Blood and meat spot percentages were recorded both for albumen and yolk separately.

Calculated Traits:

Albumen weight was calculated by component difference: Egg weight – (yolk weight + Shell weight).

Egg shape index was measured as follows: Egg width/egg length × 100 (Romanoff and Romanoff, 1949).

Yolk index was measured as follows: Yolk height / yolk width × 100 (Funk, 1948).

Haugh units were measured according to Haugh (1937).

Percentages of egg albumen, yolk, and shell relative to original weight were also calculated.

Statistical Analysis

The genetic and phenotypic correlations and heritability of all egg quality traits were studied and standard errors of variance of the component heritabilites were estimated as descried by Dickerson (1960), and modified by Becker (1967). The standard errors of the genetic correlations were computed according to Robertson (1959). The data were analysed by least squares method of Harvey program (1960). The separation of means was carried out according to Duncan (1955).

RESULTS AND DISCUSSION

Averages and Heritabilities:

Averages and heritabilities of egg characters studied of the females (42 weeks old) and their progeny (8 weeks old) are presented in Tables 1 and 2 and are in close agreement with the values reported in the literature (Mottle *et al.*, 1972; Marks and Britton, 1972; Al-Soudi and Bernier, 1973; and Strong *et al.*, 1978). The significant differences observed in average egg weights, shape, shell thickness, and shell membranes between the dams and their daughters could be attributed to differences in age (Garrett *et al.*, 1972).

The heritabilities (Table 2) were estimated using both regression of daughters as well as the variance. Heritabilty estimates obtained by the regression of offspring on dam were higher in magnitude than those obtained by the other method for egg weight, shape, albumen weight and percentage.

Table 1. Least square means ± standard error, for the egg quality characters of both age groups

Character	42 – week old females	8 – week progeny
Egg weight (gm)	9.49 ± 0.06[a*]	8.31 ±0.02[b]
Egg length (cm)	3.05 ± 0.008[a]	2.91 ± 0.004[b]
Egg width CM)	2.35 ± 0.006[a]	2.25 ± 0.0003[b]
Egg shape index (%)	77.36 ± 0.21[a]	77.45 ± 0.10[a]
Shell weight (gm)	1.07 ± 0.03[a]	0.87 ± 0.03[b]
Shell percentage	11.21 ± 0.08[a]	9.38 ± 0.03[b]
Shell + membranes thickness (u)	172 ± 12[a]	165 ± 6[b]
Shell thickness (u)	144 ± 12[a]	134 ± 3[b]
Membranes thickness (u)	28 ± 3[b]	31 ± 1[a]
Specific gravity	1.0541 ± 0.005[a]	1.0527 ± 0.003[b]
Albumen weight (gm)	5.43 ± 0.03[a]	5.03 ± 0.03[b]
Albumen percentage	57.01 ± 0.17[b]	60.52 ± 0.07[a]
Albumen height (mm)	5.22 ± 0.04[b]	5.37 ± 0.02[a]
Haugh units	70.37 ± 0.32	73.03 ± 0.16
Yolk weight (gm)	3.03 ± 0.03[a]	2.51 ± 0.03[b]
Yolk percentage	31.78 ± 0.15[a]	30.11 ± 0.06[b]
Yolk index (%)	47.08 ± 0.21[b]	48.34 ± 0.11[a]
Yolk color	7.07 ± 0.15[b]	9.04 ± 0.06[a]
Blood spots (%)	2.58 ± 0.01[a]	2.83 ± 0.01[a]

* Values followed by different superscripts within a row differ significantly (p 0.01) from each other (Duncan, 1955).

Table 2 Heritabilities ± standard error for egg quality characters.

Character	Regression of off-spring on dam	Sire heritability	Dam heritability	Combined heritability
Egg weight	0.73±0.12	0.57±0.35	0.82±0.35	0.70±0.25
Egg Length	0.45±0.16	0.58±0.31	0.23±0.23	0.41±0.22
Egg width	0.70±0.17	0.45±0.29	0.55±0.31	0.50±0.16
Egg shape index	0.66±0.14	0.19±0.19	0.028±0.25	0.11±0.15
Shell weight	0.52±0.23	0.74±0.34	0.36±0.20	0.56±0.23
Shell percentage	0.34±0.10	0.73±0.33	0.17±0.24	0.45±0.21
Shell ± membranes thickness	0.20±0.14	0.27±0.20	-0.05±0.23	0.12±0.18
Shell thickness	0.20±0.13	0.30±0.20	–0.06±0.23	0.12±0.19
Membranes thickness	0.00	0.00	0.00	0.00
Specific gravity	0.58±0.14	0.41±0.25	0.16±0.25	0.28±0.18
Albumen Weight	0.75±0.15	0.53±0.34	0.82±0.35	0.68±0.21
Albumen percentage	0.39±0.14	0.33±0.19	0.77±0.31	0.55±0.12
Albumen height	0.34±0.19	0.42±0.30	0.68±0.33	0.55±0.28
Haugh units	0.20±0.17	0.29±0.28	0.69±0.34	0.49±0.15
Yolk weight	0.37±0.13	0.56±0.33	0.59±0.31	0.58±0.23
Yolk percentage	0.20±0.14	0.25±0.28	0.52±0.34	0.37±0.16
Yolk index	0.56±0.18	0.63±0.30	0.19±0.24	0.41±0.15
Yolk color	0.34±0.11	0.21±0.28	0.19±0.22	0.20±0.16
Blood spots	0.18±0.12	0.03±0.07	0.14±0.11	0.08±0.03

Result obtained concerning specific gravity, yolk color and blood spots which agree with those reported by Mitsumoto and Shotake (1971) and Kinney *et al.* (1968).

The sire, dam and combined hertiability estimates for all characters studied are presented in Table 2. Dam heritability was higher than sire estimates for egg weight, shape, specific gravity, albumen weight and percentage, Haugh unit and yolk weight. This may indicate either/or all larger maternal effect, dominance deviation or N and non - additive genetic effect. However, the difference between the two estimates did not reach any significance due to the very high standard error of the estimates, and as reported in similar studies with chicken (Vaccars & Van Vleck, 1972). The sire and combined heritabilities for other characters, on the other hand, were higher than those of the dams excluding the presence of any maternal and/or dominance or non-additive genetic variance effects (Falconer, 1967).

Genetic and phenotypic correlations:

The combined genetic correlation for different egg traits calculated for 8-week old quail are presented in Table 3 and phenotypic corelations calculated for both the 8-week-old progeny and the 42 week old females are presented respectively in tables 4 and 5.

As was expected, the genetic and the phenotypic correlations between egg weight and each of yolk weight, albumen weight, shell weight, egg length and width for both age groups were positive and highly significant (Tables 3,4 and 5). Genetic correlations which were higher than the phenotypic correlations reached in almost all cases 100 percent. Similar eresults were also reported on chicken (Aggarwal, 1970; and Jain, 1974).

The phenotypic correlations between egg weight and shell thickness for both age groups were intermediate to low in magnitude but highly significant (Tables 4 and 5). As has been reported for chicken (Spara and Aggarwal, 1971; Sreedharan and Mukundan, 1972). This relation indicates a thicker shell for the large sized eggs.

The phenotypic correlations between egg weight and yolk colour for the 42-week old females are intremediate,positive, and highly significant (Table 4). Since the older females had a lighter yolk color, their larger eggs with the darker yolks (within this age group) would indicate that such eggs were either the first eggs in the laying cycle or eggs from poor layers. This relation was absent in the 8-week old progeny. This may be due to their darker yolks and the fact that they were just starting to lay.

There were negative genetic and phenotypic correlations between egg weight and yolk index. This indicates that larger the eggs, the flatter are their yolks. There was also a highly negative genetic correltion between yolk weight and egg shape index. This indicates that the more rounded eggs

have relatively smaller yolks. The phenotypic correlations between albumen weight and the other egg relative constituents were intermediate.

There were highly positive genetic and phenotypic correlations between shell weight and shell thickness and specific gravity. There were also positive genetic correlations between yolk weight and shell thickness and specific gravity.

A significant genetic correlation between shell weight and yolk percentage was also noted. The negative phenotypic and genetic correlations between shell weight and yolk index indicates that the eggs with heavier shells had flatter yolks.

There were highly positive genetic and phenotypic correlations between egg length and width. Genetic and phenotypic correlations also indicated a higher albumen for the longer eggs. As expected, there was a negative correlation between egg length and shape index.

There was a very highly positive correlation between the albumen height and Haugh units.

As expected, the three namely (yolk, shell and albumen) constituents of the egg were correlated genetically and phenotypically. Any increase in the albumen percentage was accompanied by a decrease in yolk and shell percentages. This is due to the negative correlation between them. However, a positive genetic correlation existed between yolk and shell percentages. This would mean that eggs with high yolk percentage, within sibs, would also have higher shell percentage.

It can generally be concluded that most of the relative Japanese quail egg quality constituents and traits resemble those of the domestic chicken. In most cases they were also genetically similar. It is then possible to state that the Japanese quail can be used with enough accuracy as a genetic model in studying the egg quality traits and to apply the results for chicken eggs.

TABLE 3. Combined genetic correlations of egg quality traits of the 8 – week old progeny.

	Egg weight	Yolk weight	Albumen weight	Shell weight	Egg length	Egg width	Albumen height	Shell thickness	Yolk color	Haugh units	Specific gravity	Shape index	Yolk index	Albumen %	Yolk %
Yolk weight	0.95±0.02**														
Albumen weight	0.97± 0.02**	0.87± 0.04**													
Shell weight	0.75± 0.04**	0.90± 0.14**	0.52± 0.15**												
Egg length	1.02± 0.001**	1.03± 0.08**	0.89± 0.05**	0.80± 0.09**											
Egg width	0.93± 0.03**	0.80± 0.08**	0.95± 0.02**	0.58± 0.16**	0.96± 0.02**										
Albumen height	0.42± 0.17*	0.41± 0.18**	0.42± 0.17**	0.18± 0.27	0.43± 0.20*	0.23± 0.22									
Shell thickness	0.29± 0.20	0.86± 0.10**	0.20± 0.38	0.77± 0.17**	0.09± 0.49	0.20± 0.44	0.41± 0.31								
Yolk color	0.23± 0.26	0.40± 0.24	0.14± 0.27	0.22± 0.22	0.26± 0.32	0.36± 0.27	0.27± 0.27	0.45± 0.46							
Haugh units	0.28± 0.20	0.31± 0.20	0.26± 0.20	0.08± 0.23	0.29± 0.24	0.06± 0.24	0.99± 0.007**1	0.57± 0.33	0.25± 0.29						
Specific gravity	0.13± 0.26	0.53± 0.20**	-0.22± 0.25	0.53± 0.20**	0.19± 0.32	0.10± 0.30	0.49± 0.21	1.05± 0.06**	0.58± 0.26*	0.57± 0.20**					
Shape index	-0.33± 0.35	-0.67± 0.22**	-0.01± 0.40	-0.48± 0.33	-0.31± 0.45	0.001± 0.46	-0.58± 0.28*	-0.73± 0.37*	-0.28± 0.31	-0.60± 0.28*	-0.40± 0.47				
Yolk index	-0.31± 0.21	-0.29± 0.23	-0.17± 0.23	-0.76± 0.11**	-0.36± 0.25	-0.47± 0.20	0.40± 0.21	-0.30± 0.43	-0.28± 0.31	0.51± 0.19**	-0.42± 0.26	-0.56± 0.33			
Albumen %	0.01± 0.23	-0.30± 0.23	0.31± 0.21	-0.64± 0.15**	0.18± 0.28	0.27± 0.25	0.05± 0.25	1.52± 0.64*	-0.35± 0.30	-0.04± 0.26	-1.13± 0.09**	0.98± 0.01**	0.30± 0.027		
Yolk %	0.19± 0.26	0.48± 0.22*	-0.12± 0.27	0.69± 0.15**	0.43± 0.27	-0.05± 0.31	0.03± 0.29	1.61± 0.92	0.40± 0.33	0.10± 0.30	1.15± 0.13**	-1.20** 0.26**	-0.13± 0.33	-0.94± 0.04**	
Shell %	-0.35± 0.20	-0.05± 0.24	-0.62± 0.13**	0.34± 0.21	-0.28± 0.26	-0.50± 0.19**	-0.36± 0.21	0.61± 0.29*	-0.06± 0.32	-0.27± 0.23	0.53± 0.22*	-0.29± 0.42	-0.63± 0.16**	-0.95± 0.02**	0.78± 0.12**

$p < 0.05$ $^{**}p < 0.01$

TABLE 4. Phenotypic correlations between egg quality traits of the 42-wook old females.

	Egg weight	Yolk weight	Albumen weight	shell weight	egg length	egg width	Albumen height	Shell thickness	Yolk color	Haugh units	Specific gravity	Shape index	Yolk index	Albumen %	Yolk %
Yolk weight	0.75 ± 0.06**														
Albumen weight	0.79 ± 0.03**	0.47 ± 0.06**													
Shell weight	0.58 ± 0.11**	0.52 ± 0.11**	0.43 ± 0.10**												
Egg length	0.75 ± 0.06**	0.62 ± 0.12**	0.59 ± 0.09**	0.41 ± 0.10~											
Egg width	0.88 ± 0.03**	0.69 ± 0.12**	0.73 ± 0.07**	0.59 ± 0.09**	0.59 ± 0.10**										
Albumen height	0.20 ± 0.12	0.006 ± 0.10	0.17 ± 0.12	0.13 ± 0.12	0.16 ± 0.12	0.21 ± 0.12									
Shell thickness	0.49 ± 0.10**	0.19 ± 0.11	0.24 ± 0.12	0.59 ± 0.10**	0.28 ± 0.12*	0.37 ± 0.11**	0.15 ± 0.12								
Yolk color	0.35 ± 0.11**	0.07 ± 0.12	0.07 ± 0.13	0.09 ± 0.13	0.37 ± 0.11**	0.33 ± 0.11**	0.16 ± 0.02	0.16 ± 0.12							
Haugh units	-0.05 ± 0.13	-0.17 ± 0.12	-0.12 ± 0.12	-0.02 ± 0.12	0.002 ± 0.13	-0.13 ± 0.13	0.95 ± 0.01**	0.02 ± 0.13	0.11 ± 0.13						
Specific gravity	0.45 ± 0.10**	0.17 ± 0.12	0.24 ± 0.12	0.60 ± 0.10**	0.23 ± 0.12	0.34 ± 0.11**	0.11 ± 0.13	0.93 ± 0.02**	0.10 ± 0.13	-0.02 ± 0.13					
Shape index	-0.25 ± 0.12	0.08 ± 0.12	0.13 ± 0.12	0.20 ± 0.12	-0.40 ± 0.11**	0.47 ± 0.10	0.05 ± 0.13	0.16 ± 0.12	-0.004± 0.13	-0.33 ± 0.13	0.18 ± 0.12				
Yolk index	-0.09 ± 0.13	-0.18 ± 0.12	0.002 ± 0.13	0.02 ± 0.13	-0.23 ± 0.12	-0.02 ± 0.13	0.09 ± 0.13	0.009 ± 0.13	-0.32 ± 0.11	0.09 ± 0.13	0.11 ± 0.13	0.20 ± 0.12			
Albumen %	-0.17 ± 0.12	-0.59 ± 0.09**	0.36 ± 0.10**	-0.39 ± 0.10**	-0.16 ± 0.12	-0.15 ± 0.12	0.23 ± 0.12	-0.25 ± 0.12*	-0.14 ± 0.12	0.26 ± 0.12*	-0.24 ± 0.12	=0.04± 0.43	0.26 ± 0.12*		
Yolk %	0.10 ± 0.13	0.65 ± 0.03**	-0.33 ± 0.10**	0.03 ± 0.12	0.15 ± 0.12	0.07 ± 0.13	-0.33 ± 0.11**	-0.03 ± 0.13	0.16 ± 0.12	-0.34 ± 0.11**	-0.05 ± 0.13	-0.04± 0.13	-0.40± 0.11**	-0.89 ± 0.03**	
Shell %	-0.20 ± 0.12	0.01 ± 0.13	-0.17 ± 0.12	0.77 ± 0.02**	0.08 ± 0.13	0.21 ± 0.12	0.16 ± 0.12	0.60 ± 0.08**	-0.01 ± 0.13	0.08 ± 0.13	0.64 ± 0.08**	0.17 ± 0.12	-0.15± 0.12	-0.50 ± 0.10**	0.04 ± 0.13

*$p < 0.05$, ** $p < 0.01$

TABLE 5. Phenotypic correlations between egg quality traits of the 8 – week old progeny.

	Egg weight	Yolk weight	Albumen weight	Shell weight	Egg length	Egg width	Albumen height	Shell thickness	Yolk color	Haugh units	Specific gravity	Shape index	Yolk index	Albumen %	Yolk %
Yolk weight	0.84± 0.02**														
Albumen weight	0.92± 0.004**	0.60± 0.04**													
Shell weight	0.61± 0.40**	0.57± 0.04**	0.41± 0.06**												
Egg length	0.78± 0.03**	0.72± 0.02**	0.67± 0.04**	0.52± 0.04**											
Egg width	0.82± 0.02**	0.67± 0.03**	0.74± 0.03**	0.57± 0.04**	0.54± 0.05**										
Albumen height	0.29± 0.06**	0.27± 0.06**	0.30± 0.06**	0.08± 0.06	0.23± 0.06**	0.20± 0.06**									
Shell thickness	0.16± 0.06**	0.16± 0.07**	0.11± 0.06	0.36± 0.04	0.16± 0.06**	0.12± 0.07	-0.04± 0.07								
Yolk color	0.12± 0.07	0.10± 0.07**	0.09± 0.07	0.07± 0.06	0.12± 0.07	0.12± 0.07	0.11± 0.07	0.13± 0.13							
Haugh units	0.11± 0.07	0.14± 0.06**	0.13± 0.07	-0.05± 0.09	0.09± 0.07	0.04± 0.07	0.97± 0.004**	-0.05± 0.07	0.10± 0.07						
Specific gravity	0.03± 0.07	0.04± 0.07	-0.11± 0.06	0.50± 0.04**	0.03± 0.07	-0.02± 0.07	0.10± 0.07	0.72± 0.03**	0.15± 0.06*	0.09± 0.07					
Shape index	-0.008± 0.07	-0.14± 0.06*	0.04± 0.07	-0.06± 0.06	-0.48± 0.03**	0.34± 0.06*	-0.06± 0.07	-0.04± 0.07	0.04± 0.07	0.08± 0.07	-0.06± 0.07				
Yolk index	-0.30± 0.06*	-0.34± 0.06**	-0.11± 0.06	-0.40± 0.04**	-0.27± 0.06**	-0.31± 0.06**	0.10± 0.07	-0.02± 0.07	0.004± 0.07	0.16± 0.06*	0.004± 0.07	-0.02± 0.07			
Albumen	-0.02± 0.07	-0.49± 0.05**	0.37± 0.05**	-0.38± 0.04**	-0.13± 0.06	-0.04± 0.06	0.02± 0.07	-0.15± 0.06*	-0.02± 0.07	0.03± 0.07	-0.16± 0.06*	0.13± 0.06	0.24± 0.06**		
Yolk %	0.14± 0.06*	0.62± 0.04**	-0.22± 0.05**	0.20± 0.06**	0.22± 0.06	0.13± 0.06	0.05± 0.07	0.05± 0.07	0.02± 0.07	0.02± 0.07	-0.05± 0.07	0.14± 0.06	-0.22± 0.06**	-0.93± 0.009**	
Shell %	-0.30± 0.06**	-0.18± 0.06**	-0.48± 0.04**	0.56± 0.04*	-0.19± 0.06**	-0.22± 0.06**	-0.19± 0.06**	0.27± 0.06**	-0.02± 0.07	-0.13± 0.06	0.58± 0.04**	-0.009± 0.07	-0.14± 0.06	-0.40± 0.06**	0.04± 0.07

* p ± → 0.05
± ≤ ± → 0.01

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THE EFFECT OF DIFFERENT PROPORTIONS OF UREA IN THE RATION ON FATTENING AND CARCASS PERFORMANCE OF AWASSI LAMBS

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SUMMARY

This study was designed to investigate the digestibility of fattening rations containing different proportions of urea, date stones, and green alfalfa and to study its effects on the carcass performance of the finnish Awassi lambs.

Two experiments were carried out. Experiment one was designed to determine the digestibility of rations. The actual proportions of urea nitrogen from the total nitrogen in the four rations were 0, 10.7, 15.6 and 23% for the rations 1,2,3 and 4 respectively. Total dry matter intake was slightly decreased as the proportion of urea-nitrogen was increased in the rations.

The apparent digestibility of organic matter for the rations 1,2,3 and 4, were 80.94, 75.82, 75.07 and 75.61% respectively. The corresponding values for digestibility of crude protein were 75.2, 68.3, 64.9, and 65.46%, for ether extract 86.61, 86.26, 86.68 and 88.2% for crude fiber 78.71, 71.41, 74.59 nd 69.92%, and for nitrogen free extract 82.46, 78.37, 76.85 and 79.21%. The values for total digestible nutrients were 81.33, 78.64, 78.78 and 80.71% respectively.

Differences among treatments for all digestibility coefficients were statistically not significant.

* Part of M.Sc. thesis submitted by the senior author to the University of Baghdad.

The second expriment was designed to investigate the utilization of rations used in experiment one. The average daily body gain were 126.2, 114.7, 118.7 and 130.5 gms for the group 1,2,3 and 4 respectively. The corresponding dressing percentage values were 48.1, 48.6, 48.1 and 47.7.% respectively. These differences were not significant.

The proportion of urea–nitrogen from the total nitrogen in the rations had no significant effect on the fat thickness over the longissimus dorsi muscle of the rib eye area.

The examination of the financial returns showed that the cost of ration for one kg body gain were 376, 260, 253 and 226 Fills for groups 1,2,3 and 4 respectively.

It is concluded that using 23% of the total nitrogen as ures in the feeding for fattening.

الخلاصة

اجريت هذه الدراسة لمعرفة مدى امكانية استعمال اليوريا كمصدر للبروتين لتجهز نسب مختلفة من النتروجين الكلي في العليقة المتكونة من نوى التمر ومولاس قصب السكر والجت الاخضر بهدف رفع نسبة البروتين الخام في العليقة لزيادة الاستفادة من نوى التمر في تسمين الحملان العواسية ودراسة تأثيرها على القيمة الهضمية والزيادة الوزنية وصفات الذبيحة .

وقد شملت هذه الدراسة تجربتين ، التجربة الاولى صممت لغرض معرفة معامل الهضم العلائق تحتوي على اليوريا لتجهز نسب مختلفة من نتروجين العليقة الكلي مع الجت الأخضر على اساس ان نسبة نتروجين اليوريا في هذه العلائق ، صفر ، ١٠,٧ ، ١٥,٦ و ٢٣ ٪ من نتروجين العليقة الكلي للمعاملات الاولى ، الثانية ، الثالثة والرابعة على التوالي . وقد لوحظ وجود زيادة طفيفة في معدل استهلاك نوى التمر كلما ارتفعت نسبة اليوريا في العليقة .

وظهر من النتائج ان متوسطات معاملات هضم المركبات الغذائية ماعدا معامل هضم الدهن المستخلص كانت اقل من معاملات هضم المركبات الغذائية للعليقة القياسية ولكن الفروق كانت غير معنوية .

اما بالنسبة للتجربة الثانية فقد شملت تسمين الحملان العواسية على نفس العلائق المستعملة بالتجربة الاولى ودراسة تأثير هذه العلائق على الزيادة في وزن الحيوانات ونسبة التصافي بعد ذبح الحيوانات عندما وصل معدل اوزان المجموعة الى ٤٦ كغم لوحظ ان المجموعة التي استهلكت العليقة التي احتوت على ٢٣ ٪ نتروجين اليوريا كانت الزيادة الوزنية فيها اكثر من بقية المجاميع ، وكذلك تحويل الغذاء ، ومع هذا لم تكن الفروق معنوية بين المجاميع الاربعة . اما نسبة التصافي والتركيب الفيزياوي لمنطقة الأضلاع ٩ ـ ١٠ ـ ١١ فلم تكن الفروق معنوية بين المعاملات .

ويظهر من نتائج هذا البحث ان وجود مجروش نوى التمر واليوريا في عليقة الاغنام العواسية يكون اكثر اقتصادياً من اية مادة علفية اخرى حيث ان كلفة العلف لكل كغم واحد من الزيادة في الوزن الحي كانت ٣٧٦ ، ٢٦٠ ، ٢٥٣ ، ٢٢٦ ، فلس للمعاملات الاولى ، الثانية ، الثالثة والرابعة على التوالي .

INTRODUCTION

Fattening rations, either for cattle or for shep, are usually expensive because of the inclusion of big proportion of grains. Meanwhile, supplying the animals with plant protein to cover fattening requirments adds another source of costly feeds. It is therefore, a quite important policy to formulate fattening rations which would include cheaper sources of energy and proteins.

In Iraq, there are considerable amounts of dates which are produced and proccessed for human consumption. The resultant of this proccessing is a reasonable amount of date waste i,e. date stones, date pulps and date molasses. Date stone, which is poor in protein has been extensively investigated as energy source in rations for sheep (El–Shazly *et al.*, 1963; Al–Kinani and Alwash, 1975). On the other hand considrable informations are now available on the possibility of using urea (NPN) as partial replacement for plant protein in ruminant retions (El–Asshry, 1971; Orskov *et al.*, 1972).

EXPERIMENTAL

Animal and Housing:

Animals utilized in experiment one, consisted of four Awassi sheep (eighten months old, average weight 65 kg). The animals were held in metabolism cages and were given free access of water and mineral blocks. Feed was provided daily in two meals at 9.00 h and 11.00 h. In Experiment 2, four groups of eleven Awassi Lambs (5.5–6.5 months old, average weight 25 kg) were housed in four pens in an experimental animal house at Ameria College of Agriculture, Abu–Ghraib.

One lamb from group 4 died during the fattening period. Water and l blocks were offered *ad lib*. Concentrates were given daily at 8.30, 11.00 and 13.00 h.

The green alfalfa was provided at 10.30 and 16.00 h. Animals were weighed weekly.

Feed:

Four diets containing crushed date stones supplemented with 7% cane molasses and different proportions of urea nitrogen were given daily nitrogen from urea represented 0, 10.7, 15.6 and 23% of the total nitrogen in the rations. The chemical composition of date stones and green alfalfa is shown in Table 1.

Table 1. The chemical composition of date stones and green alfalfa (g/100g).

		In the dry matter				
	Dry matter	Crude protein	Ether extract	Nitrogen free extract	Crude fiber	Ash
Date stones	95.62	6.9	10.4	67.2	13.5	2.1
Green alfalfa	31.6	19.2	2.5	40.2	28.5	9.6

Experimental Design:

The first experiment was designed to study the digestibility of diets containing various percentages of urea–nitrogen from the total nitrogen in the diet.

Four rams were alloted randomly, so each ram received one of the four experimental diets. The experiment consisted of four periods, 22 days each as 4 X4 latin square design. The first 12 days of each period was considered as a control period, followed by 10 days of collection period to determine the digestibility of the rations.

The second expreiment was to investigate the utilization of some diets by fattening 43 Awassi lambs. The lambs were slaughtered when the average live weight of the group reached 46 kg. The lambs were divided randomly into four groups, so that each group consisted of 11 lambs. Different carcass traits were studied.

Determination and Analytical Methods:

Digestibility was determined by the measurement of the food consumed and by quantitative collection of the faeces. Food and faeces were analysed for dry matter, ether extract, crude fiber, nitrogen,and ash (A.O.A.C., 1970). Samples of faeces for nitrogen analysis were preserved in 5N acetic Lambs were slaughtered after fasting for 16 hours. The hot carcasses

were weighed immediately after slaughtering. All carcasses were chilled in cold room for 48 hrs at 5C. The chilled carcasses were weighed and ribbed between the 11th and 12th ribs and all carcass measurements and weighis were taken at both sides of the carcass. The *Longissimus dorsi* muscle area and adjacent subcutaneous fat thickness area were determined in duplicate as described by Naumann (1952).

RESULTS AND DISCUSSION

a. Digestibility Trial:

Apparent digestibility of organic matter, crude protein, ether extract, crude fiber, and nitrogen free extract for all four experimental rations are shown in Table 2. The value of all digestible nutrients of each diet was calculated. The digestibility of ether extrat was increased by raising the level of urea–nitrogen in the ration. In contrast, the digestibility of organic matter, crude protein, crude fiber and nitrogen free extract were decreased. Differences among treatments for all digestibility coefficients were statistically not significant. Similar results were reported by Bhattacharya and Khan (1973). Total dry matter intake was slightly decreased as the proportion of urea–nitrogen was increased in the rations.

b. Fattening Trial:

A gradual gain in weight was observed in all four groups (Table 3). It is apparent that there is a alight improvement in daily gain associated with increase in the proportion of urea–nitrogen in the rations. Differences among different experimental groups were not significant.

Table 2. Apparent digestibility of constituents and total digestible nutrient of the four rations.

	Digestibility % *					
Urea nitrogen % in Ration**	Organic matter	Crude protein	Ether extract	Crude fiber	Nitrogen free-extract	Total digestible nutrient
0	80.94	75.20	86.61	78.71	82.46	81.33
10.7	75.82	68.30	86.26	71.41	78.37	78.64
15.6	75.07	64.93	86.68	74.59	76.85	78.78
23	75.61	65.46	88.20	69.92	79.21	80.71

* Each value represents a mean result of four rams.

** From the total N in the ration

Table 3: Performance of Awassi lambs receiving different proportions of urea–nitroggn from the total nitrogen in the ration during different periods.

	Groups			
	1	2	3	4
No. of lambs	11	11	11	10
Period (days)	166	189	192	175
Initail weight (kg)	25.4	25.9	23.7	23.6
Final weight (kg)	46.36	47.59	46.36	46.45
Average daily gain (g)	126.2	114.7	118.0	130.5
Daily feed intake (Kg total ration)	1.86	1.33	1.32	1.35
Daily feed intake (Kg date stone)	0.628	0.688	0.698	0.774
Feed intake per kg gain (Kg total ration)	14.74	11.89	11.39	10.94
Carcass weight (Kg)	22.30	23.14	22.42	22.2
Chilled carcass weight (Kg)	21.83	22.53	21.88	21.7
Dressing percentage	53.08	53.82	53.76	53.51
Rib–eye area (cm^2)	11.6	11.6	10.96	11.1
Fat thickness (mm)	7.24	6.25	7.20	7.16

Dressing percentage values and average hot and chilled carcass weight were higher in the rations containing urea than in the control ration. Physical composition of the 9–11 rib cuts and the fat thickness over *L. dorsi* muscles were lower in the rations containing urea than in the control ration (Table 3). All differences were not significant. Similar results were obtained by Bhattacharya and Khan (1973) and Bhattacharya and Pervez (1973).

The financial returns showed that the cost of ration for one kg body gain were 376, 260. 253 and 226 Fills for groups 1,2,3, and 4 respectively.

It is recommended that using urea as a useful source of nitrogen in sheep diets with a good source of readily fermentable carbohydrates and relatively low dietary levels of total nitrogen will be benificial. Nutritive value of high levels of date stone rations improved by using urea to supply 23% of the total nitrogen in the ration with cane molasses.

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EFFECT OF DIFFERENT FLOOR DENSITIES ON BROILER PERFORMANCE UNDER STANDARD AND HOT TEMPERATURE

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SUMMARY

The effect of different housing densities on broiler performance were studied under standard rearing temperature (33–21 C) and hot dry climate (40–45 C and 13–15% humidity).

Under each temperature conditions 380, one-day-old, Nichol chicks were randomly assigned to four groups at the densities of 8,10, 12 and 14 birds / m^2.

The hot and dry climate significantly influenced the body weight. The average body weight of chicks at 8 weeks was 425 gms less than the control.

The average feed efficiency under standard rearing condition (2.28) was remarkably better than that recorded under hot and dry climate (2.45).

Concerning the floor density, the feed efficiency of birds reared under standard conditions improved slightly by increasing housing density up to 14 chicks / m^2. The best efficiency of feed utilization under hot and dry climate (2.38) was found in D8.

The respiration rate and pulse rate of birds were much higher under hot and dry climate. The percentage of dressed carcass, giblets and liver were higher in chicks reared under standard rearing conditions.

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الخلاصة

لقد حاولنا في هذه التجربة دراسة تأثير كثافات ارضية مختلفة للافراخ على الصفات الانتاجية لفروج اللحم المربّى تحت ظروف درجات الحرارة القياسية المثالية (٣٣ ـ ٢١° م) والمربى تحت ظروف المناخ الحار الجاف صيفاً (٤٥ ـ ٤٠° م) والمقترن برطوبة نسبية بمعدل ١٣ ـ ١٥ ٪ لقد ربي ٣٨٠ فرخاً من هجين لومان بعمر يوم واحد في كل من ظرفي التجربة وقسم كل منها بصورة عشوائية الى اربعة مجاميع بكثافات ٨ ، ١٠ ، ١٢ و ١٤ فرخاً على المتر المربع الواحد .

لقد احدث المناخ الحار الجاف صيفاً تأثيراً سلبياً بشكل محسوس على الوزن الحي حيث بلغ معدل انخفاض الوزن بين المجموعتين ٤٢٥ غراماً بعمر (٨) اسابيع . لقد بلغت كفاءة التحويل الغذائي لافراخ المجموعة القياسية (٢,٢٨) وهي افضل بشكل واضح من تلك التي سجلت في ظروف المناخ الحار (٢,٤٥) .

وبخصوص الكثافة الارضية ، لقد بينت النتائج وجود تحسن تدريجي في كفاءة التحويل الغذائي للافراخ المرباة في الظروف القياسية بازدياد هذه الكثافة ولغاية ١٤ فرخاً / م٢ . اما في ظروف المناخ الحار فلقد بينت النتائج ان افضل كفاءة للتحويل الغذائي تم الحصول عليها عندما ربيت الافراخ بمعدل ٨ فرخاً / م٢ . ان معدل سرعة التنفس ونبض الطيور كان اعلى كثيراً لدى الطيور المربّاة في ظروف المناخ الحار .. ان نسبة الوزن المسلوخ والاحشاء الداخلية المأكولة وبضمنها الكبد كانت اعلى في الافراخ المربّاة في ظروف المناخ القياسي .

INTRODUCTION

High temperatures, above 33 C, had been cited in literature to have an adverse effect on growth performance, feed consumption and feed utilization (Adams *t al. 1962; Osbaldson, 1968; Lobachev and Egorov, 1971; and Deaton t al.*, 1972). This also had been confirmed under the hot and dry summer climate in Iraq by Alzujajy (1969).

Increasing housing density is one of the most important factors affecting the economic return from broiler production, which is relatively limited under hot and dry environments (Guidry, 1962, and Deaton *t al.*, 1972).

Determining the suitable number of broilers per square meter is crucially needed under the hot and dry prevailling climate.

The present work was undertaken to find out the most convenient floor space for broilers reared under hot and dry summer conditions as well as under standard temperature.

MATERIALS AND METHODS

The experiment was conducted to study the effect of different housing densities under two different climatic conditions, namely, standard temperature and hot dry conditions.

Under each temperature, 380, one–day–old Lohman Nichol chicks were randomly assigned to four groups at the densities of 8,10,12 and 14 birds / m^2, expressed as D8, D10, D12 and D14, respectively.

Broilers raised at standard temperature (33–21C) were subjected to 50–60 % humidity, while the air temperature under hot dry conditions ranged between 40–45 C during the day, and 25–30 C during the night with a relative humidity of 13–15 %.

Birds were fed on a ration containing 21 % protein and 2,900 calories of M.E / kg. Chicks were individually weighed at one day old and bi-weekly thereafter up to the marketing age of 8 weeks. Feed consumption and mortality rate were estimated.

At the end of the experiment some physiological perameters, i.e., rectal temperature, respirationrate and pulse rate were determined for five randomly chosen chicks from each group. Similarly, 5 birds from each group were slaughtered for carcass study. In addition, the weight of some internal organs, i.e., heart and liver were recorded. Data obtained were statistically analyzed acoording to Steel and Torrie (1960).

RESULTS AND DISCUSSION

Body weight:

Data in Table 1 revealed that the hot and dry climate adversely influenced the body weight. The reduction in average body weight of chicks, for all groups reached 425 g, when compared with the body weight of chicks reared under standard conditioms. The difference is highly significant ($p < 0.01$) as recorded in Table 2. This is confirmed by the findings of Alzujajy (1963, 1969 and Alzujajy *et al.*, 1978).

Meanwhile, data in Tables 2 and 3 showed no significant difference in body weight of chicks due to floor density. This result is almost in agreement with the findings of Guidry (1962) and Deaton (1972).

Analysis of variance (Table 2,3) showed that the interaction between the different temperatures and floor dinsities significantly affected the weight.

Under standard rearing conditions, the average body weight insignificantly decreased by increasing the floor density up to 12 chicks / m^2, except in D8 and in D14. Anyhow, the economic return as expressed by the total weight of birds raised per m^2 is much higher than that of less desely housed groups.

Under hot and dry climate there was insignificant increase in body weight up to 12 chicks except that between D8 and D14. This result is almost in agreement with the findings of Guidry (1962), Deaton *et al.*, (1972) and Mehta and Singh (1971) who found that the more densely housed birds have higher growth rate up to 16 weeks. The work of Singh and Mehta (1969), Yamashita *et al.* (1973) and Alzujajy *et al.* (1978) showed that the average body weight gain up to 10 weeks decreased linearly with increasing floor density up to 12, 15 and 18 birds / m^2.

Feed Efficiency:

Data in Table 4 showed that the average feed consumption per bird, reared at standard brooding temperature, was 3.699 kg versus 2.940 kg for bird raised under hot and dry condition. The high environmental temperature reduced the feed consumption by 21 %. This adverse effect was previously confirmed by Adams *et al.* (1962) and Alzujajy *et al.* (1978).

The average feed efficiency under standard brooding conditions (2.28) was remarkably better than that recorded under hot and dry climate (2.45).

Concerning the floor density, the feed efficiency of birds reared under standard conditions improved slightly by increasing housing density up to 14 chicks / m^2. A converse result was obtained under hot and dry climate. The best efficiency of feed untilization under hot and dry climate (2.38) was found in D8. This result can be explained by the pronounced reduction in feed intake compared to the higher density groups.

Under standard rearing conditions, the best feed efficiency was obtaied by D14. This might be attributed to the decreased heat loss from birds due to their reduced movement. However, no significant difference was found in feed conversion due to floor density.

Study of Some Physiological Parameters:

It was observed that respiration rate and pulse rate of the birds were much higher under hot and dry climate and was accompanied by panting as a result of heat prostration (Table 5). The chickens seem to reach the limit of their normal physiological regulation and resort to panting as the only means of loosing heat rapidly enough to keep their body temperature from rising. The birds under hot and dry climate, however, succeeded in maintaining their body temperature near normal (41.8^{0}C), although those in the standard temperature achieved a lower body temperature (41.4^{0}C). Different physiological processes for the birds raised under standard thermal conditions occured within the normal limits.

Carcass Performance:

Data presented in Table 6 showed that the percentage of dressed carcass, giblets and liver were higher in chicks reared under standard rearing conditions. The difference, however, was insignificant. This case has the same trend with the body weight increment.

The carcass percentage was slightly higher in chicks for those reared under hot and dry climate than those raised under standard temperature. The same trend was also observed concerning the heart weight. The hot and dry climate increased the respiration rate and consequently the heart rate to maintain the thermo-regulation via the excess heat loss.

The data of carcass performance (Table 6) showed no significant difference due to the floor density under both climatic conditions.

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Table 1. Average body weight of chicks as affected by different temperatures and housing densities.

(Weeks)	Standard rearing temperature D8*	D10	D12	D14	Hot and dry climate D8	D10	D12	D14
0	39±0.7	99±0.6	39±0.6	39±0.7	39.0±0.5	39.±0.7	39.0±6	39±0.6
2	183±3.0	178±2.9	175±2.8	169±2.7	152±2.8	160±2.9	161±2.7	164±2.9
4	608±3.2	595±3.7	558±3.0	533±4.0	407±6.2	425±5.3	419±5.3	446±5.1
6	1072±4.3	1045±4.8	1036±5.2	1006±5.5	793±9.8	511±11.3	815±9.8	852±2.6
8	1712±6.0	1687±5.1	1638±6.1	1619±7.0	1202±13.1	1258±14.0	1227±12.0	1271±15

D8– Density of Chicks / m^2

Table 2 Analysis of variance for body weight at 8 weeks.

Source of Variation	DF	SS	MS	F
Temperature	1	32.3852	32.3852	781.496**
Floor density	3	0.1593	0.0351	1.28
Temp. × f. density	3	0.5970	0.1990	4.38*
Error	712	29.5087	0.0444	
Total	719	62.6502		

** Significant at 1 % level

* Significant at 5 % level.

Table 3. All possible comparisons among body weight averages according o Duncan's Multiple Range Test.

	8 / m^2	10 / m^2	12 / m^2	14 / m^2	Mean
Hot and dry Climate	e* 1202	de 1.258	de 1.227	d 1.271	I 1.239
Standard rearing conditions	1 1712	ab 1.687	bc 1.638	c 1.619	II 1.664
Mean	A 1.457	A 1.473	A 1.432	A 1.445	

* Avareges having the same lettler (s) are not statistically significant.

Table 4. Analysis of variance for final body weight

S. of variation	D.F.	S.S.	M.S.	F.
Replicate	1	0.000260	0.000260	
Temp.	1	0.204425	0.204425	148.35**
Density	4	0.006144	0.001536	1.115
Temp. × density	4	0.074825	0.018706	13.575**
Error	9	0.012508	0.001378	
Total	19	0.298162		

L.S.D for temperature at 0.05 0.375

0.01 0.540

L.S.D. for T × d at 0.05 0.084

0.01 0.121

Table 5. Average feed consumption, body gain and feed efficiency of chicks as affected by different temperature and housing densities.

Floor density (chicks / m^2) Item	8	10	12	14	Average
Average feed intake (g. / bird)					
Standard temp.	3852	3762	2620	3562	3599
Hot and dry climate	2765	3000	2933	3063	2940
Final body weight (g. / bird)					
Standard temp.	1712	1687	1638	1619	1664
hot dry climate	1202	1258	1227	1271	1239
Total body gain (g. / bird)					
Standard temp.	1672	1647	1598	1579	1624
hot dry climate	1162	1218	1187	1231	1200
Feed conversion					
Standard temp.	2.30	2.28	2.27	2.26	2.28
hot dry climate	2.38	2.46	2.47	2.49	2.45

Table 6. Rectal temperature (C^0), respiration rate (n/min) and pulse rate (n./min.) of broilers at 8 weeks.

Criteria	Hot and dry climate			Standard rearing temperature		
Density/m	Rectal Temp.(C^0)	Respiration rate	Pulse rate	Rectal temp.	Resp. rate	Pulse rate
8 birds	41.4±1.6	53±1.7	244±5.1	41.8±1.2	45±1.5	211±4.6
14 birds	42.0±05	58±1.2	308±6.3	41.7±1.3	43±0.9	244±5.3

Table 7. Carcass performance as affected by different temperature and floor densities.

Floor density	(Standard temperature)					(Hot and dry climate)				
Criteria	D8	D10	D12	D14	AverageD8	D10	D12	D14	Average	
Carcass %*	69.6	69.3	68.7	68.4	68.9	69.0	69.6	69.2	96.5	69.2
Giblets	6.64	6.57	6.55	6.56	6.58	5.80	5.94	5.98	6.09	5.91
Liver %	2.78	2.77	2.79	2.82	2.79	2.25	2.30	2.33	2.34	2.34
Heart %	0.46	0.45	0.46	0.47	0.46	0.45	0.45	0.46	0.52	0.49
Dressing percent**	76.2	75.9	75.2	75.0	75.6	74.8	75.5	75.2	75.6	75.3
Total edibile meat %	64.2	64.1	63.8	63.2	63.8	62.8	63.0	64.4	63.6	63.2

* Including neck
** Including skin.

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BODY GROWTH OF CHICKS FED ON RATIONS SUPPLEMENTED WITH DESSICATED THYROIDS, POTASSIUM IODIDE AND L–THYROXINE AND REARED UNDER HIGH ENVIRONMENTAL TEMPERATURE.

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SUMMARY

Four groups of one–day old Lohman chicks were fed for fifty six days a broiler ration (control), supplemented with 0.9 ppm of dessicated thyroid, 5 ppm L–thyroxine or 125 ppm iodide as potassium iodide. Chicks were reared in cages at temperatures ranged from 35.4 to 37.5 C . Loss of body weight ($p < 0.05$) occured after 14 days post–feeding of L–thyroxine, while body weight gain was recorded at 28 ($p < 0.01$), 42 and 56 ($p < 0.05$) days post feeding of potassium iodide. Respiratory rate was unchanged in all groups of chicks except decrease ($p < 0.05$) recorded after 28 days post feeding of dessicated thyroids. Rectal temperature was unchanged. Twenty eight days post feeding of potassium iodide and 42 and 56 days of feeding either potassium iodide or L–thyroxine, weight of paired thyroids was depressed ($p < 0.01$).

The latter finding could be attributed to the depressed level of thyroid–stimulating hormone caused by L-thyroxine and potassium iodide.

الخلاصة

لقد ربيت اربعة مجاميع من افراخ هجين نيكلز ابتداء من عمر يوم واحد ولغاية ٥٦ يوماً على خلطة فروج لحم قياسية (مجموعة السيطرة) ، مضافاً اليها ٠,٩ جزء بالمليون من مسحوق الغدة الدرقية ، ٥ أجزاء بالمليون من ل ـ ثايروكسين و

١٢٥ جزء بالبليون من اليود على هيئة يوديد البوتاسيوم . لقد تمت تربية الافراخ في الاقفاص حيث تراوحت درجة الحرارة بين ٣٥,٤ ـ ٣٧,٥°م .

لقد حصلت خسارة معنوية في الوزن بعمر (١٤) يوماً بعد اضافة ل ـ ثيروكسين الى العليقة ، فيما سجلت زيادة معنوية في الوزن بعمر ٢٨ و ٤٢ و ٥٦ يوماً من جرّاء اضافة يوديد البوتاسيوم .

لم يحدث تغير محسوس في درجة حزارة الفتحة المشتركة وفي سرعة التنفس بين المجاميع المختلفة ، فيما عدا نقص معنوي في سرعة التنفس بعمر ٢٨ يوماً من جراء اضافة مسحوق الغدة الدرقية . ولوحظ كذلك نقص معنوي في وزن الغدة الدرقية بعد ٢٨ يوماً من تغذية يوديد البوتاسيوم و ٤٢ و ٥٦ يوماً من تغذية يوديد البوتاسيوم او ل ـ ثايروكسين .

INTRODUCTION

Feeding iodinated casein had qualitatively similar effect to that of thyroxine (T_4) and / or tri-iodotyronine (T_3) given to various species by any route (Srivastava and Turner, 1967). The purpose of giving iodinated casein is presumably to elevate blood level of thyroid hormones and thus produce a state of hyperthyroidism. Dessicated thyroids obtained from abbatoirs could serve as a cheaper source of T_3 and T_4; nevertheless, it has not been widely employed for the purpose of promoting body growth of chicks. Iodine requirement for feeding chicks varied according to the rearing temperatures (May, 1974; Rogler and Parker, 1978).

Studies of iodine requirement at temperatures exceeding 35 C could not be traced in the available literature.

The present study aimed to find out the effect of adding dessicated thyroids, potassium iodide and L–thyroxine to standard broiler ration on body growth and some physiologic phenomena of chicks reared under high environmentel temperatures (35.4–37.5C).

MATERIALS AND METHODS

Recently hatched Nichol chicks were randomly assigned to four groups of 100 chicks each, and housed in battery brooder; numbers in compartments were adjusted to increasing age of the birds by randomly removing birds to be sacrificed from all compartments at any one time.

The first group (control) received a standard broiler ration containing 22% protein, 3100 K cal. of M.E. and 75 ppb iodine/1 kg ration. The experimental groups recieved the controled ration supplemented with 0.9 ppm of dessicated thyroids, 5 ppm L–thyroxine and 125 ppb iodine as potassium iodide, respectively.

At two– week interval, the followings were recorded: body weight, respiratory rate, oxygen consumption and rectal temperature for individual chicks as well as feed consumption for each group. After recording, 10 chicks were randomly sacrificed from each group and the thyroid glands, heart, lungs and liver were extirpated and weighed.

Oxygen consumption was measured with the chick in a closed chamber containing air and soda lime as a CO_2 and H_2O absorbant. The chamber was attached to a U–shaped volumetric tube filled colored water. Three readings of two minutes each were averaged and the volume of oxygen consumed / minute was recorded for each chick.

For each parameter, means recorded at any interval were compared with its respective control, according to Steel and Torrie (1960).

RESULTS AND DISCUSSION

Rectal and cage temperatures:

Air temperature is shown in Table 1. It ranged from 35.4 to 37.5 C. Rectal temperature was between 41.3 and 42.5 C (Table 2). Due to the thermo–regulatory system of the chicks, variation in temperatures inside the batteries at the different periods of measurements failed to influence rectal temperature. Different treatments, as well, could not change the body temperature.

Body weight:

Body growth was depressed ($P < 0.05$) at 14 days of feeding L–thyroxine to chicks (Table 3). Excessive thyroxine were shown to decrease growth rate (Singh *et al.*, 1968, Falconer, 1971), especially under such high temperature condition. On the other hand, potassium iodide given at a rate which provided 125 ppb,improved the growth of the chicks at days ($p < 0.01$), 42 and 56 ($p < 0.05$) postfeeding. Previous experiments revealed that 75 ppb of iodine was required for maximal growth of chicks under normal rearing conditions (Creek *et al.*, 1957, Rogler & Parker, 1978). However, at least 150 (Creek *et al.*, 1957) and 300 ppb (Rogler and Parker, 1978) were needed for normal thyroid size and histology, respectively.

Feed conversion:

The efficiency of feed conversion was best for chicks received potassium iodide followed by L–thyroxine (Table 4). Chicks fed with the control ration supplemented with desicated thyroids were least efficient in feed

conversion. The highest rate of body growth and efficiency of feed conversion in chicks received 123 ppb iodide in its ration, which signifies the importance of adding iodine to the ration of broilers reared under high temperatures. Table 4 also revealed that mortality rate throughout the experimental period ranged from 6 to 11% for the four groups.

Respiratory rate:

Respiratory rate remained unchanged in all groups throughout the experimental period (Table 5).

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TABLE 1. Air temperature inside battery brooders throughout the experimental period (C).

Treatment	Age (days) 1	14	28	42	56
Control	35.5	35.5	37.5	36.5	36.4
Dessicated thyroids	35.5	35.5	37.5	36.5	36.4
L–thyroxine	35.4	35.5	37.2	36.0	36.0
Potassium iodide	35.4	36.0	37.5	36.0	36.0
Average	35.45	35.62	37.42	36.25	36.20

TABLE 2. Rectal temperature of chicks (C) at different ages and treatments.

Treatment	Age (days) 14	28	42	56
Control	41.3 ± 1.1	42.5 ± 1.8	41.8 ± 2.5	42.0 ± 1.1
Dessicated thyroids	41.6 ± 1.7	41.4 ± 2.4	42.0 ± 2.2	41.9 ± 1.0
L–thyroxine	41.3 ± 1.2	42.1 ± 2.4	42.0 ± 1.8	42.3 ± 1.9
Potassium iodide	42.1 ± 0.4	42.2 ± 2.3	42.0 ± 2.0	41.8 ± 2.8

Values are given as mean ± standard error (10 chicks/treatment). Means are insignificantly different ($p > 0.05$).

Table 3 . Body weight (g) of chicks at different ages and treatments.

Age (days)	Control Mean ± SE	N	Desicated thyroids Mean ± SE	L – thyroxine N	L – thyroxine Mean ± SE	Potassium Iodide N	Potassium Iodide Mean ± SE	Potassium Iodide N
1	39.8 ± 0.21	(100)	40.0 ± 0.1	(100)	39.5 ± 0.3	(100)	39.8 ± 0.2	(100)
14	178.2± 2.0	(90)	182.0± 2.0	(88)	17.6 ± 1.7*	(88)	182.6 ± 1.8	(90)
28	460.0 ± 6.0	(78)	450.9 ± 4.6	(77)	464.0 ± 4.6	(76)	493.5 ± 5.2**	(80)
42	700.1 ± 12.8	(68)	714.6 ± 13.1	(67)	701.5 ± 14.0	(62)	744.0 ± 9.7*	(70)
56	896.3 ± 24.8	(52)	925.5 ± 22.4	(54)	925.0 ± 23.1	(49)	955.1 ±15.1*	(54)

Means with asterisks (*,**) are sificantly different from their controls within the same age at $P < 0.05$ and $P < 0.01$ respectively.

TABLE 4. Mean body weights and feed conversion of chicks at 56 days of age, and the mortality rate throughout the experimental period.

Item	Treatment Control	Dessicated thyroids	L– thyroxine	KI
Body weight (g) ± SE	896.3 ± 24.8	925.5 ± 22.4	925.0 ± 23.1	955.1 ± 15.1*
Feed conversion:				
Kg feed/Kg B.wt.	3.183	3.251	2.997	2.718
%	100.0	10.1	93.5	85.4
Mortality (%)	8	6	11	6

* $P < 0.05$.

TABLE 5. Respiration rate (per minute) of chicks at different ages and treatments.

Treatment	Age (days) 14	28	42	56
Control	63.4 ±,3.6	68.3 ± 6.4	62.3 ± 10.1	47.3 ± 2.6
Desicated thyroids	65.4 ± 3.8	54.0 ± 1.3	57.7 ± 2.4	52.7 ± 2.5
L-thyroxine	58.9 ± 1.8	58.8 ± 3.4	47.7 ± 5.4	55.4 ± 3.4
Potassium Iodide	61.9 ± 5.4	70.7 ± 2.3	50.5 ± 6.0	54.6 ± 9.4

Values are given as mean standard error (10 chicks/ treatment group). The mean with an asterisk (*) is significantly different ($p < 0.05$) from its respective control within the same age.

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CATION EXCHANGE CHARACTERISTICS OF SOME ALLUVIAL SOILS OF IRAQ

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SUMMARY

Sodium–Calcium+Magnesium exchange studies were conducted on surface soil samples representing some alluvial soiils of the middle and the southern parts of Iraq. Isoconcentration isotherms were constructed at different electrolyte concentrations, i.e., 100, 500, and 1000 me./L. Selectivity cofficients and Gapon exchange constant were also calculated for these soils.

The results showed that these soils have a relatively high preference for calcium+magnestum than sodium ions, but less than that of the tropic soils for the same cations. The values of Gapon exchange constant are not strictly constant. The average value obtained for Gapon constant is about 19.10^{-3}.

Comparisions among the affinity of the soils studied for sodium adsorption showed that these soils are not significantly different in this respect. However, they can be arranged in the following order based on magnitudes of relative affinity for sodium adsorption:

Amarah > Fudialia > Al–Dawia > Mussiab

The results obtained in this work have practical and theoretical value for better understanding of the relationships between different cations namely sodium, calcium and magnesium, and the solid phase of the soil during leaching and irrigation.

خصائص التبادل الكاتيوني في بعض الترب الرسوبية في العراق

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الخلاصة

لقد درست في هذا البحث طبيعة التبادل الكاتيوني بين الكاتيونات الاحادية الشحنة (الصوديوم) والكاتيونات الثنائية الشحنة (الكالسيوم + المغنسيوم) في اربعة نماذج ترب ممثلة لمعظم الترب الرسوبية في وسط وجنوب العراق . حيث عوملت هذه النماذج ولحد الاتزان مع محاليل الكتروليتية مختلفة التركيز تحوي على خليط من هذه الكاتيونات بنسب مختلفة . وكانت التراكيز لهذه المحاليل في ثلاث مستويات هي ١٠٠ و ٥٠٠ و ١٠٠٠ ملي مكافيء / لتر ، اما نسبة الصوديوم ، الكالسيوم + المغنيسيوم فتراوحت في كل مستوى من ٠,١ ٤ الى ٩ ، ١ .

لقد اظهرت النتائج التي حصلنا عليها ان الترب المدروسة تتصف بتفضيل عالي بالنسبة الى امدصاص الكاتيونات الثنائية الشحنة بالمقارنة مع الصوديوم . الا ان هذا التفضيل هو اقل نسبياً من الترب الاستوائية الحاوية على نسبة عالية من الكاولينايت واكاسيد الحديد . كما حسبت من النتائج التي تم الحصول عليها ثوابت التبادل الكاتيوني حسب معادلة كابون وظهر لنا ان هذه الثوابت ليست ذات ثبوتية عالية في مجال التراكيز المدروسة وكمعدل كان ثابت التبادل الكاتيوني لكابون مساوياً الى ١٩ × ١٠ - ٣ ومثل هذه القيمة مقاربة للقيمة المقترحة من قبل مختبر الملوحة في الولايات المتحدة الامريكية والتي اقترحت على اساسها العلاقة التجريبية بين SAR و ESR

وعند المقارنة بين تفضيل الترب المدروسة لامدصاص الصوديوم ظهر ان هذه الترب لاتختلف كثيراً عن بعضها في هذا المجال . الا انه امكن ترتيبها من ناحية مدى تفضيلها لامدصاص الصوديوم بالشكل التالي ،

العمارة > الفضيلية > الدواية > المسيب

ان النتائج التي تم الحصول عليها في هذه الدراسة تحمل اهمية تطبيقية كبيرة بالنسبة لاستخدامات المياه المختلفة النوعية كما تساعدنا قيم الثوابت التي تم الحصول عليها في التنبؤ بمحتوى الكاتيونات المتبادلة للترب خلال عمليات الاستصلاح والاستغلال .

INTRODUCTION

Salt–affected soils in Iraq occupy about 70 per cent of the middle and the southern territory of the country. At rpresent it has become necessary to bring these soils into production by their reclamation. Leaching is one of the most important processes of this reclamation. One of the major factors governing the adsorption, desorption and removal of different cations during leaching is the selectivity of these soils for different cations.

As a follow up to the information published earlier (Alzubaidi and Hardan, 1972), concerning the competition between sodium and calcium on exchange sites during leaching of some soil samples from Amiria. the present study is done to give more detailed information about cation exchange equilibria of Iraqi soils.

MATERIALS AND METHODS

Four alluvial soil samples (0–30 cm), representing different locations of the middle and the southern parts of Iraq were used in this study. Soil samples were collected from the following locations : Fudailia, Amarah, Al–Dawla and Mussiab. F, AM, AD and M are used in this study to represent these locations.

Soil samples were air dried, ground and sieved through a 2mm sieve for the experiement and analysis. Chemical properties and particle size analysis of these samples are shown in Table 1. Methods of analysis used in this work are similar to those described in USDA Handbook No. 60 (1954).

Eighteen glass columns (15 cm height and 4 cm diameter) were packed with soil from each of these soil samples. Then soil samples were leached with different salt solutions containing a mixture of NaCl, $CaCl_2$, and $MgCl_2$

at different levels of concentration which are 100, 500 and 1000 me./L. S_1, S_2 and S_3 are used in this paper to represent these levels respectively. Each level of concentration consist of six different solutions with different Na/Ca+Mg ratios. Table 2 shows the composition of applied solutions. Each of six soil columns were leached with one level of concentration of soil columns were continued until the applied and effluent solution had the same composition. Then the soil columns were leached with ethanol to remove the excess soluble salts, and were analysed for exchangeable cations. All treatments were duplicated.

RESULTS AND DISCUSSION

Ion Exchange Isotherms:

Ion exchange equilibria according to Helfferich (1962) can be described by ion exchange isotherms, which show the ionic compostions of the exchangers as a function of the experimental conditions. Using the obtained data from this study and plotting the equivalent fractions of soluble calcium+magnesium versus their equivalent fractions in solid phase of soil samples. Figures 1–4 were obtained. The effect of total concentration for the preference of calcium+magnesium of the studied soil samples can be easily observed in these/figures.

From these figures, one can also easily conclude that the studied soil samples have a high preference for calcium+magnesium over sodium ions. Moreover the preference for calcium+magnesium increases as total concentration of solution decreases. This reflects the valence–dilution effect (Reeve and Doering, 1966; Scofield 1947).

The four soil samples showed almost the same affinity for calcium+magnesium when the same level of concentration and the same Na / Ca + Mg ratio were considered. This indicates the similarity of mineralogical composition of these soils, because the preference value of any soil for any cation is determined by the mineralogical composition of the exchange complex (Bolt and Bruggenwert 1976; El–Swaify and Swindal, 1970).

It is of interest to compare the ion exchange isotherms obtained in this study with those obtained El – Swaify and Swindal (1970) for tropic soils from Hawaii, Molokai and Kwahai, which consist mainly of kaolinite and iron oxides. Plotting the average for exchange isotherm of the four studied soil samples together with these for Molokai and Kawahae soil at the level of 0.1 N of total concentration Figure 5 was obtained. From this Figure, the following conclusion can be made : the affinity of Molokae and Kawahae soil for divalent cations is higher than the affinity of Iraqi soil for the same cations. This can be expialned on the basis of difference in mineralogical composition of these two groups of soils. The relatively high affinity of the tropic soils for divalent cation seems to be caused by the presence of kaolinite and iron oxides which are dominant in these soils. Wherease, relatively less affinity of Iraqi soils for divalent cations is connected with the presence of montmorillonite and illite minerals, which are the dominant minerals of most Iraqi soils (Al–Rawi *et al*, 1969).

Selectivity Coefficients:

Ion exchange equilibria can also be characterized by selectivity coefficients which quantitatively describe the soil preference for divalent cations (Ca+Mg) over sodium in each point of the ion exchange isotherm points. Therefore the rational coefficients (N^{Ca+Mg}_{Na}) were calculated according to the following equation proposed by Helfferich (1962) and successfully used by El– Swaify and Swindal (1970) for the soil study.

$$N^{Ca+Mg}_{Na} = \frac{\frac{Q_{Ca+Mg}}{Q_O}\left(1 - \frac{C_{Ca+Mg}}{C_O}\right)^2}{\frac{C_{Ca+Mg}}{C_O}\left(1 - \frac{Q_{Ca+Mg}}{Q_O}\right)^2}$$

Where:

C_0 and C_{Ca+Mg} means total and Ca+Mg concentration in me./L

Q_0 and Q_{Ca+Mg} means cation exchange capacity and exchangeable calcium+magnesium in me./100 gm soil.

Table 3 shows the values of selectivity coefficients of calcium+magnesium for the studied soil samples. These values substantiate the above mentioned fact, that the studied soil samples have high preference values for calcium+magnesium over sodium. However, the values of the selectivity coefficients vary with total concentration of applied solutions and with Na/ Ca+Mg ratios. Selectivity coefficient increases as the total concentration decreases. This is attributed, as mentioned above, to the valence–dilution effect.

The obtained values for selectivity coefficients can be used as a good guide for evaluating the guality of irrigation water which may be used for irrigation and reclamation of these soils.

Gapon Exchange Constant:

Cation Exchange constant or some times call the practical selectivity coefficient is usually calculated for salinity studies by the following Gapon eguation type (Fiskell, 1971; USDA Handbook No 60):

$$K_G = ESR/SAR$$

Where:

K_G means Gapon constant.

$$ESR\ (Exchamgeable\ Sodium\ Ratio) = \frac{Na_{ex.}}{Ca_{ex.} + Mg_{ex.}}$$

$$SAR(Sodium\ Adsorption\ Ratio) = \frac{Na_{sol.}}{\sqrt{\frac{Ca_{sol.} + Mg_{sol.}}{2}}}$$

ex. and sol. means exchangeable and soluble.

Table 4 shows the values of Gapon constant obtained in this study. The values of K_G as shown in this table are not strictly constant, and varies with sodium saturation percentage. K_G Values vary from 8.10^{-3} to 36.10^{-3}

While the average value is 19.10^{-3} This value is very close to the value obtained for soil samples from Amiria by Alzubaidi and Hardan (1972) and also by U.S. Salinity Laboratory Staff (1954).

Figures 6–9 show the relationships between the values of Gapon constant and of sodium saturation percentage of the studied soil samples. The values of K_G decrease in the beginning when sodium saturation percentage vary between 0 to 10 ; at higher concentration the K_G values increase with the increase of sodium saturation percentage. The change of values K_G with the change of sodium saturation percentage values were noticed by several workers (Fiskel. 1971; Fiskel and Reneau Jr, 1970; Laerwerff and Bolt, 1959), Particulary in montmorillonitic soils. This may be caused by the heterogeneity of exchange complex sites of the soil (Talibudeen, 1972).

The test of the linear relationships between SAR and ESR values, for studied soil samples (Figure 10), showed a good linear correlation (r=0.98). These soils show the same slope at the low SAR values (less than 50), while above this value, little differences in the slopes can be noticed. This indicates the similarity of the mineralogical composition of these soils. Therefore, it is possible to suggest the same regression eguation for these suoils, particularly, at low SAR values (less than 50).

Table 5 shows the average K_G values for the studied soils. although the K_G values not differ significantly among the studied soils. In general, the following order based on magnitudes of the relative affinity for sodium adsorption can be given according to the obtained data:

$$AM > F > AD > M$$

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Table 1. Chemical properties and particle size analysis of soil samples.

Properties	Fudialiah F	Amarah AM	AL–Dwia AD	Mussiab M
Particle size analysis				
Sand %	47.1	34.4	36.2	50.0
Silt %	26.5	29.1	33.8	31.5
Clay %	26.5	36.5	29.7	17.7
CEC me./100 gm of Soil	14.5	17.5	20.8	21.0
CEC me./ 100 gm of Clay	46.3	43.7	58.3	110.6
EC mmohos/cm	6.3	42.0	4.5	5.00
pH	7.9	7.9	7.9	8.3
o.M %	0.91	0.02	1.05	0.57
Lime %	31.3	26.6	26.4	31.8
gypsum %	0.00	1.35	0.00	0.00
Exchangeable cation me./100 gm				
Na	2.02	7.80	1.56	1.20
K	0.84	0.96	2.07	1.10
Ca+Mg	11.64	8.74	16.37	18.70
ESP	13.9	44.5	7.80	5.7

Table 2: The composition of applied solutions used for equilibration.

Solution No.	Concentration level	Total Concentration (C_0)	Concentration me./L C_{Na}	of cations C_{Ca+Mg}	Na/Ca+Mg	SAR	Equivalent Fraction of Ca+Mg $C_{Ca}+Mg$: C_{Na}
1	S_1	100	20	40+40	1:4	3.16	0.80
2			33.3	33.3+33.3	1:2	5.75	0.67
3			50	25+25	1:1	10.00	0.50
4			66.6	16.6+16.6	2:1	16.26	0.33
5			80	10+10	4:1	25.24	0.22
6			90	5+5	9:1	40.18	0.10
7	S_2	500	100	200+200	1:4	7.07	0.80
8			166	166+166	1:2	12.89	0.67
9			250	125+125	1:1	22.36	0.50
10			334	83+83	2:1	36.22	0.33
11			400	50+50	4:1	56.58	0.22
12			450	25+25	9:1	90.00	0.10
13	S_3	1000	200	400+400	1:4	10.0	0.80
14			333	333+333	1:2	18.7	0.67
15			500	250+250	1:1	31.61	0.50
16			666	166.5+166.5	2:1	51.67	0.33
17			800	100+100	4:1	80.00	0.20
18			900	50+50	9:1	126.94	0.10

Table 3. Selectivity coefficient of studied soil samples for Ca+Mg versus. Na

Solution No.	Selectivity coefficient			
	F	AM	AD	M
1	7.19	7.19	7.19	13.06
2	14.96	10.15	12.33	18.68
3	18.89	14.36	18.89	18.89
4	17.95	17.95	16.32	19.80
5	19.62	16.98	18.27	16.98
6	20.67	19.43	18.28	20.67
7	7.9	3.06	7.19	2.24
8	18.26	7.13	14.63	8.37
9.	6.60	1.00	1.12	6.00
10	4.47	6.26	5.48	5.46
11	3.35	4.24	3.77	5.35
12	4.10	4.10	4.855	5.61
13	3.13	5.62	7.19	7.19
14	4.67	3.65	8.37	7.13
15	3.32	1.00	2.85	5.01
16	2.02	2.02	4.19	2.89
17	2.50	1.82	2.50	1.42
18	2.35	2.17	0.88	2.53

Table 4 Gapon exchange constant of studied soil samples.

Solution No.	Gapon Exchange constant K_G			
	F	AM	AD	M
S_1 1	0.026	0.028	0.027	0.020
2	0.020	0.024	0.022	0.018
3	0.018	0.020	0.017	0.018
4	0.019	0.020	0.020	0.019
5	0.019	0.022	0.021	0.021
6	0.022	0.022	0.023	0.022
S_2 7	0.013	0.019	0.012	0.012
8	0.016	0.013	0.010	0.011
9	0.018	0.011	0.010	0.015
10	0.010	0.016	0.018	0.017
11	0.028	0.024	0.025	0.025
12	0.031	0.031	0.031	0.031
S_3 13	0.012	0.009	0.009	0.009
14	0.012	0.009	0.009	0.009
15	0.015	0.009	0.012	0.012
16	0.014	0.032	0.019	0.019
17	0 .24	0.030	0.037	0.037
18	0.034	0.036	0.031	0.031

Table 5: Average K_G values for studied soils.

Soil	K_G
AM	0.0208
F	0.0206
AD	0.0196
M	0.0192

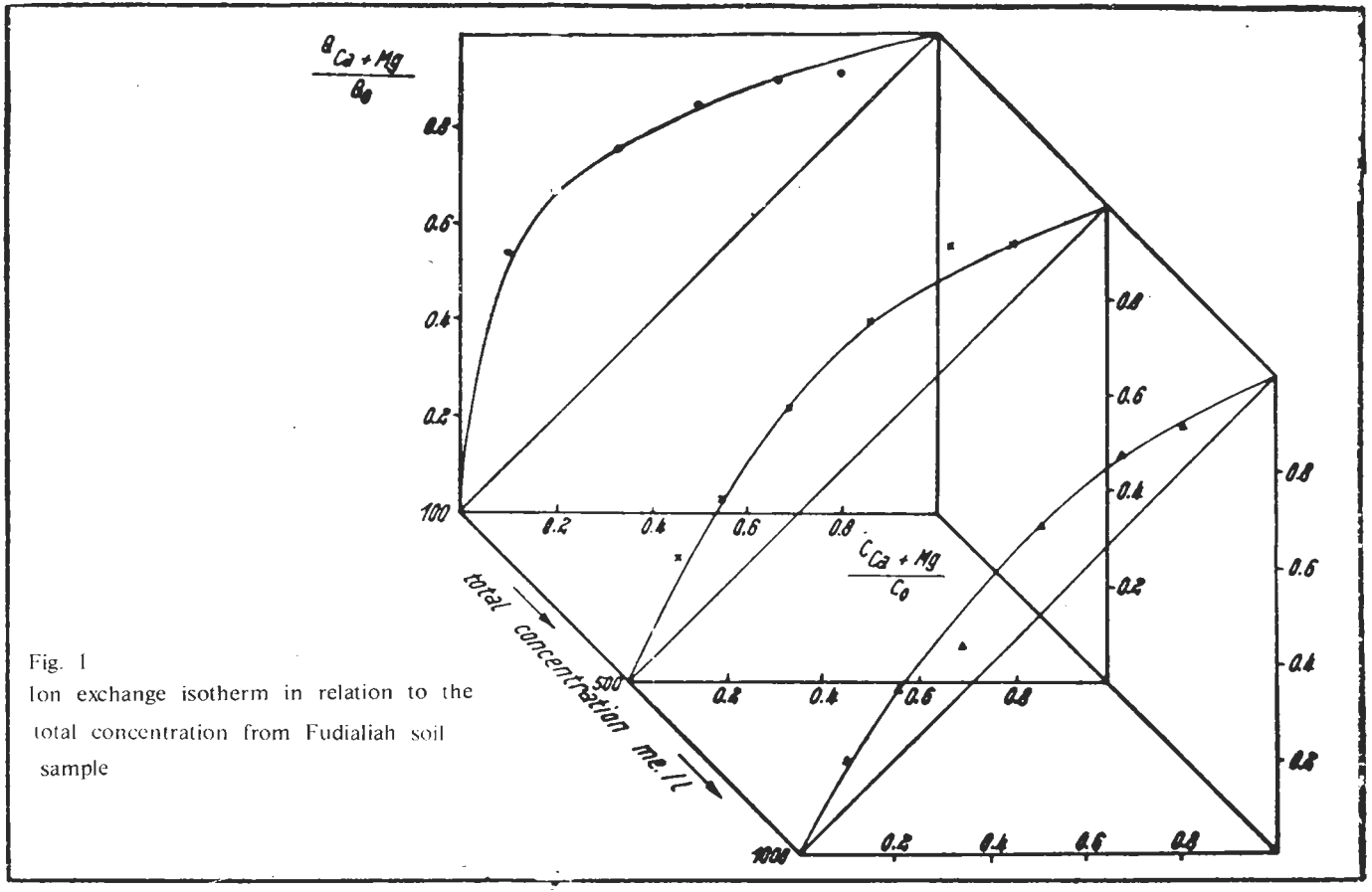


Fig. 1
Ion exchange isotherm in relation to the total concentration from Fudialiah soil sample

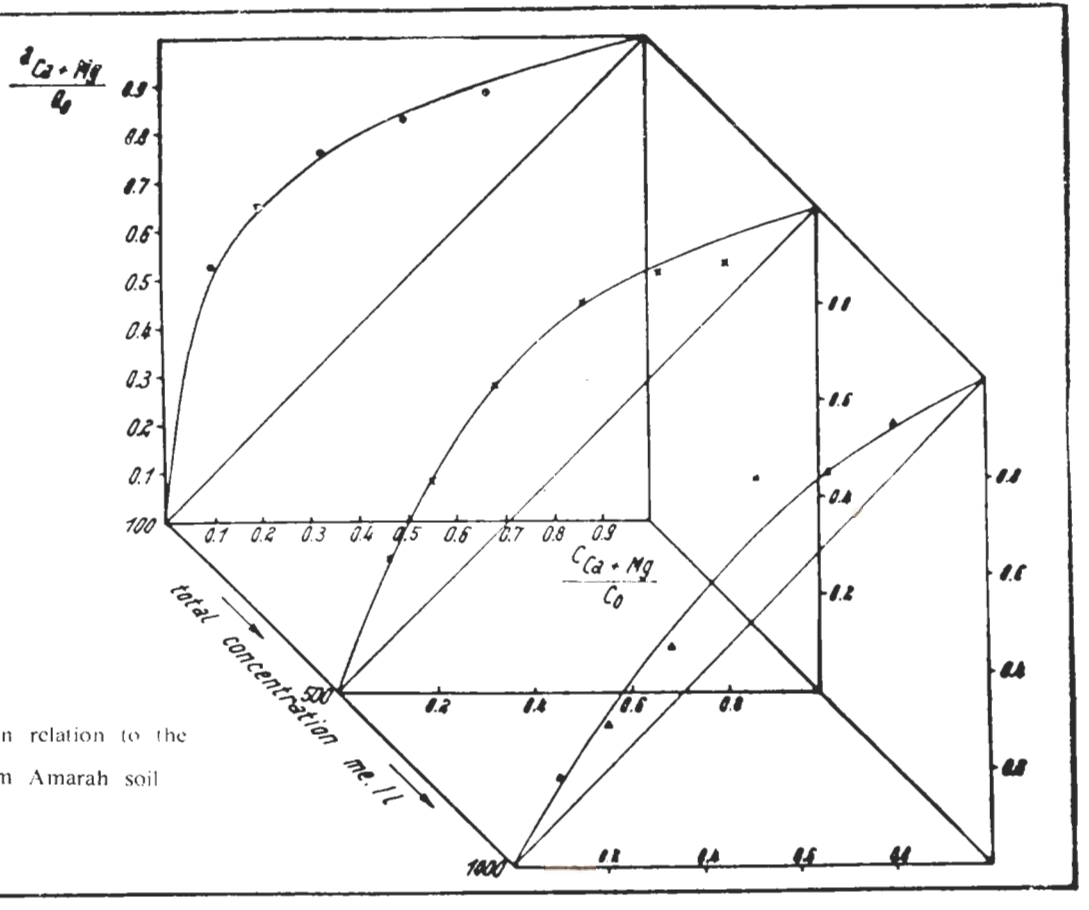


Fig. 2
Ion exchange isotherm in relation to the total concentration from Amarah soil sample

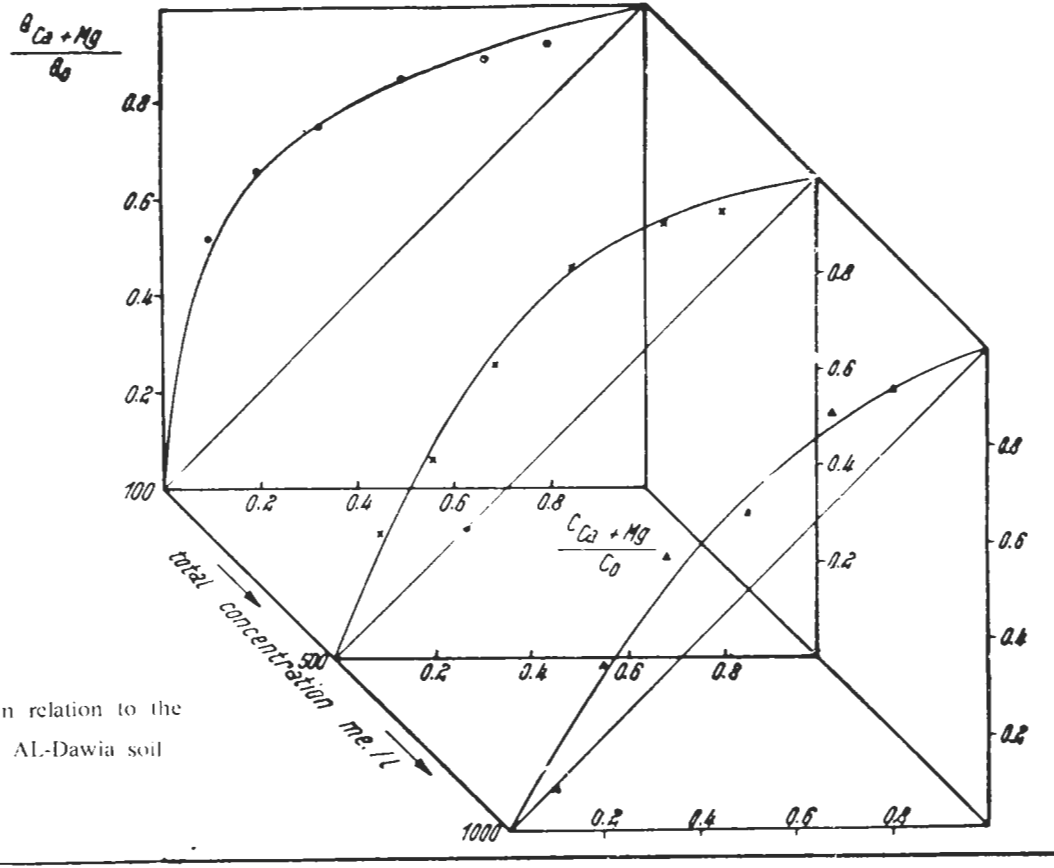


Fig. 3
Ion exchange isotherm in relation to the total concentration from AL-Dawia soil sample

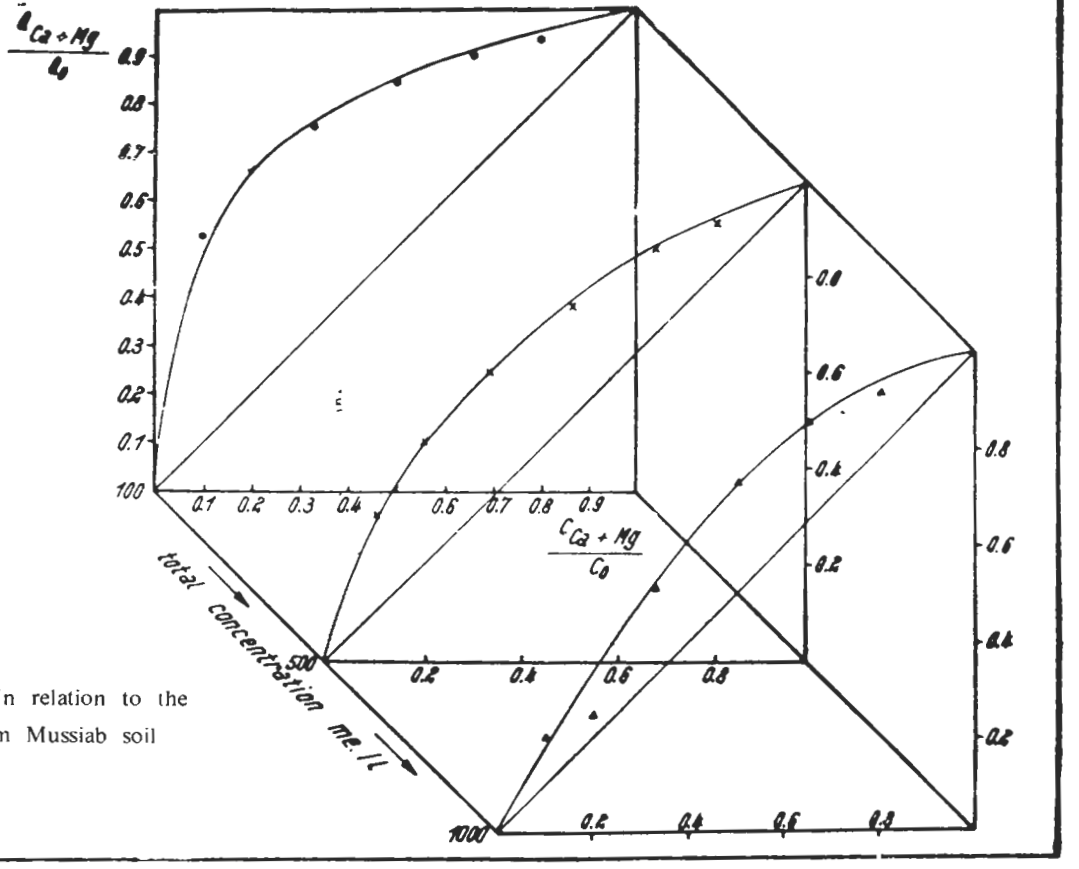


Fig. 4
Ion exchange isotherm in relation to the total concentration from Mussiab soil sample

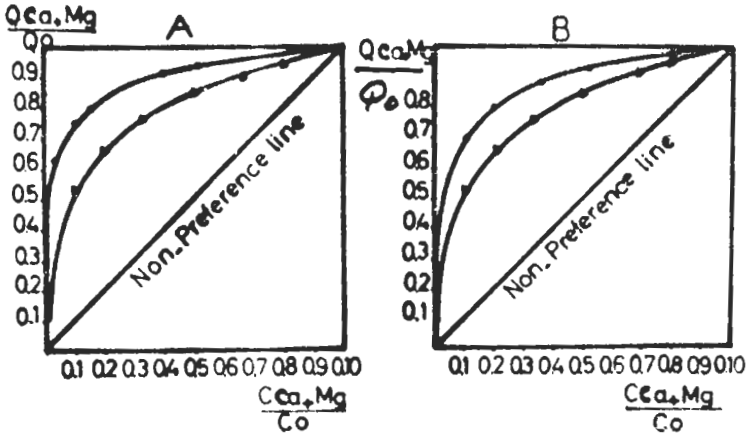
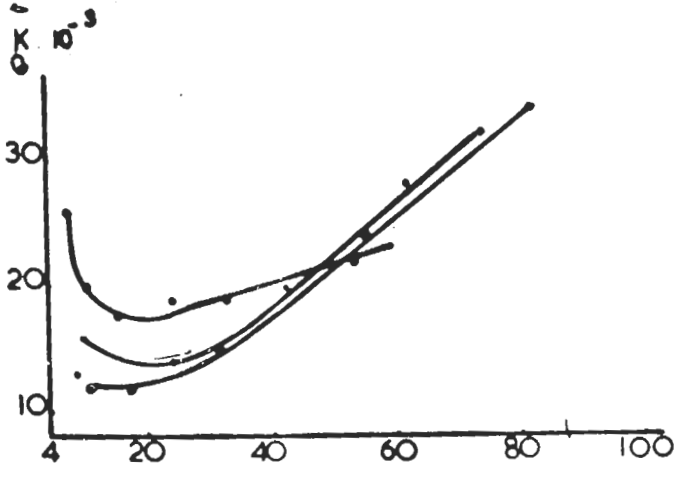


Fig (5) Ion Exchange Isotherm for Iraqi soils two tropic soil .
A. Ion Exchange Isotherm for Iraqi soils ——— & Molokai soil - - - at o.1N.
B. Ion Exchange Isotherm for Iraqi soils ——— & Kawahae soil——— o. 1N.



Sodium Saturation percentage

Fig. (6) The relationship between Gapon constante & Sodium saturation percentage for Fudialiah soil.

——— at S_1 level of concentration.
——— at S_2 level of concentration.
——— at S_3 level of concentration.

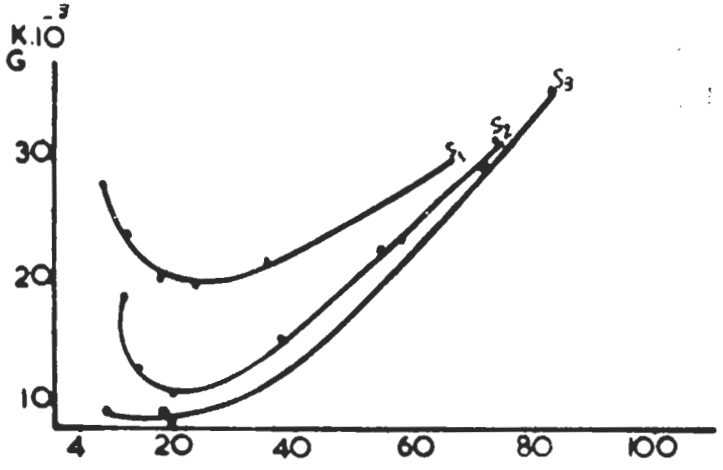


Fig. (7) The relationship between Gapon constante & sodium saturation percentage for Amarah soil

- at S_1 level of concentration.
- at S_2 level of concentration.
- at S_3 level of concentration.

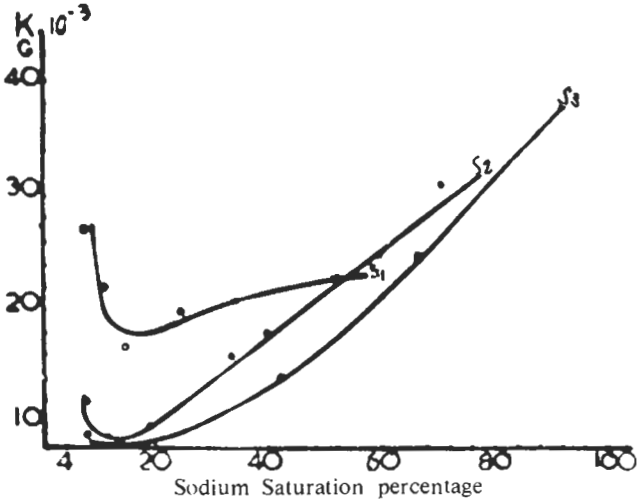
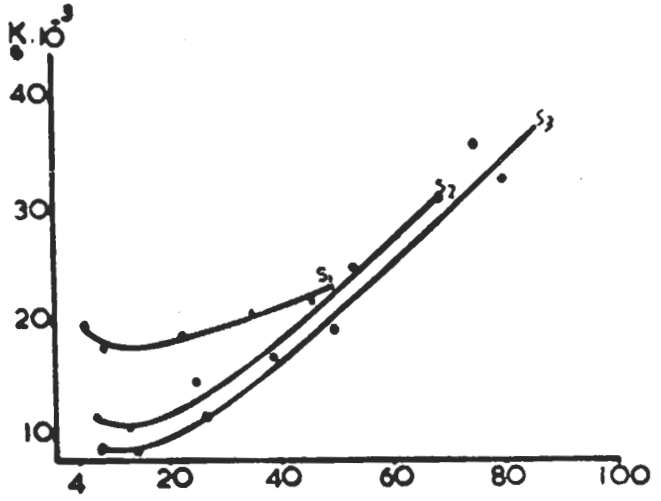


Fig. (8) The relationship between Gapon constante & sodium saturation percentage for AL-Dawia soil.

- at S_1 level of concentration.
- at S_2 level of concentration.
- at S_3 level of concentration.



sodium Saturation percentage

Fig. (9) The relationship between Gapon constante & sodium saturation percentage for Mussiab soil.

—o— at S_1 level of concentration.
—o— at S_2 level of concentration.
—o— at S_3 level of concentration.

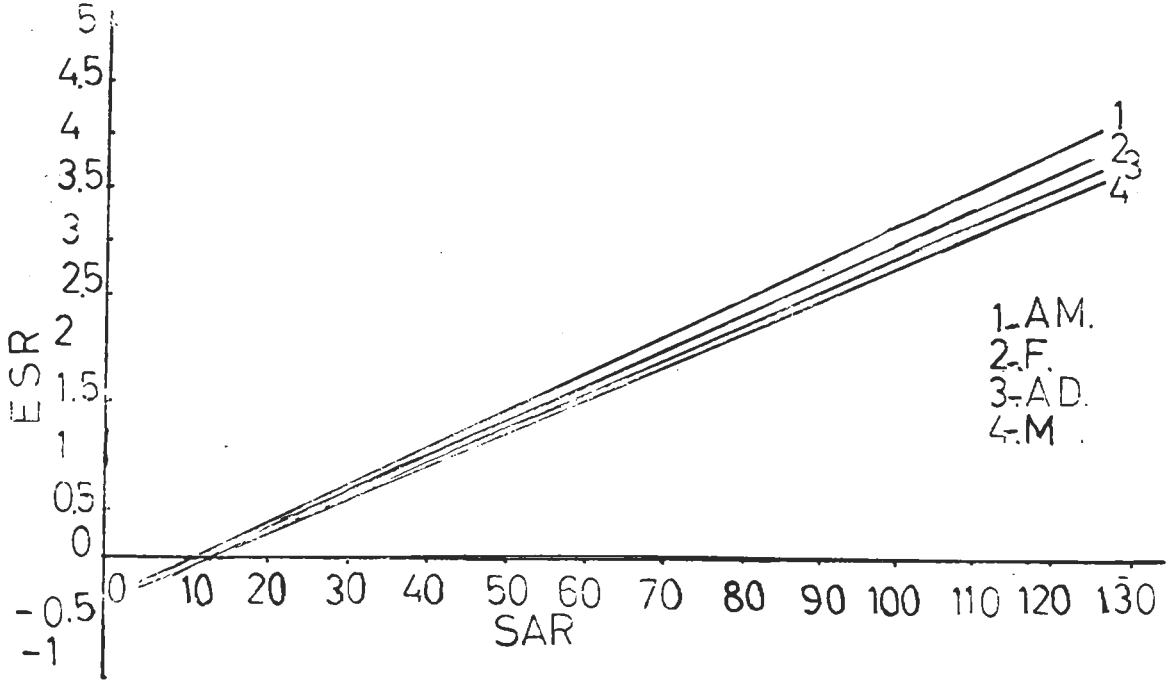


Fig.(10) The linear relation-ship between SAR and ESR for the studied soils samples.

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THE MOST EXTENSIVE SOIL CATENA IN AMERIYAH COLLEGE FARM*

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SUMMARY

Ameriyah College Farm was covered with a semi-detailed soil survey using a topographic map of 1:5000 scale. Mapping units were obtained from Al-Agidis proposed soil classification at the series level for the Iraqi Alluvial Soils. No complete catena was encountered in the area. Soil series in interrupted catenas were encounterred in various directions, and two sets of most extensive catenas were aligned somewhat parallel to each other.

A complete soil characterisation was made for each soil series that include, PSd, pH, EC, ESP, lime, gypsum, O.M, phosphorus and major cations to reveal their genesis. Characterisation was made preceeded by morphological studies and ended with the placement of these soils within the American Soil Taxonomy.

الخلاصة

غطيت مزرعة الكلية في العامرية بمسح شبه تفصيلي باعتماد خارطة طوبوغرافية بمقياس $\frac{1}{5000}$ كاساس وباستخدام وحداث خارطة مأخوذة عن تصنيف الترب الرسوبية العراقية للعكيدي عند مستوى السلاسل . لم تلاحظ كاملة في ارض المزرعة . بينما لوحظت سلاسل تنتظم في كاتينات مقطوعة وباتجاهات مختلفة من حيث انتظامها . وبرزت كاتينتين غير كاملة بصورة توازي الواحدة الاخرى نوعها . ولقد جرى توظيف كامل لكل سلسلة من هذه السلاسل اشتمل على

*Part of master thesis in soil science, submitted by the first author to the College of Agriculture, University of Baghdad 1975.

التوزيع الحجمي للدقائق ودرجة التفاعل والتوصيل الكهربائي والنسبة المئوية للصوديوم المتبادل ونسبة الكربونات ونسبة الجبس والمادة العضوية والفسفور والقواعد الرئيسية لكشف وراثة هذه الترب . سبق هذا التوصيف توصيف مورفولوجي وتبعة تصنيف لهذه الترب في النظام الامريكي لتصنيف التربة .

INTRODUCTION

Catena was originally suggested by Milne (1939). Catenary groupings are widely used in developing soil keys in various countries due to abrupt local changes in relief, and loss easily developed genetic inferences. Two or more intricately related members of Catena can be designated in a geographic unit as a catenary complex or a catenary soil association (Radwenski and Ollier, 1959). Stunt soil survey works in Iraq and particularly those involved with alluvial soils need to be modified after the standerisation of mapping, characterization and interpretation.

Characterization is a documentation of soil properties with the intention of giving adequate information for both classification and interpretation.

This paper deals briefly with genesis and morphology of the extensive mapping units in Ameriyah College Farm followed by a discussion of fundamental characterisation of the major mapping units, physically, chemically, and morphologically.

Soils of Ameriyah College Farm (12 Km. NW. of Baghdad) represent the usual saline alkali soil cover. These soils are of Fluviatile origin. Their parent material are eroded, transported and deposited by the Euphrate's river system.

MATERIALS AND METHODS

Ameriyah College Farm is covered with a semi-detailed soil survey. Free soil survey procedure was used. Delineations were made according to microvariations in soil forming factors. Auger holes were bored and morphology was described for mapping units according to USDA soil survey standards (1951) and classified according to Al-Agidi's (1975) proposed soil classification of the Iraq alluvial soils at the series level.

Most extensive mapping units were recognized on area basis, and a pair of interrupted (incomplete) catena members were chosen for our study. Upon characterization both mapping and taxonomic units were further evaluated and perfected.

The following determinations were carried out on samples collected from all horizons (Table 1). Mechanical analysis was made by the hydrometer

Table 1. Physical and Chemical Characteristics of Soils of A'Ameriyah College Farm.

	Depth in cm	Particle Size Dis. Sand%	Sitt%	Clay%	Class	pH	Ece mmoh/	ESP	EPP	Lime %	Gyp.meq. /100gm/	O.M.%
Abu-Munaiser Series	0-35	19.0	38.0	43.0	Clay	8.0	1.5	0.9	0.2	21.7	nil	1.13
	35-65	17.0	36.0	47.0	Clay loam	7.9	1.8	3.6	0.9	21.9	nil	0.75
	65-170	21.0	32.0	47.0	Clay	7.7	7.5	4.7	0.8	21.1	1.0	0.55
	170-200	30.0	38.0	32.0	Loam	7.7	10.3	4.2	0.8	21.3	nil	0.35
	200-230	17.0	39.0	44.0	Clay	7.2	9.1	8.7	0.7	23.0	nil	0.31
	0-30	21.0	48.0	31.0	Clay loam	7.6	48.7	43.2	3.1	23.4	52.0	0.69
	30-85	20.0	48.0	32.0	Clay loam	27.2	20.8	34.0	2.1	21.6	16.5	0.36
	85-155	15.0	30.0	55.0	Clay	8.5	17.2	30.7	1.1	25.8	26.0	0.43
Hikteriya Series.	155-180	19.0	32.0	49.0	Clay	8.8	17.0	29.2	1.5	26.0	57.0	0.92
	180-200	21.0	41.0	38.0	Clay loam	8.9	15.7	29.1	0.7	28.4	23.0	0.40
	200-240	9.0	42.0	49.0	Silt clay	8.3	12.8	14.2	0.5	50.0	96.0	0.43
Pawana Series	0-15	26.0	53.0	21.0	Silt loam	7.3	137.4	50.4	2.2	17.3	66.0	1.04
	15-40	24.0	54.0	22.0	Loam	7.4	40.4	12.4	2.0	27.7	78.0	1.38
	40-52	18.0	73.0	9.0	Silt loam	7.5	8.6	9.2	1.5	13.5	150.0	0.43
	52-81	16.0	65.0	19.0	clay loam	7.2	7.6	8.9	1.2	20.2	180.0	0.53
	81-91	14.0	65.0	21.0	Siltloam	7.3	6.1	8.8	1.3	20.3	86.0	0.50
	91-116	18.0	53.0	29.0	Silt clay loam	7.5	5.3	6.4	1.5	22.3	nil	0.43
	116-153	30.0	46.0	24.0	Loam	7.3	5.7	5.9	1.3	22.1	nil	0.38
	153-208	26.0	40.0	34.0	Clay loam	7.6	7.4	4.1	0.8	23.2	63.3	0.39
	208-222	18.0	51.0	31.0	Silt clay loam	8.1	6.3	3.7	0.6	23.8	nil	0.39

Nadireh Series	0–40	25.0	32.0	43.0	Clay	8.9	32.6	29.2	2.0	20.2	55.0	0.67
	40–95	19.0	40.0	41.0	Silt clay	9.0	17.7	21.8	1.2	21.9	38.0	0.44
	95–110	19.0	42.0	39.0	Clay loam	8.7	17.4	17.1	1.4	23.2	16.0	0.40
	110–155	17.0	42.0	41.0	Silt clay	8.0	20.4	24.4	0.9	24.1	23.0	0.35
	155–175	25.0	37.0	38.0	Clay loam	8.7	15.7	18.3	0.9	23.4	22.0	0.38
	175–205	20.0	30.0	50.0	Clay	8.9	13.4	19.4	1.1	26.5	55.0	0.54
Ahmedi Series	0–30	15.0	41.0	44.0	Silt clay	7.7	4.8	3.6	2.3	22.0	nil	0.7
	30–85	15.0	41.0	44.0	Silt clay	7.7	4.8	3.6	2.3	22.00	nil	0.7
	85–100	11.0	37.0	52.0	Clay	7.2	20.4	36.9	1.6	23.3	40.0	0.3
	100–122	21.0	37.0	42.0	Clay	7.6	21.8	40.9	1.5	25.0	34.0	0.5
	122–137	37.0	31.0	32.0	Clay loam	7.7	22.4	45.6	1.8	23.5	8.0	0.1
	137–148	59.0	23.0	18.0	Sandy loam	7.3	23.6	40.6	1.3	17.3	0.8	0.2
	148–205	27.0	43.0	30.0	Clay loam	8.7	27.0	50.6	0.9	22.1	22.0	0.4
Sadda Series	0-25	27.0	43.0	30.0	Clay loam	7.5	2.7	3.5	2.9	23.6	nil	1.21
	25-115	15.0	38.0	47.0	Clay	8.2	6.4	4.2	1.8	34.0	1.0	0.36
	115-1135	12.0	41.0	47.0	Silt clay	7.4	8.6	5.1	0.7	23.2	nil	0.24
	135-195	15.0	37.0	48.0	Clay	8.1	6.6	5.4	0.6	24.2	nil	0.37
	195-205	11.0	43.0	46.0	Silt clay	8.2	7.8	8.3	0.8	25.2	nil	0.25
	205-240	19.0	20.0	61.0	Clay	7.9	5.9	10.5	0.7	23.5	nil	0.46

method (Means and Parchar,1964). The method of analysis used for the ECe. is that recommended by U.S. Regional Salinity Labortary (1954). Soil reaction values were determined by means of Beckman electrode PH meter in extract of saturation paste. Exchangeable sodium percentage (ESP) and exchangeable potassium percentage (EPP) were determined by calculation method (by dividing exchangeable Na and K into Cation Exchange Capacity, C.E.C.).

Lime content was determined volumetrically by the method described in USDA Handbook 60 (1954). Values of Ec. were found by electrical conductivity bridge from extract of saturated paste.

Soluble calcium and magnesium were determined by Versenate method, sodium and potassium by flame photometer, and exchangeable cation extracts were determined by using ammonium acetate (USDA handbook 60, 1959). Organic matter by oxidation method while available P_2O_5 was determined by Fogg method (1958). Mineralogical studies (Table 2) of the fine and medium sand fraction, prepared by mechanical analysis by the method of Pettijohn (1938) and Fleet (1926). were also done.

RESULTS AND DISCUSSION

The incomplete soil catenas recognized as the most extensive soil catenas, and systematically described are Abu-Munaiseer and Nadirah series (Al-Agidi, 1975):

Abu-Munaiseer series ----- Hiteriyah series ---- and Pawana series
«DW 87« «DM 87» «DM 95»
Nadireh series ---------- Sadda series ------- and Ahmedi series
«DM» 117» «DF 127» «TF 1176»

Abu-Munaiseer Series «DW 87»: Typifying Pedon description;

Ap 0-35 cm — Clay, brown (10YR5/3) moist, and pale yellow brown (10YR6/3) dry; moderate medium subangular blocky structure, hard when dry, sticky and plastic when wet, vertical cracks; many fibrous and medium roots of *Hordium vulgare;* very few big roots of *Alhagi maurorum* and *Lagonychium farctum;* slightly calcareous, mildly alkaline reaction, smooth diffuse boundary.

C1 35-65cm — Clay loam; brown (10 YR4/3) moist, light brownish gray (10YR6/2) dry, moderate fine subangular blocky, firm when moist, slightly hard when dry, slightly sticky when wet, many fibrous roots of *Hordium vulgare;* slightly calcareous, moderate alkaline, and smooth diffused boundary.

Table 2. Minerals Contents of Soils of A'Ameriyah College Farm.

	Depth	Textural	Percents of Minerals						Wrl
	in cm	Class	Quartz	Chert	Feldspar	Mica	Calcite	Others	Q/F
Abu-Munaiseer Series	0–35	Clay	15.0	32.8	3.7	8.5	3.7	36.93	4.1:1
	35–65	Clay loam	7.3	19.8	4.1	12.8	8.3	47.7	1.8:1
	65–170	Clay	9.3	19.8	5.5	28.4	10.2	26.9	1.7:1
	170–200	Loam	22.2	23.2	4.9	8.4	6.4	35.0	4.5:1
Hikteriyah Seri	0–30	Clay loam	9.2	28.3	1.7	26.2	9.6	25.0	5.5:1
	30–85	Clay loam	8.5	28.3	1.0	27.7	14.8	19.8	8.5:1
	85–155	Clay	6.6	19.9	0.3	23.0	8.9	14.3	22.0:1
	155–180	Clay	13.8	15.4	0.3	23.8	11.1	35.6	46.0:1
	180–200	Clay loam	3.6	21.9	0.3	39.2	18.7	16.3	12.0:1
Pawana Series	0–15	Silt loam	9.9	24.5	1.3	20.4	8.3	35.4	7.6:1
	15–40	Loam	10.2	23.5	1.9	14.0	8.9	41.5	5.4:1
	40–52	Silt loam	17.0	20.5	0.8	19.3	12.7	29.7	21.3:11
	52–81	Silt Clay loam	12.7	19.5	0.5	18.6	8.1	40.5	25.4:1
	81–91	Silt loam	10.1	16.1	—	16.0	4.5	42.9	10.1:1
	91–116	Silt clay loam	15.2	18.8	1.3	26.0	11.1	27.4	11.7:1
	116–153	Loam	16.5	14.1	1.9	24.3	17.2	26.0	8.7:1
	153–208	Clay loam	14.7	17.5	1.2	26.3	18.6	21.7	12.3:1
Nadireh Series	0–40	Clay	15.9	27.7	1.0	13.5	11.8	30.1	15.9:1
	40–95	Silt clay	9.2	20.0	1.7	30.0	13.7	25.4	5.5 :1
	95–110	Silt clay loam	12.1	22.4	1.7	23.3	18.9	21.9	7.1:1
	110–155	Silt clay	8.9	22.6	2.7	34.6	11.7	19.5	3.3:1
	155–175	Clay loam	13.8	27.2	0.9	17.9	16.5	23.7	15.3:1
	175–205	Clay	14.6	28.3	0.9	13.2	5.7	37.3	16.2:1
Ahmedi Series	0–30	Silt clay	10.3	24.3	1.8	17.5	9.3	36.8	5.7:1
	30–85	Silt clay	10.3	24.3	1.8	17.5	9.3	36.8	5.7:1
	85–100	Clay	14.4	18.7	2.1	13.5	12.3	38.9	6.9:1
	100–122	Clay	18.2	20.6	0.8	7.9	9.6	42.9	22.7:1
	122–137	Clay loam	21.4	35.4	2.1	13.6	11.0	16.5	10.2:1
	137–148	Sandy loam	20.8	29.9	0.9	14.7	10.3	23.4	23.1:1
	148–205	Clay loam	17.6	32.0	0.8	16.5	14.7	18.4	22.0:1
Sakia Series	0–25	Clay loam	9.3	29.2	3.7	8.6	3.0	43.2	2.5:1
	25–115	Clay	15.4	19.0	—	16.4	2.0	47.2	15.4:1
	115–135	Silt clay	6.8	25.4	0.6	17.3	2.4	47.5	11.3:1
	135–195	Clay	8.9	27.1	3.2	34.4	4.9	21.5	2.8:1
	195–205	Silt clay	7.4	29.0	2.7	4.1	10.1	46.7	2.7:1

C2 65-170cm Clay; grayish brown (10YR5/2) moist, yellowish brown (10YR5/4) dry, with small lense of loamy textured material, very few faint strong brown (7.5YR5/6) mottles, moderate medium and fine subangular blocky structure, friable when moist, hard to very hard when dry, sticky and plastic when wet, strong to slightly calcareous, mildly alkaline, smooth diffuse boundary.

C3 170-200cm Loam; yellowish brown (10YR5/4) moist, brown (10YR5/6) dry, with small lense of sandy textured material, moderate coarse granular structure, friable when moist, slightly hard when dry, slightly sticky, slightly plastic when wet, many fine pores, strong calcareous, mildly alkaline, smooth diffuse boundary.

C4 200-230cm Clay; yellowish brown (10YR5/4) moist, yellowish brown (10YR5/6) dry, strong compact subangular blocky structure, firm when moist, hard when dry, sticky and plastic when wet, strongly calcareous, neutral reaction.

Abu-Munaiseer series consists of deep moderately well drained alluvial soils that formed in clay loam over fine textured materials that include clay and loam of lower Mesopotamian plain, silted out of Euphrates water. It is moderately drained member of the drainage sequence (catena) that includes Abu-Ghraib series «DF 87» of imperfect drainege.

Below the depth of 170 cm, lenses of lighter textural material and even loam were encountered. Rust spots occured at the depth more than 150 cm. It is non–saline at surface soil and saline in sub-soil. The reaction ranges from neutral to moderately alkaline at pH 7-8.

Abu-Munaiseer series differs from Mufti series «TW 864» Catena soils in the second and third strata, which include moderately fine and moderately coarse textured. Reactions of the horizons are ranged from mildly alkaline to moderately alkaline. The soil cracks upon drying.

2. Sadda Series «DF 127»: Typifying Pedon description:

Ap 0-25cm Clay loam; brown (10YR5/4) moist, pale brown (10YR6/3) dry, moderate medium subangular blocky, firm when moist, slightly hard when dry, slightly sticky, slightly plastic when wet, abundant fine and medium roots of *Hordum vulgare,* majority roots of *Lagonychium farctum* descending vertically, smooth diffuse boundary.

C1 25-115cm Clay; brown (10YR4/3), light brownish gray (10YR6/2) dry, with abundant medium distinct strong brown (7.5YR4/6) mottles, 1-3 in. diameter at 40 cm depth, moderate coarse subangular blocky, firm when moist, hard when dry, sticky, plastic when wet; many fibrous roots of *Hordium vulgare,* one large majority root of *Lagonychium farctum* descending vertically through the

horizon, strong calcareous, moderately alkaline, smooth diffused boundary.

C2 115-135cm Silt clay; pale brown (10YR6/3) moist, yellowish brown (10YR6/4) dry, few fine distinct light reddish brown mottles (5YR6/4), moderate fine subangular blocky, friable when moist, slightly hard when dry, slightly sticky, plastic when wet; few fibrous roots of *Hordium vulgare,* roots of *Lagonychium farctum* descending vertically through horizon; strong calcareous, neutral to mildly alkaline; smooth diffuse boundary.

03 135-175cm Clay; light yellowish brown (10YR6/4) moist, yellow (10YR7/6) dry, very few faint light reddish brown (5YR6/4) mottles; moderate medium subangular blocky structure; firm when moist, slightly hard when dry, sticky, plastic when wet; very few fibrous roots of *Hordium vulgare;* strong calcareous; strongly alkaline; smooth diffuse boundary.

C4 175-205cm Silt clay; brown (10YR4/5) moist, yellowish brown (10YR5/4) dry, moderate medium subangular blocky; friable when moist, soft when dry, slightly sticky, slightly plastic when wet; strong calcareous, moderate alkaline, smooth gradual smooth boundary.

C5 205-240cm Clay; brown (10YR5/3) moist, yellowisn brown (10YR5/4) dry, moderate fine subangular blocky structure; very firm when moist, very hard when dry, very plastic, very sticky when wet; strong calcareous, neutral reaction.

Sadda series is deep, imperfectly drained, brown to pale brown, alluvial soils that formed in stratified clay over fine textural material of lower Mesopotamian plain that is silted out of Euphrates river. Sadda series is the imperfectly drained member of the drainage sequence that includes Dujailah series «DP 127» of poor drainage, Saklawiyah series «DV 127» of very poor drainage. Rust spots occured at depth below 50cm, and ground water table was at depth below 250cm. The reaction ranges from slightly alkaline to neutral and pH from 7-8.

Ahmedi Series «TF 1176»; Typifying Pedon description:

Ap 0-30cm. Silt clay; brown (10YR4/3) moist, light gray (10YR7/2) dry; moderately medium subangular blocky, structure, friable when moist, hard when dry, slightly sticky, slightly plastic when wet; few medium roots of *Hordium vulgare, Triticum aestivum,* and *Alfelfa spp.,* coarse roots of *Lagonychium farctum;* cracks of 10-15 mm width and 35 cm length, strongly calcareous, mildly alkaline, smooth diffuse boundary.

C1 30-85cm Silt clay; brown (10YR4/3) moist, light gray (10YR7/2) dry, with many medium distinct strong brown (7.5YR5/6) mottles; moderately medium subangular blocky structure, firm when moist, slightly hard when dry, slightly sticky slightly plastic when wet; very few medium and fibrous roots of *Hordium vulgare and Triticum aestivum,* few medium roots of *Alfalfa spp.,* few coarse roots of *Lagonychium farctum,* cracks of 10-15 mm width with 5cm depth; strongly calcareous; mildly alkaline; smooth diffuse boundary.

C2 85-100cm Clay; brown (10YR5/3) moist, yellowish brown (10YR5!4) dry; few fine distinct strong brown (7.5YR5/8) mottles; moderately fine and medium subangular blocky structure; firm when moist, slightly hard when dry, slightly sticky, slightly plastic when wet; pieces of pottery; strongly calcareous; neutral reaction; smooth diffuse boundary.

C3 100-122cm Clay; brown (10YR5/2) moist; weak medium subangular blocky structure; friable when moist, slightly hard when dry, sticky, slightly plastic when wet; strong calcareous; mildly alkaline reaction; veins of lime; smooth diffuse boundary.

C4 122-137cm Clay loam; brown (10YR4/3) moist, with few fine distinct brown (7.5YR5/2) mottles; moderate very fine to fine subangular blocky structure; very friable when moist, soft when dry, slightly sticky to non sticky, non plastic when wet;
small vacant earthworm tubes 1-2mm in diameter; few fibrous roots of *Lagonychium farctum;* strongly calcareous; mildly alkaline reaction; smooth diffuse boundary.

C5 137-148cm Sandy loam; dark yellowish brown (10YR4/4) moist, with few fine faint brown (7.5YR5/4) mottles; structureless «single grain»; loose when moist and dry;non sticky, nonplastic when wet; strongly calcareous; neutral reaction; gradual wavy boundary.

65 148-205cm Clay loam; brown (10YR5/3) moist, moderately medium subangular blocky structure; friable when moist, slightly hard when dry; sticky, plastic when wet; small vertical small and vacant worm tubules; few coarse roots of *Alhagi maourorum* and *Lagonychium farctum;* very few medium and fibrous roots of same plants; strongly calcareous; strongly alkaline reaction; diffuse wavy boundary.

Ahmedi series is deep, imperfectly drained, dark brown alluvial soils that formed in silty clay, over fine textural material of lower Mesopotamian plain, silted out of Euphrates river. Ahmedi series is tha imperfectly

drained member of the suggested drainage sequence (catena) which may include other members.

This series is some times capped with lighter textured material of sandy loam texture. Rust spots and mottling occured at the depth of about 40cm and the ground water table was found below 255cm. Structure varies moderataly from medium subangular blocky to structureless of single grains, and whole pedon is from firm to friable. Root distribution is few in the upper 40cm. The reaction of this series ranges from neutral to strongly alkaline. Some pieces of pottery were found at the depth of 90cm.

Pawana Series «DM95»; Typifying Pedon description:

Ap 0-15cm — Silt loam; brown (10YR4/3) moist, dark yellowish brown (10YR4/4) dry; moderate medium platy structure; very friable when moist, soft when dry;non to slightly sticky, slightly plastic when wet; few undecomposed organic matter, few medium roots of *Imperata cylinderica* and *Alhagi maurorum,* slightly calcareous;neutral reaction; smooth diffused boundary.

C1 15-40cm — Loam; dark brown (10YR3/3) moist, yellowish brown (10YR5/4) dry; moderate fine subangular blocky structure; friable when moist, soft when dry;non sticky, slightly plstic when wet; fragments of bricks; few fine and medium roots of *Imperata cylinderica* and *Alhagi maurorum;* strongly calcareous; neutral reaction; smooth diffused boundary.

C2 40-52cm — Silt loam; brown (10YR4/3) moist, yellowish brown (10YR5/3) dry, moderate fine subangular blocky structure; very friable when moist, soft when dry, stightly plastic when wet; very few fine and medium roots of *Imperata cylinderica* and *Alhagi maurorum;* strongly calcareous; neutral to mildly alkaline; smooth boundary diffused.

C3 52-81cm — Silt clay; brown (10YR5/3) moist, yellowish brown (10YR5/8) dry, with few fine faint light brown (7.5YR6/4) mottles at 75cm depth; moderate fine subangular blocky structure; friable when moist, slightly hard when dry, slightly sticky, slightly plastic when wet, some decomposed unknown roots, medium root channals of 1-8mm diameter; strongly calcareous; neutral reaction; smoth diffused boundary.

C4 81-91cm — Silt loam; grayish brown (10YR5/2) moist, yellowish brown (10YR5/4) dry; moderate subangular blocky structure; firm when moist, slightly hard when dry, slightly sticky, slightly plastic when wet; medium root channels of *Alhagi maurorum;* few very fine and medium roots of *Alhagi maurorum;* strongly calcareous; neutral reaction; gradual boundary.

C5 91-116cm Silt clay loam; brown (10YR5/3) moist, pale brown (10YR6/3) dry; moderate medium subangular structure; friable when wet, slightly hard when dry, slightly sticky, slightly plastic when wet; few medium pores; fragments of bricks; few medium roots of *Alhagi maurorum,* root channels of 1mm diameter; strongly calcareous; mildly alkaline reaction, smooth diffused boundary.

C6 116-151cm Loam; grayish brown to yellowish brown (10YR5/2-5/4) moist; yellowish brown (10YR5/4) dry; with few fine distinct yellowish red (5YR5/8) mottles at 125cm; moderate medium subangular blocky structure; friable to firm when moist, soft to slightly hard when dry, non to slightly sticky, slightly plastic when wet; Pieces of bricks; many fibrous roots of *Alhagi maurorum,* few to very few fibrous, medium and coarse roots of *Imperata cylinderica;* few fine root channels; strongly calcareous; neutral reaction; smooth diffused boundary.

C7 151-208cm Clay loam; brown (10YR5/3) moist, pale brown (10YR6/3) dry; with few to very few fine, faint to distinct yellowish red to light gray (5YR5/8-6/1) mottles; moderate medium subangular blocky structure; friable when moist, slightly hard when dry, slightly sticky, slightly pistic when wet; few fine fragmants of bricks 5mm in diameter at depth 180cm, few coarse roots of *Alhagi maurorum,* few fine channels of more than 2mm diameter; strongly calcareous; mildly alkaline reaction; smooth diffused boundary.

C8 208-222cm Silt clay loam; brown (10YR5/3) moist; moderate medium subanguler blocky structure; friable when moist, slightly hard when dry, slightly sticky, slightly plastic when wet; very few fine holes 1-2mm diameter; strongly calcareous; moderate alkaline reaction; smooth diffused boundary.

Pawana series consists of moderately well drained, brown to dark brown, alluvial soils that formed from a silty loam material over moderately texture material of lower Mesopotamian Plain, silted out of Euphrats water.

Pawana series is the moderate well drained member of the drainage sequence (catena) that includes Pak series (DW 25) of well drainage, Howaider series (DE95) of imperfect drainage, and Musari series (DP 95) of poor drainage. Puffed material at the surface was strongly saline, then became moderately saline with increased depth. This series possesses the relatively highest topographical position in the area. The reaction of the whole soil pedon ranges from neutral to moderately alkaline, pH 7-8.

Nadireh Series «DM117»: Typifying Pedon description:

Ap 0-40 cm	Clay; brown (10YR4/3) moist, yellowish brown (10YR5/4) dry; structureless, massive; very friable when moist, soft when dry; slightly sticky, slightly plastic when wet; many medium roots of *Alhagi maurorum* and *Lagonychium farctum;* strongly calcareous; moderately alkaline; smooth diffuse boundary.
C1 40-95cm	Silt clay; brown (10YR4/3) moist; many fine distinct reddish yellow (7.5YR6/6) mottles at 80cm; moderately medium subangular blocky structure; friable when moist, slightly hard when dry; slightly sticky to sticky, slightly plastic when wet; common very fine roots of *Alhagi maurorum* and *Lagonychium farctum;* strongly calcareous; strongly alkaline reaction; smooth diffuse boundary.
C2 95-110cm	Silt clay; brown (10YR4/3) moist, yellowish brown (10YR5/4) dry; with many medium distinct reddish brown (5YR5/4) mottles; week medium subangular blocky structure; very friable when moist, soft when dry, non-sticky plastic to non- plastic when wet; strongly calcareous; strongly alkaline reaction; smooth diffuse boundary.
C3 110-155cm	Silt clay; brown (10YR;(10YR4/3) moist; massive to very weak medium subangular blocky; friable when moist, slightly hard when dry, slightly sticky, slightly plastic when wet; strongly calcareous; moderate alkaline reaction; smooth diffuse smooth diffuse boundary.
C4 155-175cm	Clay loam; dark yellowish brown (10YR5/4) moist, with few fine distfnct reddish brown (5YR5/4) mottles; moderately fine to medium subangular blocky structure; friable when moist, slightly hard when dry, slightly sticky, slightly plastic when wet; strongly calcareous; strongly alkaline reaction; smooth diffuse boundary.
C5 175-205cm	Clay; very dark grayish brown to very dark brown (10YR3/2-2/2) moist; moderate fine medium angular to subangular structure; friable to firm when moist, hard to very hard when dry; slightly sticky to sticky, plastic when wet; strongly calcareous; strongly alkaline reaction; smooth diffuse boundary.

Nadireh series consists of moderately well drained alluvial soil that formed from silt clay over fine textured materials of lower Mesopotamian Plain silted of Euphrates water. Nadireh series is the moderately well drained member of the the drainage sequence (catena) that inncludes Al-Safa (DF117) of imperfect drainage, Shahireh series (DP117) of poor drainage, and Ananeh series (DV117) of very poor drainage.

The surface of the soil is of clayey texture, dark colored and becomes slightly saline with depth. Structure of the pedon ranges from moderate to strongly angular blocky. The reaction ranges from moderte to strongly alkaline, pH 8-9. There is a dark to very dark buried horizon at depth of 175-205cm.

Hikteriyah Series «87DM»: Typifying Pedon description:

Ap 0-30cm — Clay loam, dark yellowish brown (10YR3/4) moist, brown (10YR5/3) dry; moderately medium subangular blocky structure; friable when moist, slightly hard when dry, slightly sticky, slightly plastic when wet; few medium roots of *Schanginia aegyptiaca* and *Cressa cretica;* strongly calcareous; mildly alkaline reaction; smooth diffuse boundary.

C1 30-85cm — Clay loam; dark yellowish brown to dark brown (10YR3/4) moist, with medium and fine faint light reddish brown to reddish yellow (5YR6/4 -6/8) mottles at 50cm; moderate medium subangular blocky structure; narrow lense of sandy loam at 60- 85cm; very friable when moist, soft to slightly hard when dry, slightly sticky, slightly plastic when wet; few medium and roots of *Schanginia aegyptiaca* and *Cressa cretica*; strongly calcareous; mildly alkaline; smooth diffuse boundary.

C2 85-155cm — Clay; yellowish brown (10YR5/4) moist, common medium distinct reddish yellow (7.5YR6/6) mottles; moderate medium subangular blocky structure; very firm when moist, very hard when dry, very sticky, very plastic when wet; very few fibrous roots of *Schanginia aegyptiaca;* strongly calcareous; moderate to strongly alkaline reaction; smooth diffuse boundary.

C3 155-180cm — Clay; black to very dark brown (10YR2/1-2/2) moist; moderate medium subangular blocky structure; friable when moist, hard when dry, slightly sticky, slightly plastic when wet; strongly calcareous; strongly alkaline reaction; smooth diffuse boundary.

C4 180-202cm — Clay loam; light brownish gray (10YR6/2) moist; moderate to fine subangular blocky structure; friable when moist, very hard when dry; slightly sticky, slightly plastic when wet; strongly calcareous; strongly alkaline reaction; smooth diffuse boundary.

C5 202-240cm — Silt clay; yellowsh brown (10YR5/4) moist, many fine distinct olive gray (5YR4/2) mottles; at depth 220cm; fine to medium angular blocky structure; firm when moist, very hard when dry, sticky very plastic when wet; hard pan layer from 210-230cm; strongly calcareous; moderate alkaline reaction.

Alluvial soils are usually characterized by young and very young stratified materiáls. Each stratum is of specific depositional conditions. In classification of these alluvial soils, a specific genetic case stands. Strata are ly different in texture and in other related characteristics. The occurence of these layers is governed more by geologic processes rather than pedological processes. Particle size distribution, presented in table 1, shows marked changes between adjacent horizons, thus indicating multiple deposits. Similarity in texture was noted only i n the upper two horizons (Ap and C1) in Hikteriyah and Sadda series as indicated in Table 1.

Concentration of clay as shown in table 1 generally increases with the depth in Abu-Munaiseer, Sadda and Ahmedi series. Notable sharp decrease in clay is obvious in C3 and C4 horizon of Abu-Munaiseer and Ahmedi series. These differences are attributed to original differences in parent materials. Translocation of clay within zones of similar texture has been limited due to shortages of water passing through these soils. The sharp changes in clay contents of C7, and C5 horizons of Pawana, Nadireh and Hikteriyah series respectivaly, points out a lithologic discontinuity that reflects the presence of relatively more recent materials overlying on older ones.

There is a unigue similarity in texture of C1 and C2 in each of Abu-Munaiseer and Hikteriyah series. The variations in clay contents may be explained on the basis of variations in water current during floods and irrigations.

The C2 horizons in each of Nadireh, Ahmedi and Sadda pedons are of close textural classes. Thus considered similar for our catenal purposes. The comparisons ascertained the lack of any genetic relationship.

The pH values of all pedons generally increase with depth except for Abu-Munaiseer series, where an inverse trend exists. The pH values of the horizons decrease with depth.

In comparing horizons of similar texture, in various pedons, no apparent soil development seems to exist. It is not expected to note a decrease in pH with time as a result of less clay. This is well exhibited in C1 and C2 horizons of Abu-Munaiseer and Hikteriyah series and C1 horizons of Ahmedi and Sadda series. The same observation was also noted in the pH values of horizons of similar texture and different pedons.

Increasing of clay content due to soil formation is generally accompained by a rise in soil reaction.

It is concluded that Ameriyah alluvial soils are characterized by young or very young stratified materials. Each stratum is of specific deposition. The case of absence of sequences of genetically related horizons stands. The sharp changes in clay contents of some horizons of some series points out a lithologic discontinuity that reflects the presence of relatively fresh material overlying older material.

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SALT TOLERANCE, ION UPTAKE AND QUALITY OF FODDER SWANK *(Panicum colonum L.)*

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SUMMARY

The effect of varying levels of salinity (3-25 mmhos cm-1) on germination, green and dry matter yields, ash, protein, macro and some trace element contents of fodder-swank was studied in gravel culture. The fodder was grown in pots in Arnon and Hoagland nutrient solution. The data indicated that the increase in salinity resulted significant adverse effect on germination, tilfering ad green matter yield of this fodder ($p < 0.5$). The salt-tolerance limit (50 % reduction in yield) of this fodder mas found to be about 8.5 mmhos cm-1. The mineral uptake studies displayed nearly a positive relationship between salinity levels and ash, protein, Na and Cl contents, and a negative relationship between salinity and K and Mg uptake. The influence of salinity on trace elements (Cu and Zn) was inconsistent, but there was an increased lavel of Fe with increasing salinity from Ec 15-25.

الخلاصة

التحمل الملحي والأمتصاص الأيوني ونوعية المحصول العلفي (*Panicum colonum* L.)

تمت تأثير مستويات مختلفة من الملوحة (٣ ـ ٢٥ مليموز / سم) على الأنبات والمادة الخضراء والجافة للحاصل وكذلك على الرماد والبروتين ومحتوى العناصر الكبرى وبعض العناصر الدقيقة للنبات العلفي *(Panicum colonum)* حيث تمت زراعة هذا المحصول في أصص تحتوي على الحصى الناعم ومحلول هوكلند وأرنون الغذائي واشارت النتائج التي تم الحصول عليها الى ان زيادة الملوحة تسبب تأثير

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سلبي معنوي على الأنبات والتفرع والمادة الخضراء للحاصل ($P < 0.05$) . وان حد التحمل الملحي (٥٠ ٪ فقدان في الحاصل) لهذا المحصول قد وجد عند التوصيل الكهربائي ٨,٥ مليموز / سم . واظهرت دراسات الامتصاص المعدني علاقة موجبة تقريباً بين مستويات الملوحة من جهة وكل من الرماد والبروتين ويحتوي كل من الصوديوم والكلور وعلاقة سلبية بين الملوحة من جهة وامتصاص كل من البوتاسيوم والمغنيسيوم وان تأثير الملوحة على العناصر الدقيقة (النحاس والزنك) كان متناقضاً . الا انه وجد زيادة في مستوى الحديد عندما زادت الملوحة من ١٥ الى ٢٥ مليموز / سم .

INTRODUCTION

Salt accumulation in the soils is one of the major causes for reduced crop production. According to Elci (1975), besides all other reclamative measures, growing of salt tolerant crops can give some yield upto a certain level of the salts, which otherwise would be impossible with the salt sensitive crops. Swank *(Panicum colonum)* L.) is one of the widely grown forages in Pakistan. There is general opinion among the farmers that it is a salt tolerant plant and is grown in mixed cultures. Although salt tolerance studies in the case of some fodders have been reported (Mohammad, 1967; Hussain and Hussain, 1970), but no scientific investigation has been carried out on swank. The increased importance of livestock in the country emphasises the need for information on the salt tolerance limit and effect of salts of the yield and quality of this fodder.

MATERIALS AND METHODS

This study was undertaken in two phases as under:-
a/. Germination trials in petri dishes for 15 days.
b/. Growth studies in glazed pots.

a. Germination trials: Effect of varying salinity levels on the germination of swank was determined during a 15 day experiment. The salinity levels of 3, 5, 10, 15, 20 and 25 mmhos cm-1 were prepared by mixing NaCl, $Na_2 SO_4$, $CaCl_2$ and $MgCl_2$ in the ratio of 4:10:5:1 in Arnon and Hoagland (1940) nutrient solution. The selected seeds of swank were sown in petri dishes having paper discs and water with different salinity levels and incubated at 25 ± 2 C. The paper discs rested upon glass triangles. The germination trials were carried out in triplicate. The used solution was pipetted out daily to maintain the salinity levels, and germinated seeds were counted daily upto 10 days.

b/. Growth Studies in Gravel Culture:

Gravel (2-5 mm) separated from Lawrencepur sand was washed successively with diluted HCl. Canal and distilled water were used as a supporting medium for the growing plants. Calculated amounts of NaCl, Na_2SO_4, $CaCl_2$ and $MgCl_2$ in the ratio of 4:10:5:1 on equivalent basis were dissolved in Arnon and Hoagland nutrient solution to prepare the required salinity levels. The precipitation of $CaSO_4$ was checked by using a mixture (1:1) of tartaric acid, 0.4% and $FeSO_4$, 0.5% (0.6 ml/l), as suggested by Arnon and Hoagland (1940). Twelve Kilograms of gravel was filled in each of the glazed pots. The required amount of the salt solution was put in the glazed pots where plants were grown. The pots were drained and replenished with the solution daily after maintaining the required salinity levels. In this way it became possible to maintain the required level of salinity in the root zone. The crop was harvested after a period of about 60 days and data was collected for the number of tillers per plant and fresh/dry weights of shoots.

Air dried plant material was ground to pass through a 40 mesh screen for different estimations. Ashing was carried out in a muffle furnace. After wet digestion of the Plant samples with HNO_3+HCLO/ Na, K and Ca were determined by flame photometry, and Mg, Fe, Zn and Cu by atomic absorption spectrophotometry. Protein was determined by the Kjeldahl method and crude fat by Soxhlet extraction using petroleum ether (BP 40-60°C)as the solvent (AOAC, 1971). The data was statistically analysed after Steel and Torrie (1960).

RESULTS AND DISCUSSIONS

The effect of different levels of salinity on germination, plant height and tillering is shown in Table-1. The data indicated that the salinity has significant adverse effect on the germination of Swank. The germination at EC levels 3,5 and 10 was not significantly different. however, with increase in EC from 10 to 25 mmhos cm^{-1}, the germination decreased from 85 to 35E; reduction being more prominent at higher salinity levels. Similar trend in germination for jute was reported by Khan (1973). The results show that restricted amounts of salts present in solution had no effect on the plant haight, but increase in salinity from 5 to 25 mmhos cm^{-1} reduced the plant height from 116 to 51.5 cm. It was observed that salinity also had significant adverse effect on the number of tillers per plant; with the increase in salinity from 3 to 25 mmhos cm^{-1}, the tillers per plant decreased from 17 to 8.5. The statistical analysis showed that at an EC of 5 and 10, tillering was not different whereas, an EC of 15, a significant decrease in the number of tillers was observed.

The green matter yield of this fodder as influenced by varying salinity levels is presented in Table-2. Maximum green matter was in the case of

EC, 3 (Control). However, with the increase in salinity (EC, 3-25), the green matter yield significantly decreased from 948.5 to 107.5 g pot^{-1}. A similar pattern was observed for dry matter yield. The drop in the yield closely parelleled to the reduction in tillering.

The influence of different salinity levels on total ash and some major mineral elements (Na, K, Ca, Mg and Cl) has been shown in Table – 3 It was found that with the increase in salinity (EC, 3 – 25) there was a gradual increase in ash contents, the maximum being 19 % at an EC of 25. An increase of total ash with the increasing salinity in beans, carrots and beet was reported by Heller *et al.* (1940). The data also revealed that as the salinity was increased, the contents of Na and Cl markely increased whereas, Na + K slightly increased up to EC, 10, then levelled off after a sudden increase having been observed at EC, 15. The K values showed a gradual decrease with increasing salinity while Ca exhibited an irregular pattern. The Mg value showed a distinct trend where Mg level increased with increasing Ec from 3 – 10 and decreased and leveled off with increasing Ec from 15 – 25.

The inorganic analysis of this fodder confirmed the finings of Storey and Wyn-Jones (1977) that osmotic compensation at high salt levels was largely achieved by the accumulation of Na salts. For the salinity levels used in this study (EC, 3-25) the major changes were an increase in the leaf Na as well as N+K, and a decrease in the leaf K and Mg. The lower levels of salinity (EC, 3-10) affected the leaf composition to a lesser extent than the higher levels (EC, 15-25). Chloride content and yield were found to have an inverse relationship (r=0.866). Negative correlation between yield and Cl in plants was reported by Bernstein (1964).

Increasing levels of salinity reduced the K uptake. This may be due to the pressure of high NaCl which generally icreases the Na and Cl, and decreases the K in shoots. A marked reduction in K uptake is considered associated with accumulation of high Na in the roots (Mass and Hoffman, 1977; Bernstein, 1964; Joseph and Waisal, 1977). Gandhi and Paliwel (1975) reported decrese in the absorption of Ca and Mg in wheat under saline condition. In these studies, however, the uptake patterns of Ca and Mg as a function of increasing salinity were irregular.

Effect of root medium salinity on the protein and some trace element contents of this fodder is shows in Table-4. An increasing trend in the protein velues with an increase in the salinity level was observed. Comparison of green or dry matter yields with protein content revealed generally an inverse relationship. Protein contents ranged from 13.97 to 19.67% over the salinity range of 5 to 25 mmhos cm^{-1} as compared to the control with 12.49% protein. The average values were however, high enough to rate this crop as a good guality fodder. Similarly the concentrations of trace elements (Zn, Cu and Fe), were sufficiently high to meet the animals requirements. The influence of root medium salinity on

the trace element contents was not consistent. However, the plants under salt stress contained more of Zn than the control ones.

It is concluded that Swank is not as salt tolerant as some recognized plant species such as fodder beet and Hijazi lucerne. It was, however, found medium salt tolerant and may be used effectively as secondary colonizer, because it adds a lot of green matter to the soil which helps to solubilize native calcium carbonate and eventually ameliorate the soil.

Therefore, results of this study showed that swank is a medium salt tolerant and may be useful as secondary colonizer, because it adds abundant green matter to the soil, which helps to stabilie native cahcium carbonate and eventualy ameliorate the soil. Further field investigation, however, is essary.

Table 1. Effect of salinity on germination, plant height, and tillering in fodder swank.

Root medium salinity mmhos cm^{-1}	Germination %	Plant haight mm	Tillers plant
3 (Control)	85	116.0	17.0
5	97	116.5	11.5
10	85	97.0	11.5
15	72	84.5	10.0
20	53	67.5	8.5
25	35	51.5	8.5
LSD 5%	19.1	10.5	2.5

Table 2. Effect of salinity on green and dry matter Yields of fodder swank grown in solution culture.

Salinity mmhos cm^{-1}	Yieldpot^{-1} Green matter	Yield g pot^{-1} Dry matter
3 (Control)	948.5	209.4
5	600.7	120.5
10	398.0	98.0
15	310.0	72.5
20	173.5	41.0
25	107.5	27.0
L.S.D. 5%	164.1	48.1

Table 3. Effect of salinity on ash and mineral elements of fodder swank.[1]

Salinity (mmhos cm^{-1})	Ash %	Na	K	Ca	Mg me/100 g^{-1}	Cl	Na+K
3 (Control)	14.3	20.0	108.7	8.0	49.1	25.7	128.7
5	15.0	27.5	100.4	10.0	46.1	39.0	127.9
10	16.0	37.5	94.7	16.0	42.5	49.0	132.2
15	16.7	72.5	88.9	8.0	37.0	57.3	161.4
20	17.2	78.5	80.6	7.5	31.2	59.8	168.0
25	19.0	102.5	67.5	10.0	30.3	98.0	170.0
L.S.D. 5%	0.7	3.9	2.5	1.4	1.7	1.4	

1: Dry matter basis.

Teble 4. Effect of salinity on protein and selected trace element contents of fodder-swank.[1]

Salinit mmhos cm^{-1}	Protein %	Zn	Cu ppm	Fe
3 (Control)	12.49±0.56	29.20±0.56	9.38±0.50	455.47±7.27
5	13.97±0.72	72.69±1.62	12.11±0.40	458.58±6.68
10	13.44±0.69	67.98±2.10	16.26±0.78	720.54±14.66
15	16.61±0.62	89.54±0.50	13.46±0.28	500.67±14.00
20	18.02±0.79	119.35±2.11	15.42±0.80	462.80±10.00
25	19.67±0.64	108.37±5.65	17.51±0.33	638.37±13.45

1. Dry matter basis

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THE RELATIONSHIP OF KERNEL SIZE TO GRAIN' YIELD OF SEVERAL GENOTYPES OF CORN (ZEA MAYS)

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SUMMARY

A field irrigation experiment on corn was conducted for two seasons (spring and autumn) in 1978 at the Agricultural Experimental Station, University of Baghdad.

The main objective of the study was to determine the relationship between kernel size and grain yield of different genotypes of corn. A split plot design was used with three replications. Five genotypes namely, Akbar, Mixture, Neelum, Pride of Saline, and Dinoprofesky were used as main plots and four seed size lots, ungraded, small, medium and large were as sub plots.

Seed size did not affect grain yield in both seasons. The genotype X seed size interaction was not statistically significant for grain yield.

From the above information, it appears to be beneficial to grade corn seed for size (small, medium and large) when using, mechanization only.

الخلاصة

طبقت هذه الدراسة في الموسم الربيعي والخريفي من عام ١٩٧٨ في محطة التجارب الحقلية التابعة الى كلية الزراعة ـ جامعة بغداد لدراسة العلاقة بين حجم البذور والحاصل في الذرة الصفراء .

استخدم تصميم الالواح المنشقة وكانت المعاملات الرئيسية تمثل خمسة تراكيب وراثية بينما المعاملات الثانوية كانت تمثل اربعة حجوم (غير مدرج وصغير ومتوسط وكبير) وعلى اساس وزن ٣٠٠ حبة .

لم يؤثر حجم البذور على الحاصل كذلك لم تكن هناك فروق احصائية معنوية للتفاعل بين حجم البذور والتراكيب الوراثية وبالنظر للتوسع الكبير الذي طرأ على زراعة الذرة الصفراء في القطر خلال السنوات الاخيرة مما يتطلب استخدام المكننة بشكل فعال في الزراعة لذا فمن الضروري تدريج البذور واستخدام التدريج وبما ان حاصل الحبوب لم يتأثر بحجم الحبة لذا فيمكن استخدام اي حجم شريطة ان تكون هذه البذور متساوية في الشروط الحيوية الاخرى .

INTRODUCTION

It is known that variation in kernel size and shape by planters may cause uneven distribution of corn (*Zea mays* L.) seeds. This causes a great problem in mechanical planting of this crop. With the expansion in corn production in Irag, it would be more important to study this problem. Since the morphological characters of seeds especially, seed size, is the main factor related to this problem. It is necessary to investigate the relationship of seed size to the grain yield and other factors in crops. Although, clark and Peck (1968) considered seed size an important trait that can be easily manipulated and of economic importance.

Seedling vigor has been shown to be related to seed size in *sorghum* (Abdullahi and Vanderlip, 1972), sunflower (Robinson, 1974) and in many legumes (Black, 1958). The increase in seed size has been positively correlecorrelated with plant performance in the field (Burris *et al.*, 1973 and Fehr and Probest, 1971). In other studies, no relationship between seed size and yield was found for *sorghum* (Abdallahi and Vanderlip, 1972), soybean (Johnson and Luedders, 1974), rape (Major, 1977), or sunflower (Robinson, 1974). Glenn *et al.* (1974). This indicated that spring vigor of corn as measured by plant dry weight, plant height or visual ratings at several dates, during vegetative growth was not related to grain yield.

MATERIALS AND METHODS

This study was conducted at the Agricultural Experimental Station, University of Baghdad in Abu-Ghraid, during the spring and autumn seasons of 1978.

Seeds of five genotypes of corn were screened to obtain lots of small, medium, and large seeds and the weight of 300 seeds was determined. The three seeds sizes and ungraded seed formed four treatment groups for each genotype (Table 1).

The design of the experiment was a split-plot including five genotypes of corn, i.e., Akber (Synthetic); Mixture (open pollinated); Neelum (Synthetic); Pride of Saline (open pollinated); and Din-profesky (open pollinated) as main plots and four seed size treatments, Ungraded (A), Small (B), Medium (C), and Large (D) as sub-plots.

Three replications were used. The dates of planting were March 15 for the spring season and July 21, for the autumn season. Each treatment was planted in four rows 5m long 90 cm apart. Final population density was determined at 44000 plant/ha.

The experimental field was fertilized with 80 kg/ha N & 60 kg/ha P_2O_5. Grain yield was obtained by hand cutting of the central rows. Corrected weight (15.5% moisture) was converted to Kg/ha. Data were anahyzed according to the methods of analysis of variance (Steel and Torrie, 1960).

RESULTS AND DISCUSSION

Growing conditions were good throughout the spring season of 1978. The unusual high temperatures in July and August slightly afected the growth in the autumn season of the same year.

Analyzed dates of the two seasons for grain yield (kg/ha) are given in Table 2. It is evident that seed size did not affect grain yield in both seasons and confirm the result reported by Gleen *et al.* (1974), who studied the relationship between spring vigor of corn and the final grain yield. Similar results were also reported by other workers for differant crops (Abdullahi and Venderlip, 1972; Johnson and Luedders, 1974; Major, 1977; and Robinson, 1974).

Differences among genotypes for grain yield were not significant Similarly, seed size X genotype interaction was found to be non significant in this study.

The result of combined analysis of variance in Table 3 revealed that grain yield (kg/ha) did not reflect significant differences due to seasons. This result indicates that grain yield in this study was consistent from season to season.

Seed sie had no effect on grain yield under field conditions. Therefore, grading corn seed for size (small, medium) or large) would be important only under mechanization. At the same time corn planter adjustment according to the seed size will regulate the recommended seed flow during planting.

Table 1. Seed size of three graded seed lots and the ungraded lot of five genotypes of corn tested during spring and autumn (1978).

Genotypes	Seed size (Weight of 300 seeds (g).							
	Ungraded (A)		Small (B)		Madium (C)		Large (D)	
	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
Akbar	75.62	79.80	70.43	63.15	93.25	78.10	112.59	90.20
Mixture	72.39	65.10	63.04	39.00	76.89	56.20	110.70	87.70
Neelum	90.13	70.90	80.49	61.15	89.68	81.30	102.11	85.40
Pride of Saline	76.19	72.00	57.49	55.50	80.35	77.15	87.65	89.05
Din-Profesky	79.94	87.60	65.27	67.10	69.42	87.30	94.88	102.40

Seed grading (sizing and calibration) could be done by a special mechine. Extreme care must be taken to prevent seed demage. Additional information is needed to throw more light on the relationship between germ size in corn kernel and grain yield.

Table 2. Effect of seed size on corn yield (Kg/ha) tested (during Spring and Autumn 1978.

Genotypes	Spring Season Seed vigor classes Ungraded (A)	Small (B)	Medium(C)	Large (D)
Akbar	774.05	678.28	1371.19	1285.81
Mixture	2077.11	1887.38	885.53	1041.39
Neelum	597.95	595.64	1073.68	1292.71
Pride of Saline	850.94	841.62	308.55	873.73
Din-Profesky	329.28	239.15	565.40	213.32
LSD .05	NS	NS	NS	Ns
	Autumn Season			
Akbar	740.88	800.34	1145.88	1255.56
Mixture	731.88	1234.32	818.55	746.16
Neelum	711.51	1670.79	1016.67	1053.57
pride of saline	1271.91	830.86	1385.76	1068.39
Din-Profesky	690.81	665.52	626.16	575.61
LSD .05	NS	NS	NS	NS

Table 3. Mean squares from the combined analyses of the grain yield of corn

Source of variation	D.F	yield kg/ha
Seasons (S)	1	2407180.30 NS
Reps: Seasons (Error a)	4	713416.86
Genotypes (G)	4	573450.58 NS
S X G	4	804716.81 NS
(Error b)	16	352583.59
Size (S)	3	3752.69 NS
S X S	33	28756.90 NS
S X G	12	60741.92**
S X S X G	12	248209.68 **
(Error c)	60	14000 .96
Total	119	

Ns no significant differences

** $p < 0.01$

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THE EFFECT OF 6-AZAURACIL AND URACIL ON PRODUCTION OF PYRIMIDINES IN BARLEY DURING EARLY GROWTH.

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SUMMARY

A quantitative investigation has been made of pyrimidine derivatives as they occur in *Hordeum vulgare* and *Hordeum distichum* during germination and growth. The effect of 6-Azauracil and uracil on pyrimidine metabolism also has been studied.

The results suggest the presence of an enzyme which convert orotic acid to uracil by direct decarboxylation. The effect of 6- Azauracil as an inhibitor to 5-OMP decarboxylase and the reversal of the inhibition by uracil could also be suggested.

الخلاصة

تم تقدير مشتقات البريمدين كمياً في صنفين من الشعير هما *Hordeum distichum* و *Hordeum vulgare* خلال مراحل الانبات والنمو. وقد تم كذلك دراسة تأثير 6- Azauracil واليوراسيل على عمليات تمثيل البريمدينات.

وقد اشارت النتائج الى وجود انزيم مسؤول عن تحويل حامض الاوروتيك الى اليوراسيل مباشرة بازالة مجموعة الكاربوكسيل. وقد ناقش البحث احتمالية تأثير 6- Azauracil الكابت لانزيم 5- OMP decarboxylase. وعكس هذا التأثير باليوراسيل.

Based on part of M.Sc. thesis submitted by the second author.

INTRODUCTION

It has been known that orotic acid is the precurssor of pyrimidines in plants (Reifer *et al.*, 1960; Kapoor and Waygood, 1961; Buchowicz *et al.*, 1963; Wolcott and Ross, 1967; Ross *et al.*, 1971; Mazus and Buchowicz, 1971; and Ong and Jackson, 1972) and 6-Azauracil is a potent inhibitor to 5-OMP decarboxylase (Handschumacher and Pasternak, 1958; Pasternak and Handschumacher, 1959; Ashworth *et al.*, 1972). The inhibitor exerts its effect on 5-OMP decarboxylase only after being first converted into the corresponding 5-nucleotide (Handschumacher, 1960; Ross, 1964)). It has been suggested that this effect is attributable to the shunting, by direct decarboxylation of orotate from pyrimidine nucleotide production into the formation of uracil, which has been shown to be a limiting factor in the biosynthesis of pyrimidine derivatives (Ashworth *et al.*, 1972; Brown and Al-Baldawi, 1977).

Previous work by several workers showed that uracil reverses the effect of 6-Azauracil on pyrimidine biosynthesis in plants (Trotter, 1949; Shimeno and Kinoshita, 1963; Fujii, 1963; Ross, 1965).

The initial problem proposed in this work is whether 6-Azauracil and uracil have an effect on the production of pyrimidines in barley.

EXPERIMENTAL

Materials

Seeds of *Hordeum distichum weah* and *Hordeum vulgare nomar* were supplied by the General Body for Applied Agricultural Researches, Ministry of Agriculture and Agrarian Reform. After brief treatment with 0.1% (V/V) solution of mild detergent to ensure wetting, seeds were surface sterilized by immersion for 5 min in 0.1% W/V $HgCl_2$. After being well washed in several changes of sterile water, they were soaked aseptically with aeration for 16 h in either sterile water or 10 mM 6-Azauracil solution or 10 mM mixture of uracil and 6-Azauracil solution. Seeds were germinated at 30°C in a green house, with a lighting regime of 16 h light and 8 h dark.

Chemicals

Analytical grade chemicals and all solvents employed in the investigation were purchased from British Drug Houses Ltd., Dorset, U.K. Pyrimidine bases, nucleosides, nucleotides and 6-Azauracil were obtained from Koch-Light Laboratories Ltd., Bucks, U.K. Activated Norit OL Charcoal was obtained from Hopkin and Williams Ltd., Essex U.K., and purified before use by the procedure of Al-Baldawi (1976).

METHODS

Extraction and Determination of Pyrimidine Derivatives

By using mortar and pistel, weighed batches of freshly harvested seedlings were extracted with a cold $HClO_4$ (0.3 M) Approximately 1 ml of $HClO_4$ was used/g fresh weight of tissue. Dry seeds were milled in a C580 microhammer (Glen Creston Ltd., U.K.) and then homogenized in cold 0.3 M $HClO_4$ (10 ml/g of powdered seed). Homogenates obtained from either seeds or seedlings were centrifuged at 5000xg for 20 min at room temperature, and the supernatant decanted. Residue were re-extracted three more times in a similar way and the combined supernatants were largely freed from (ClO_4^-) by precipitation at room temperature with conc. KOH followed by centrifuging at 4000xg for 15 min. After the pH of the supernatant had been adjusted to 3.5 with glacial acetic acid, the supernatant was subjected to a preliminary purification by adsorption onto charcoal.

Adsorbed compounds were eluted from the charcoal by suspension in spectroscopically pure ethanol (25% V/V) containing 5% (V/V) of ammonia solution (Sp. gr. 0.91), and stirred for 2 h. After allowing the flask to stand for 20 h, the charcoal was removed by centrifuging at 5000xg for 30 min. To ensure the complete elution of the compounds from the charcoal, the procedure was repeated four times. The eluates were pooled and filtered through Whatman No. 1 filter paper to remove traces of charcoal. Finally, the pooled eluate was evaporated to dryness in vacuo at 40°C, separated by high voltage electrophoresis on Whatman 3 mm paper, under 2500 volts for 30 min., the buffer system used was formic acid: acetic acid (1.5 M; pH 2), then subjected to paper chromatography on Whatman No. 1, in Butan-1-01: glacial acetic acid: water (60:15:25 by vol.) (solvent 1); Propan-2-01: ammonia solution (Sp. gr. 0.91): water (70:10:20 by vol.) (solvent 2); Propan-2-01: conc. HCl:Water (130: 33: 37 by vol.) (solvent 3), pyrimidine derivatives separated in this way, were shown to be chromatographically homogeneous. Homogenity of chromatographic bands were examined by using uv-light.

Recovery experiments showed that, from extraction to determination, there was a 10% loss of pyrimidine derivatives, such losses are atributable mainly to the charcoal adsorption and elution steps.

After purification and separation, pyrimidine derivatives were determined spectroscopically.

RESULTS

Seeds of *Hordeum vulgare* and *Hordeum distichum* were imbibed separately in distilled water (control), or 10 mM 6-Azauracil solution, or 10 mM 6-Azauracil + uracil solution. The pH of the solutions were adjusted to 5.5 before use. Batches of 100 seeds, seedlings from 5, 10, 15, 20, 25 and 30-days old were extracted and their content of pyrimidine derivatives were estimated and identified as follows:

(1) Hordeum distichum

(a) Compounds migrated towards the Anode: Three bands were migrated to the anode after the current was applied. The first band was migrated 4.5 cm from the origin towards the anode. Darker zones could be seen within it under the UV-ligh. The band was taken to be hetrogeneous. The migration of this band was similar to that of 5-UMP reference sample. The band was eluted and purified by paper chromatography side by side with 5-UMP in solvent 1 and was show to be homogeneous (Table 1). This band was eluted and re-chromatographed in solvent 2 and in solvent 3. This was confirmed by Spectrophotometry.

The second band was migrated 4.75 cm from the origin towards the anode. The migration of this band was similar to that of Orotidine reference sample. The band eluted and purified by paper chromatography in solvents 1, 2, and side by side with Orotidine and was shown to be homogeneous. Their spectrophotometric behaviours were also identical to that of orotidine (Table 1).

The third band was travelled 5 cm from the origin towards the anode. Chromatographic behaviours of this band in solvents 1, 2, showed that this compound is not one of the more commonly occuring pyrimidine derivatives. Therefore, it was neglected.

(b) Compounds migrated towards the Cathode: Two bands were travelled 8.25 cm and 14 cm from the origin towards the cathode after using the High-Voltage Electrophoresis under the same conditions mentioned above.

After purification and identification by paper chromatography, the compounds did not appear to be any of the more commonly occuring pyrimidine derivitives. Therefore, they were neglected.

c. Compounds stayed at the origin

After viewing the electrophoretogram under uv-light a broad heterogeneus band was seen at the origin. After elution it was subjected to paper chromatography in solvent 1 for separation and identification, side by side with the authentic samples.

In uv-light, three dark homogeneous bands could be seen of R_F values 0.36, 0.49 and 0.6 and they correspond to uridine, uracil and thymine respectively (Table 1). Their homogenity confirmed by re-chromatography in solvent 2 and 3, followed by spectrophotometry.

2. Hordeum vulgare

High-Voltage paper Electrophoresis in formic: acetic acid buffer at pH 2 showed that 5-UMP and orotidine were the bands migrated towards the Anode, and that uridine, uracil and thymine were stayed at the origin. Homogenity was demonstrable by paper chromatography in solvents 1, 2, and 3 and confirmed by spectrophotometry (Table 2).

Table 1

Characteristics of identified band components from the adsorbed fraction of *Hordeum distichum* seeds and seedling germination and growth.

Electrophoretic behaviour (1)		Chromatographic behaviour			Ultraviolet absorption				Concentration mole/seed or seedling							
					pH2		pH12									
Direction of migration	Migration distance cm/30 min	R_F in (2) Solvent 1	R_F in (3) Solvent 2	R_F in (4) Solvent 3	max nm	min nm	max nm	min nm	Dry Seed	5 day – old Seedling	10 day–old Seedling	15 day–old Seedling	20 day–old	25 day–old Seedling	30 day –old Seedling	Compouod identified
Anode	4.25	0.08	0.03	0.74	261	231	261	242	0.0223	0.0281	0.0144	0.0259	0.0367	0.0079	0.0231	5'– UMP
Anode	4.75	0.18	0.2	0.50	267	234	267	245	0.0175	0.0380	0.0241	0.0625	0.0810	0.0495	0.0124	Orotidine
Origin	0.0	0.36	0.35	0.62	262	230	262	235	0.0734	0.0395	0.0166	0.0291	0.0710	0.0492	0.0333	Uridine
Origin	0.0	0.49	0.36	0.66	259	227	284	241	0.0879	0.0512	0.0653	0.0382	0.0749	0.0333	0.0307	Uracil
Origin	0.0	0.60	0.5	0.76	264	233	291	244	0.0681	0.0523	0.0266	0.0460	0.0780	0.0610	0.0532	Thymine

(1) Formic: acetic acid buffer at pH2; voltage applied 2500 v for /30/ minutes.

(2) Butan – 01 : acetic acid: water.

(3) Propan – 2 – 01: ammonia solution: water

(4) Propan – 2 – 01: conc. HCl: water.

Table 2

Characteristics of identfied band components from the adsorbed fraction of *Hordeum vulgare* seeds and seedling during germination and growth.

Electropnoretic behaviour[1]		Chromatographic behaviour			Ultraviolet absorption				Concentration mole / seed or seedling							
Direction of migration	Migration distance cm / 30 min.	R_F In[2] Solvent 1	R_F In[3] Solvent 2	R_F In[4] Solvent 3	PH_2		pH_{12}		Dry Seed	5 day – old Seedling	10 day – old Seedling	15 day – old Seedling	20 day – old Seedling	25 day - old Seedling	30 day – old Seedling	Compound identified
					max nm	min nm	max nm	min nm								
Anode	4.25	0.08	0.03	0.74	261	231	261	242	0.0253	0.0281	0.0267	0.0144	0.044	0.0325	0.0158	% – UMP
Anode	4.75	0.18	0.2	0.50	267	234	267	245	0.0161	0.0175	0.0283	0.0746	0.088	0.078	0.0416	Orotidin
Origin	0.0	0.36	0.35	0.62	262	230	262	235	0.0620	0.0325	0.0291	0.0263	0.0644	0.0236	0.0173	Uridine
Origin	0.0	0.49	0.36	0.66	259	227	284	241	0.0682	0.0460	0.074	0.0273	0.104	0.065	0.0312	Uracil
Orugin	0.0	0.60	0.5	0.76	264	233	291	244	0.0487	0.0151	0.020	0.0230	0.065	0.048	0.028	Thymine

(1) Formic : acetic acid buffer at pH_2; voltage applied 2500 V for / 30 / minutes.
(2) Butan – 1 – 01 : acetic acid : water.
(3) Propan – 2 – 01 : ammonia solution: water.
(4) Propan – 2 – 01 : conc. HCl : water.

DISCUSSION

The production of pyrimidine constituents of *Hordeum vulgare* and *Hordeum distichum* increased during germination and growth (Fig. 1-5) and that confirms the operation of the orotate pathway in barley as in the other plants (Buchowicz and Reifer, 1961).

6-Azauracil stimulates the production of the pyrimidines during germination and growth (Fig, 1-5). This suggests the presence of direct decarboxylation of orotic acid to uracil by orotic acid decarboxylase. However, the operation of such path in wheat seedlings (Buchowicz and Lesnawiska, 1970), in peas (Ashworth *et al.*, 1972; Al-Baldawi, 1976) and in the present work, stimulation of pyrimidines production in *Hordeum vulgare* and *Hordeum distichum* during germination and growth by 6-Azearacil supports the existence of an enzyme catalyzing the direct decarboxylation of orotic acid to uracil. Ths result is supported by those of Kulhanek *et al.* (1965, 1967) who reported the existence of an enzyme responsible for the direct decarboxylation of orotic acid to uracil in *E. coli*. This direct decarboxylation initiated due to the inhibitory effect of 6-Azauracil on 5-OMP decarboxylase which has been reported previously (Handschumacher and Pasternak, 1958; Pasternak and Handschumacher, 1959; Ashworth *et al., 1972).*

The results (Fig. 1-5) show that exogenous uracil stimulate the production of pyrimidine in Hordeum vulgare and *Hordeum distichum* during germination and growth. This may be due to the reversal action of uracil on the inhibition caused by 6-Azauracil. This suggestion is supported by tha work of Trotter (1949), Shimeno and Kinoshita (1963), Fujii (1963) and Ross (1965). On the other hand, uracil stimulate the production of pyrimidines in plants (Ross *et al.*, 1971; Ashworth *et al.*, 1972; Browm and Al-Baldawi, 1977). This might be another explanation for the stimulation of pyrimidines production in barley during germination after the addition of uracil.

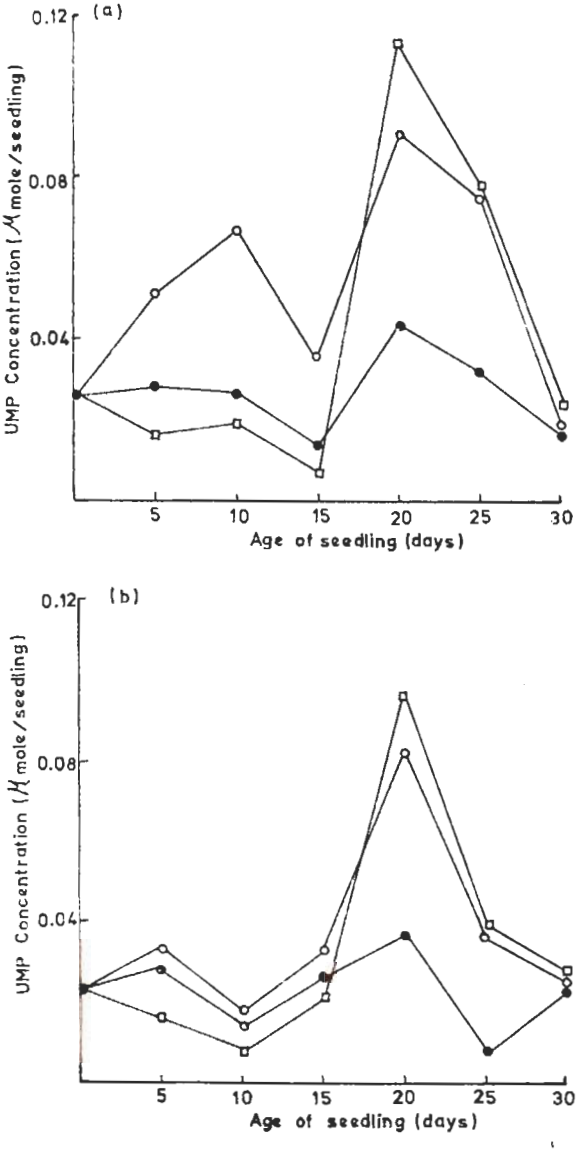

FIG.1. THE EFFECT OF 6_AZAURACIL AND URACIL ON PRODUCTION OF UMP DURING EARLY GROWTH OF

(a) HORDEUM VULGARE.

(b) HORDEUM DISTICHUM.

TREATED SEEDLINGS WERE :-

●——● Control. o——o 6_Azauracil treated □—□6-Azauracil+uracil treated.

IMBIBITION OF SEEDS COMMENCED AT ZERO TIME.

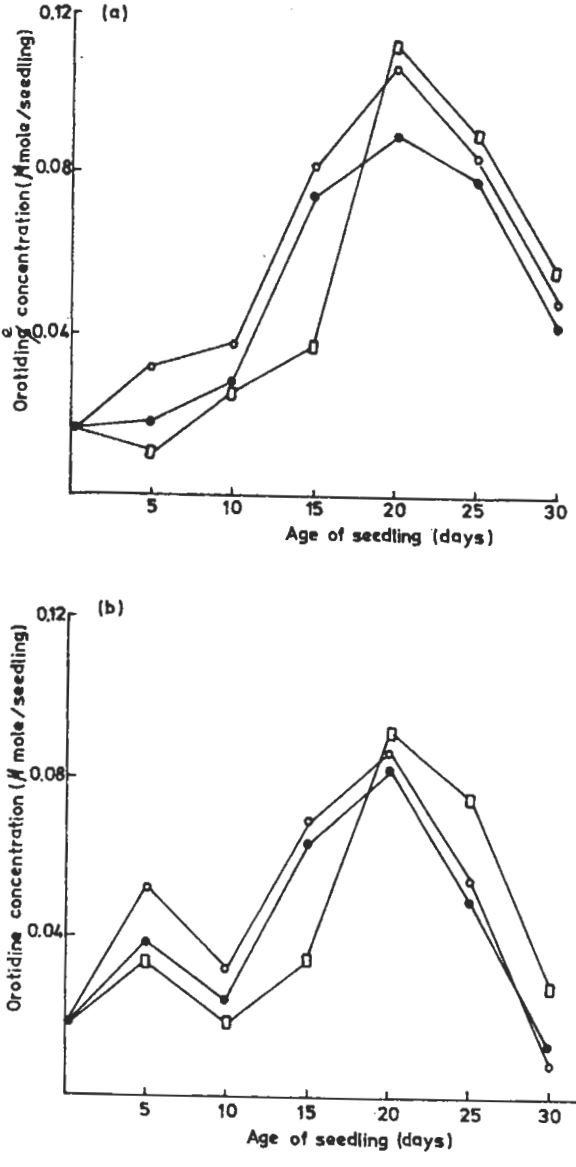

FIG. 2. THE EFFECT OF 6-AZAURACIL AND URACIL ON PRODUCTION OF OROTIDINE DURING EARLY GROWTH OF
(a) HORDEM VULGARE.
(b) HORDEM DISTICHUM.
TREATED SEEDLINGS WERE :-
●—● Control. o—o 6-Azauracil treated. □—□ 6-Azauracil + uracil treated
IMBIBITION OF SEEDS COMMENCED AT ZERO TIME.

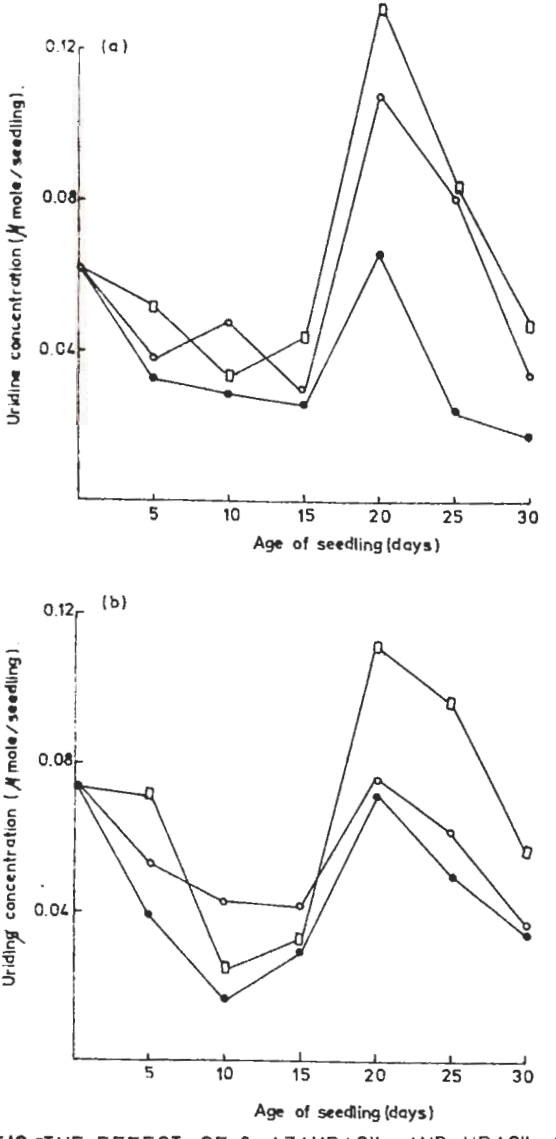

FIG.3 THE EFFECT OF 6-AZAURACIL AND URACIL ON PRODUCTION OF URIDINE DURING EARLY GROWTH OF (a) HORDEUM VULGARE (b) HORDEUM DISTICHUM.

TREATED SEEDLINGS WERE :-

- ●——● Control.
- o——o 6-Azauracil treated.
- □——□ 6-Azauracil + uracil treated.

IMBIBITION OF SEEDS COMMENCED AT ZERO TIME.

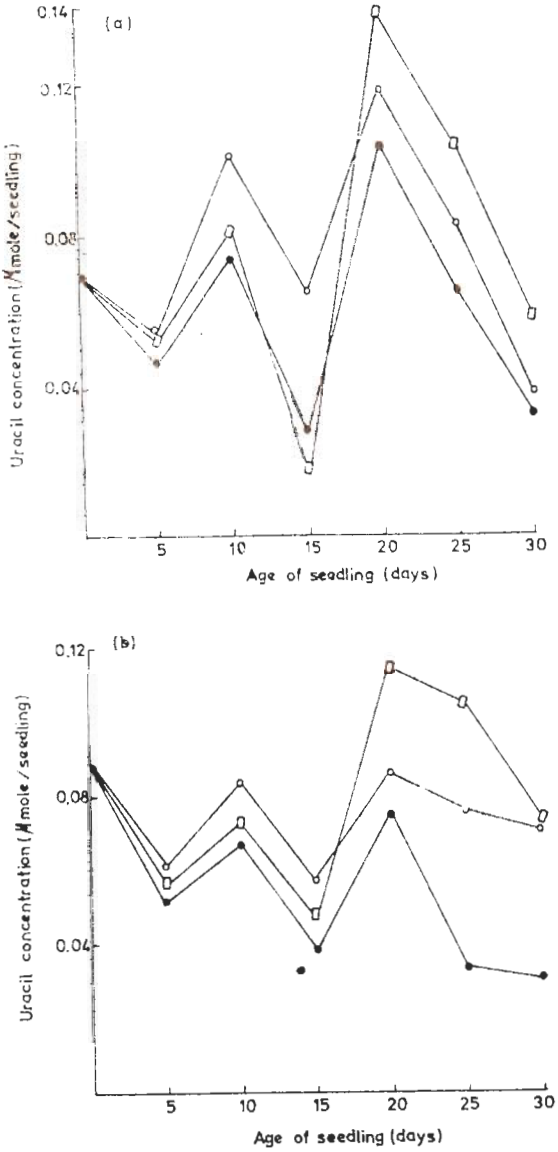

FIG. 4. THE EFECT OF 6_AZAURACIL AND URACIL ON PRODUCTION OF URACIL DURING EARLY GROWTH OF
(a) HORDEUM VULGARE.
(b) HORDEUM DISTICHUM. TREATED SEEDLINGS WERE:-
●——● Control.
o——o 6_Azauracil treated.
□——□ 6_Azauracil + uracil treated.
IMBIBITION OF SEEDS COMMENCED AT ZERO TIME.

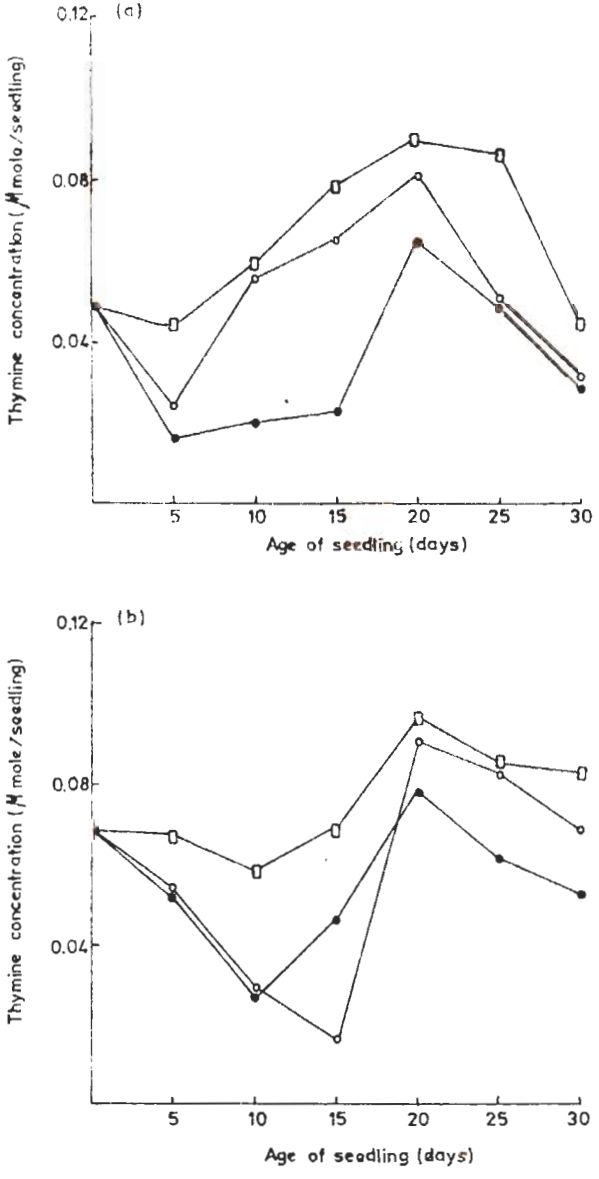

FIG. 5. THE EFFECT OF 6-AZAURACIL AND URACIL ON PRODUCTION OF THYMINE DURING EARLY GROWTH OF
(a) HORDEUM VULGARE.
(b) HORDEUM DISTICHUM. TREATED SEEDLINGS WERE:-
●—● Control. o—o 6-Azauracil treated. □—□ 6-Azauracil + uracil treated.
IMBIBITION OF SEEDS COMMENCED AT ZERO TIME.

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INVESTIGATION OF PYRIMIDINE DERIVATIVES IN BARLEY DURING EARLY GROWTH

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SUMMARY

Pyrimidine derivatives have been investigated in *Hordeum distichum* and *Hordeum vulgare*. The techniques used throughout this investigation included, high-voltage electrophoresis, paper chromatography in different solvents, followed by the use of spectrophotometry for quantitative estimation of the compounds.

The results suggested that pyrimidine derivatives occur in barley as in other plant species and may be formed through the orotate pathway.

الخلاصة

لقد تم بحث واستقصاء مشتقات البريميدين في صنفين من الشعير هما *Hordeum distichum* و *Hordeum vulgare* ومن الطرق العملية التي استخدمت في البحث هي طريقة الهجرة الكهربائية ذا فرق الجهد العالي، كروماتوغرافياً الورق في مذيبات مختلفة، ومن ثم تقدير المركبات كمياً بواسطة جهاز المطياف.

وقد اشارت النتائج الى ظهور بعض مشتقات البريمدين في الشعير كما هو الحال في النباتات الاخرى وان هذه المشتقات ربما تتولد بطريقة حمض الاوروتيك.

Based on part of M. Sc. thesis submitted by the second author.

INTRODUCTION

It has been known that pyrimidines occur widely in the tissues of animals, plants, and microorganisms. These pyrimidines occur in nucleic acids and as free nucleotides and nucleosides (Brown, 1975). Pyrimidine nucleotides serve not only as precursors of RNA and DNA, but also as stores of high energy phosphate, constituents of certain coenzymes and modulators of various enzymic reactions. Thus they play a vital role in cellular metabolism (Jaff and Gutteridge, 1974).

Most reactions in the pathway leading to the biosynthesis of pyrimidine derivatives in certain microbial and animal cell have been known of sometime (Reichard, 1959, and Crosbie, 1960). Some of these have been tentatively established in plants (Buchowicz and Reifer, 1962; King and Wang, 1965; Wolcott and Ross, 1967; Ross *et al.*, 1971; Ashworth *et al.*, 1972; Brown and Al-Baldawi, 1977). The enzymes involved in the orotate pathway in plants have been studied by many investigators (Kapoor and Waygood, 1961; Wolcott and Ross, 1966; Schwarz and Fites, 1970; Mazus and Buchowicz, 1971; and Ong and Jackson, 1972). The pathway of degradation of pyrimidine nucleotides in plants was reported by many workers (Evans and Axelrod, 1961; Barnes and Naylor, 1962; and Pitel and Durzan, 1975).

No investigations has been made of pyrimidine derivatives in barley during early growth. To obtain a more complete picture, *Hordeum distichum* and *Hordeum vulgare* have been examined with the main aim of identifying and determining the relative concentrations of such compounds.

EXPERIMENTAl

Materials and chemicals used and methods followed in this work were described in the first part of this series (Al-Baldawi and Shahinian, 1980).

RESULTS

Throughout this investigation, batches of 100 seeds, seedlings from 5, 10, 15, 20, 25 and 30-day old were used. The fraction adsorbed on charcoal eluted with ethanolic ammonia, were redissolved in a small volume of 0.01 M–HCl and separated by high-voltage electrophoresis. When the current was applied, some of the compounds were travelled to the cathode or to the anode, others stayed at the origin.

1. Hordeum distichum

a. Compounds migrated towards the Anode: Three bands were migrated to the anode when the current was applied. The first band was travelled 4.5 cm from the origin towards the anode. As in uv-light, darker zones could be seen within it, the band was taken to be hetrogeneous. The migration of

this band was similar to that of 5-UMP reference sample. The band was eluted and purified by paper chromatography side by side with authentic sample 5-UMP in solvent 1, and was shown to be homogeneous (Table 1), this band was eluted and rechromatographed in solvent 2 and in solvent 3. This was confirmed by spectrophotometry.

The second band was migrated 4.75 cm from the origin towards the anode. The migration of this band was similar to that of orotidine reference sample. The band was eluted and purified by paper chromatography in solvents 1, 2 and 3, side by side with authentic sample and was shown to be homogeneous. Their spectrophotometric behaviour was also identical to that of orotidine (Table 1).

The third band was migrated 5cm from the origin towards the anode. After elution and separation by paper chromatography in solvents 1, 2 and 3, the compound did not appear to be any of the more commonly occuring pyrimidine derivatives therefore, it was neglected.

b. Compounds migrated towards the Cathode

Two bands were migrated 8.25 cm and 14 cm from the origin towards the cathode after using the high-voltage electrophoresis under the same conditions mentioned above.

After purification and identification by paper chromatography, the compounds did not appear to be any of the more commonly occuring pyrimidine derivatives therefore, they were neglected.

c. Compounds stayed at the origin: After viewing the electrophoretogram under the uv-light a broad heterogeneous band could be seen at the origin. After elution it was subjected to paper chromatography in solvent 1 for separation and identification side by side with the authentic samples.

In uv- light, three dark homogeneous bands could be seen of R_F values 0.36, 0.49 and 0.6 and they correspond to uridine, uracil and thymine respectively (Table 1). Their homogenity confirmed by re-chromatography in solvent 2 and 3, followed by spectrophotometry.

2. Hordeum vulgare

High-voltage paper electrophoresis in formic: acetic acid buffer at pH 2 showed that 5-UMP and orotidine were the bands migrated towards the anode, and that uridine, uracil and thymine were stayed at the origin. Homogenity was demonstrable by paper chromatography in solvents 1, 2 and confirmed by spectrophotometry (Table 2).

DISCUSSION

Orotic acid pathway has been shown to operate in different plant tissues (Reifer *et al.*, 1960; Buchowicz and Lesniewska, 1970; Wolcott and Ross, 1966; Ross *et al.*, 1971; Al-Baldawi, 1976). In our present work the results (Tables 1 and 2) confirm the presence of the orotic acid pathway in

seedlings of *Horueum vulg' re* and *Hordeum distichum,* so it is expected that the orotate pathway is of wide occurrence in plants, as well as in animals and microorganisms.

Results presented in tables 1 and 2 suggested that pyrimidine contents of *Hordeum vulgare* and *Hordeum distichum* are qualitatively similar to each other. The pyrimidine contents of *Hordeum distichum* have more concentration than that of *Hordeum vulgare* and that may be to the size of the grains.

It could be seen (Tables 1 and 2) that the pyrimidines extracted from *Hordeum vulgare* and *Hordeum distichum* are orotidine, 5-UMP, uridine, uracil and thymine. It was not possible to detect even a small amount of the other pyrimidines by the techniques used. This could be explained by either absence of these pyrimidines or their presence in very small amounts due to their conversion to other pyrimidines and other compounds formed by the orotate pathway. However, it should be mentioned that Buchowicz and Reifer (1962) have reported that the concentration of orotic acid in plant tissue is very small that they could not detect it even by spectrophotometer.

The concentration of pyrimidine bases is bigger than that of nucleosides and nucleotides during germination and growth of *Hordeum vulgare* and *Hordeum distichum* (Table 1 and 2). This suggests that pyrimidine nucleosides and nucleotides may be formed from their bases and *vice versa.* This is limited to the enzymes catalyzing these reactions. This suggestion is supported by the work of Evans and Axelord (1961), Barnes and Naylor (1962), Pitel and Duran (1975), and Al-Baldawi (1976).

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Table I

Characteristics of identified band components from the adsorbed fraction of *Hordeum distichum* seeds.

Electrophoretic behaviour[1]		Chromatographic behaviour			Ultraviolet absorption				Concentration u mole/seed	
Direction of migration	Migration distance cm/30 min	R_F in[2] solvent 1	R_F in[3] solvent 2	R_F in[4] solvent 3	pH 2 max	pH 2 min	pH 12 max	pH 12 min	Normal seeds	Compound identified
Anode	4.25	0.08	0.03	0.74	261	231	261	242	0.0223	5-UMP
Anode	4.75	0.18	0.2	0.50	267	234	267	245	0.0175	Orotidine
Origin	0.00	0.36	0.35	0.62	262	230	262	236	0.0734	Uridine
Origin	0.00	0.49	0.36	0.66	259	227	284	241	0.0879	Uracil
Origin	0.00	0.60	0.5	0.76	264	233	291	244	0.0681	Thymine

(1) Formic: acetic acid buffer at pH 2; voltage appliaapplied 2500 V for minutes.

(2) Butan-2-01: acetic acid: water.

(3) Propan-2-01: ammonia solution: water.

(4) Propan-2-01: conc. HCl: water.

Table 2

Characteristics of identified band components from the adsorbed fraction of *Hordeum vulgare* seedseeds.

Electrophoretic behaviour[1]		Chromatographic behaviour			Ultraviolet absorption				Concentration u mole/seed	Compound identified
					pH 2		pH 12			
Direction of migration	Migration Distance cm/30 min.	R_F in[2] solvent 1	R_F in[3] solvent 2	R_F in[4] solvent 3	max nm	min nm	max nm	min nm	Normal seeds	
Anode	4.25	0.08	0.03	0.74	261	231	261	242	0.0253	5-UMP
Anode	4.75	0.18	0.2	0.50	267	234	267	245	0.0161	Orotidine
origin	0.00	0.36	0.35	0.62	262	230	262	236	0.0620	Uridine
Origin	0.00	0.49	0.66		259	227	284	241	0.0682	Uracil
Origin	0.00	0.60	0.5	0.76	264	233	291	244	0.0487	Thymine

(1) Formic: acetic acid buffer at pH 2; voltage applied 2500 V for /30/ minutes.

(2) Butan–1.01: acetic acid: water.

(3) Propan–2.01: ammonia solution: water.

(4) Propan–2.01: conc. HCl: water.

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INCIDENCE OF MYCOTOXIN IN STORED CORN IN IRAQ

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SUMMARY

Differnt samples of corn grains were collected from various locations in Iraq. Each snmple was subjected to different analyses including grains discoloration, identification of molds, and detection of their mycotoxins by chemical, physical, and biological methods. The rasults ravealed that discoloration was associated with mold contamination. Deteriorating fungi were *Aspergillus niger, A. flavus, A. fumigatus, A. terreus, Penicillium* spp, *Fusarium moriliforme, Mucor sp., Rhizopus* spp., *Phoma sp.*, and *Alternaria* spp. Seventy-nine percent of *A. flavus* isolates were able to produce aflatoxin B_1. However, the naturally contaminated stores were 45% with amounts ranging betheen 107 and 700 ppb. On the other hand, 30% *F.moniliforme* isolates were capable of producing zearalenone with a percentage of contamination reaching to about 27.2%. Biological test indicated that extracts of corn invaded with *A. flavus* and some other fungi, exert toxigenic effects on chicken embryos. In conrtast, zearalenone contaminated samples showed no effects on these embryos.

الخلاصة

من مناطق مختلفة في العراق تم جمع عينات من بذور الذرة الصفراء . خضعت كل عينة لفحوص لتشمل التغيير في لون البذور والمسبب ومايكوتوكسيناتها بطرق كيمياوية وفيزياوية وبيولوجية . دلت النتائج ان تغيير اللون كان أثر التلوث بكل من و *A. flavus* و *Aspergillvs niger* و spp و *Penicillium* و

و *Fusarium moniliforme* و *Mucor* spp. و *A. fumigatus* و *A. terreus*
و *Alternaria* spp. و *Phoma* spp. و Rhizopus spp. وكان بوسع ٧٥ ٪ من
A. flavus المعزولة القدرة على انتاج افلوتوكسين B_1 . وفي ٤٥ ٪ من المخازن الملوثة
طبيعياً كان التلوث يتراوح بين ١٠٧ و ٧٠٠ جزء بالبليون . ومن ناحية اخرى كان
بوسع ٣٠ ٪ من *F. moniliforme* المعزولة القدرة على انتاج الزيرالينون بنسبة تلوث
تصل ٢٧,٢ ٪ . ودلت الفحوص البيولوجية ان لمستخلص الذرة المصابة بال *A. flavus*.
وبفطريات اخرى تأثير سمي على اجنة الدجاج . وبالمقارنة لم يكن للعينات الملوثة
بالزيرالينون تأثير على مثل هذه الأجنة .

INTRODUCTION

Stored products are often contaminated with fungi, and some of them produce toxins which form a major hazard to the consumer. Corn *(Zea mays* L.) grains are usually attacked by fungi and bactria both in the field and in store yellow mold is caused by *Aspergillus flavus,* and it is considerd to be a dangerous disease of corn in the field (Brunside *et al.* 1957; Lillehoj *et al.* 1975; Rambo *et al.* 1972; and Tuite, 1961). Stored corn grains also form a suitable medium for growth of *A. flavus* and also for the production of its toxins (Anderson *et al.* 1975; Hesseltine *et al.* 1966; Shotwell *et al.* 1964; Shotwell *et al.* 1976; Shotwell *et al.* 1972; and watson *et al.* 1971).

Toxic effects including estrogenic and mycotoxicosis symptoms were observed when swine were fed on mold-deteriorated grains (Connel and Johnston, 1967; and Detory *et al.* 1971).

Another toxin producing fungus that attacks corn grain is *Fusarium moniliforme* which produces zearalenone (mirocha and Hamer, 1975; Shotwell *et al.* 1976; and Urry *et al.* 1966). In Iraq Particularly no information concerning the production of Mycotoxins on stored grains and food is available. Preliminary work carried out by Al-Adil *at el* (1977) has indicated the presence of *Aspergillus flavus* and its toxins particularly aflatoxin B_1 in different grains and some food stuff collected from local and commercial sources in and near Baghdad.

Studies have been taken up recently on this important problem and the results obtained are reported in this paper.

This work has been carried out under two headings namely:

1- Isolation of the various species of fungi associated with stored corn and identification of the toxicogenic isolates.

2- Chemical, Physical and biological determination of Mycotoxins particularly aflatoxins and zearalenone, produced by some of these isolates.

MATERIALS AND METHODS

Sample collection and preparation:

Representative samples of corn grains were collected from stores in 1977 from the fall cron, and from different provinces in Iraq including Baghdad, Dayala, Babylon. Karbala, Wasit, Qadisyiah, Arbil and Altamim. Samples were examined for detecting diseased and damaged grains which showed discoloration and cracking.

Isolation of Fungi:

Grains were surface sterilized by 1% NaOCl for two minutes, washed twice with sterilizer distilled water, placed separately on acidified Czapeks agar and incubated at 25°C + 3,for 5-7 days. Fungi emerging from the diseased kernels were purified and maintained on PDA slants for further work such as identification and toxin extraction,

Toxicogenic isolates and their toxins on stored corn:

In order to test the capacity of the different fungal isolates for producing Mycotoxins, thirty seven of them from different samples were grown of yeast extract-sucrose media for 14 days at 25°C+2 (Daris *et al.* 1966). Also twenty isolates of *F. moniliforme* were tested for Zearalenone production at 24-27°C and at 12-14°C (Mirocha and Hamar 1975). One Kg each of the diseased corn sample was collected, ground, and kept in deep-freeze until the time of analyses. Standard aflatoxin B_1, B_2, G_1, G_2 were purchased from Calbiochem (Los Angeles California, U.S.A). Appropriate standard solutions were prepared in chloroform. Zearalenone crystals were disolved in chloroform. to prepare the standard solution.

Extraction of Mycotoxins

Fifty grams from each corn sample, were extracted and cleaned up according to the method described by Seitz and Moher (1976). Fungal cultures were extracted and cleaned up as described by Jones (1972), and Seitz and Moher (1976) method was used for Zearalenone extraction.

Mycotoxin analysis:

All extracts were examined for their aflatoxin and Zearalenone content by thin layer chromotography techinque. Glass plates coated with silica gel G with a thickness of 0.25 mm were used in this study.

The spotted plates were developed in chloroform and Methanol (97:3) and the spots were detected by UV lamp (256; 365 nm). Confirmation was made on plates by application of two dimensional seperation ad spraying with H_2SO_4: Methanol (90:10) as discribed by Romer (1973). Semiquantitative determination of aflatoxin B_1 in the samples were made by comparing the fluorescence of the standerd spots. Quantitative determination was also done by using UV Spectro photo meter (Model 25 Beckman) with the aid of standard curve (Fig 1.) To confirm the presence of mycotoxins in the studied samples biological test using chicken embryos were also carried out as discribed by El-Behadli (1975) and Mclayghlin *et al* (1962; 1963).

Regarding *F. moniliforme,* it was observed that only 30 percent of the isolates were found to produce Zearalenone (Table 5).

Natural occurance of aflatoxin and zearalenone:

Chemophysical anayises showed that samples collected from the provinces of Arbil, Altamim, Dyalish and Babylon, were contaminated with aflatoxin B_1 (Table 6), the contamination being in the range of 0.107-0.7 ppm (Table 7).

Zearalenone, however, was detected only in the samples from Baghdad, Dyaliah and Altamim (Table 8). Biological tests showed that extracts of deteriorated grains were texic to embryos and the high percentage of mortality was related to the presence of aflatoxin B_1 (Table 8).

RESULTS

Grain damage and fungi survey:

Naked eye examination showed that 50.8% of the grains were discolored and 5.25% were cracked (Table 1). The survay indicated tne presence of the following fungal genera, *Aspergittus, Fusarium. Penicillium. Rhizopus, Alternaria, Mucor* and *Phoma* with infection percentages of 75.01, 17.84, 4.8, 1.8, 0.75, 0.2 and 0.17 recepectively (Table 1). *Aspergillus* was found to be the dominant genus followed by *Fusarium. Aspergillus niger* group, and *A. flavus* link ex Fries were the important species of *Aspergillus* isolates, while *E. moniliforme* Sheldon was the only species of *Fusarium* that was observed in these studies. A very high percentage (27.63 %) of this species was isolated from the discolorated grains ((Table 2).

Among the twenty isolates of *A. flavus,* sixteen were found to be aflatoxin producers. on the other hand, among the other fungi only one isolate of *Penicillium* showed the ability to produce aflatoxin.

These studies also showed that aflatoxin B_1 was the only toxin produced by the toxicogenic isolates of *A.flavus* and *Penicillium* (Table 3). Quantitative determinations revealed that aflatoxin B_1 was produced in the range of 0-300 ppm (Table 3). Presence of this aflatoxin was also detected by UV absorption technique (Fig 2) Biological test using chicken embryos also confirmed the production of the aflatoxin B_1 (Table 4).

Under tield conditions, aflatoxin B_1 was detected in the grains two weeks after inoculation, and its quantity increased with time (Fig 3).

DISCCUSION

The change in the color of the deteriorated grains may be related to fungal metabolites or to heat created by fungal activity. The results indicateed that the genera *Aspergillus, Fusarium, Penicillium* and *Rhizopus* were dominant, and capabale of deterioration of grains under storage

Table 1 Fungal invasion, Percentage of cracking, and Percentage of discoloration.

Location	grain cracking (%)	grain discolojation (%)	Percentage of grain infection										
			Aspergillus spp *A. flavus*	*A. niger*	*A. fumigatus*	*A. ochraceus*	*A. terreus*	*Fusarum* spp *Fusarum moniliforme*	*Penicillium* spp	*Rhizopus* spp.	*Mucor* spp.	*Alternaria* spp.	*Phoma* spp.
Arbil (1)*	9.8	53.4	49.74	14.72	19.28	1.01	0.00	6.09	0.00	9.137	0.00	0.00	0.00
Altamim (2)	2.6	38.0	47.48	18.99	5.58	0.00	0.00	16.75	0.00	8.93	0.00	0.00	2.23
Dyaliah (2)	8.2	51.0	30.76	25.96	0.00	0.00	0.00	31.73	6.73	4.8	0.00	0.00	0.00
Baghdad (2)	10.4	49.2	7.95	9.09	0.00	0.00	0.00	62.95	0.00	0.00	0.00	0.00	0.00
Karbilia (2)	4.6	38.8	21.05	60.52	13.15	0.00	0.00	0.00	0.00	2.63	0.00	3.36	0.00
Babylon (3)	5.8	59.8	15.23	45.71	0.00	0.00	2.85	19.04	5.714	9.52	1.9	0.00	0.00
Babylon (4)	0.0	45.5	43.33	31.1	0.00	0.00	0.00	16.66	3.33	5.52	0.00	0.00	0.00
Babylon (2)	4.8	33.0	70.18	25.28	0.00	0.00	0.00	0.00	0.00	4.52	0.00	0.00	0.00
Wasit (3)	11.6	41.6	17.3	65.38	3.84	0.00	0.00	6.73	1.923	4.8	0.00	0.00	0.00
Wasit (2)	0.0	48.6	28.57	48.47	6.12	0.00	0.00	16.32	0.00	0.00	0.00	0.00	0.00
Qadyisyiah (2)	0.0	100	0.00	96.15	0.00	0.00	0.00	0.00	0.00	3.85	0.00	0.00	0.00
Average	5.25	50.8 75.2	30.14	40.17	4.36	0.09	0.25 17.84	17.84	1.6	4.8	0.17	0.75	0.2

Type of storage (1 = In silo, 2 = pile, 3 = Artificial drying, 4 = In steel basket)

conditions. This finding agrees with the results of Christensen and Kaufmann (1968); Lopoz and Christensen (1967), and Moubasher et al (1972).

The variability in the percentage of infestation between different locations may be due to one or more of the following factors:

1- Difference in the water content of the grains resulting from different conditions during harvesting and storage.

2- Difference in the infestation with storage insects. The results of this work also indicated that there are no variations in the percentage of infection between the cracked and non-craked grains. in contrast, Koehler (1957) reported that this percentage was higher in the cracked grains. Cracks on kernels have developed in the present study under unfavorable conditions for fungal growth. Regarding the mycotoxin production, the results showed that *A. flavu* is the most dangerous organism because of its ability to produce aflatoxin B_1.

The biological tests confirmed the presence of the aflatoxin B_1 and also showed that some of the non - aflatoxin producing isolates may have other unidentified toxic metabolites and as a consequence increased the chicken mortality in the bioassay tests. A similar report was made by El-Behadli (1975). Absence of aflatoxins other than B_1 in corn infested with *A. flavus* was also noted by Trenk and Paul (1970), and Watson *et al* (1971) The other mycotoxin Zearalenone was only detected in a few locations probably because of the favorable temperature for the production of this toxin was not avalable during the time that corn grains were produced or stored . Eugenion and *etal* (1970) also made a similar observation.

Table 2 Percentage of fungi infection in corn grain.

Fungus	Percentage of infection		
	Non discolorated grain	Discolorated grain	Cracked grain
Aspergillus flavus	32.72	43.09	28.57
Aspegillus niger	43.45	35.8	42.85
A. fumigatus	5.09	4.72	8.0
A. terreus	—	1.09	—
A. Ochraceus	—	1.36	—
Fusarium moniliforme	21.8	27.63	24
Mucor spp.	0.36	0.36	—
Penicillium spp.	3.27	2.54	1.14
Alternaria spp.	0.727	—	—
Rhizopus spp.	6.54	5	8.57

Table 3 Concentration of aflatoxin B_1 produced by different isolates of *A. flavus*.

Isolates source	*A. flavus* Isolates	ppm+× of Aflatoxin B_1
Baghdad	1	40–60
	2	–
	3	60–80
	4	–
Babylon	1	60–80
	2	60–80
	3	80–100
Altamim	1	–
	2	80–100
	3	60–80
Dyaliah	1	200–300
	2	80–100
	3	2–4
	4	4–6
Arbil	1	200–300
	2	200–300
	3	6–8
Karbala	1	
Wasit	1	–

+×Semi quantitative determination was done by TLC.

Table 4. Toxicity of corn moulds to chick embryo.

Treatment	Mortality (%)[1]	Toxicity
Drilling	16	-
Ethanol	14	-
YES	38	-
Aflatoxin B_1 10 g/ml	100	
A. niger (Babylon 1)	29	-
mucor spp (Arbil 1)	72	x
Penicillium spp (Dyaliah 3)	57	x
A. flavus (Arbil 2)	100	x
A. flavus (Dyaliah 1)	100	x
Penicillum (Babylon 2)	73	x
Rhizopus spp. (Qadisyiah 10)	79	x
A. niger (Baghdad 8)	79	x
A. fumigatus (Arbil 1)	86	x
Alternaria spp. (Karbalia 1)	43	x
A. tereus (Babylon 3)	18	-
A. ochraceas (Arbil 1)	73	x
Rhizopus spp. (Babylon 2)	64	x
Penicillium spp. (Arbil)	79	x
Penicillium (Wasite 2)	57	x
A. terreus (Babylon 1)	65	x
Penicillium spp. (Baghdad 1)	100	x

1 Extract caused above 40% mortality were considered toxic.

Table 5 Amount of Zearalenone preduced by different isolates of *F.moniliforme*.

Isolates	*F.moniliforme* Isolates	Zearalenone
Altamim	1	-
	2	++
	3	-
Arbil	1	-
	2	-
	3	+
	4	-
Baghdad	1	-
	2	-
	3	++
	4	+
	5	-
	6	+++
Babylon	1	-
	4	++
	6	-
	7	-
	8	-
Wasit	1	-
	2	-

+ Fluoresoent intensity

Table 6 Natural occurence of lAflatoxin and Zearalenone in stored corn.

Sample source	Mycotoxins	
	Aflatoxin	Zearalenone
Arbil (1)*	+B	-
Altamim (2)	+B	+
Dyaliah (2)	+B	+
Baghdad (2)	-	+
Karbilia (2)	-	-
Wasite (2)	-	-
Wasite (3)	-	-
Babylone (3)	-	-
Babylone (2)	+B	-
Babylone (4)	+B	-
Qadisyiah (2)	-	-

*Type of storage (1 = in silo, 2 = Pile
3 = Artificial drying 4 = in steel basket)

Table 7. Quantitative determination of Aflatoxin B_1 in stored corn.

Sample source	Aflatoxin B_1 determined by TLC (ppm)	Alfatoxin B_1 determined by spectrophotometer (ppm)
ARBIL (1)*	0.12-0.16	6.147
Babylone (4)	0.4-0.6	0.378
Babylone (2)	0.1-0.2	0.107
Dyaliah (2)	0.6-0.8	0.7
Altamim (2)	0.4-0.2	0.134
Spiked corn grain with I ppm aflatoxin B_1	0.6-0.8	0.72

*Type of storage 1 = in silo. 2: pile, 4: in steel basket

Table 8 Toxicity of corn grains extracts to chick embryo

Treatment[1]	Conc.	Mortality	Toxicity
Drilling		7	-
Ethanol	Absolute	7	-
Aflatoxin	0.1 ug /ml	64	+
Zerealenone	7.5 ug /ml	36	-
Non infected corn	X 50	41	-
Babylone (2)	X 50	77	+
Babylone (4)	X 50	100	+
Arbil (1)	X 50	93	+
Qadsyiah (2)	X 50	56	+
Wasite (2)	X 50	47	+
Dyaliah (2)	X 50	100	+
Baghdad (2)	X 50	57	+
Altamim (2)	X 50	93	+

1 Extract causing above 41% mortality were considered toxic.

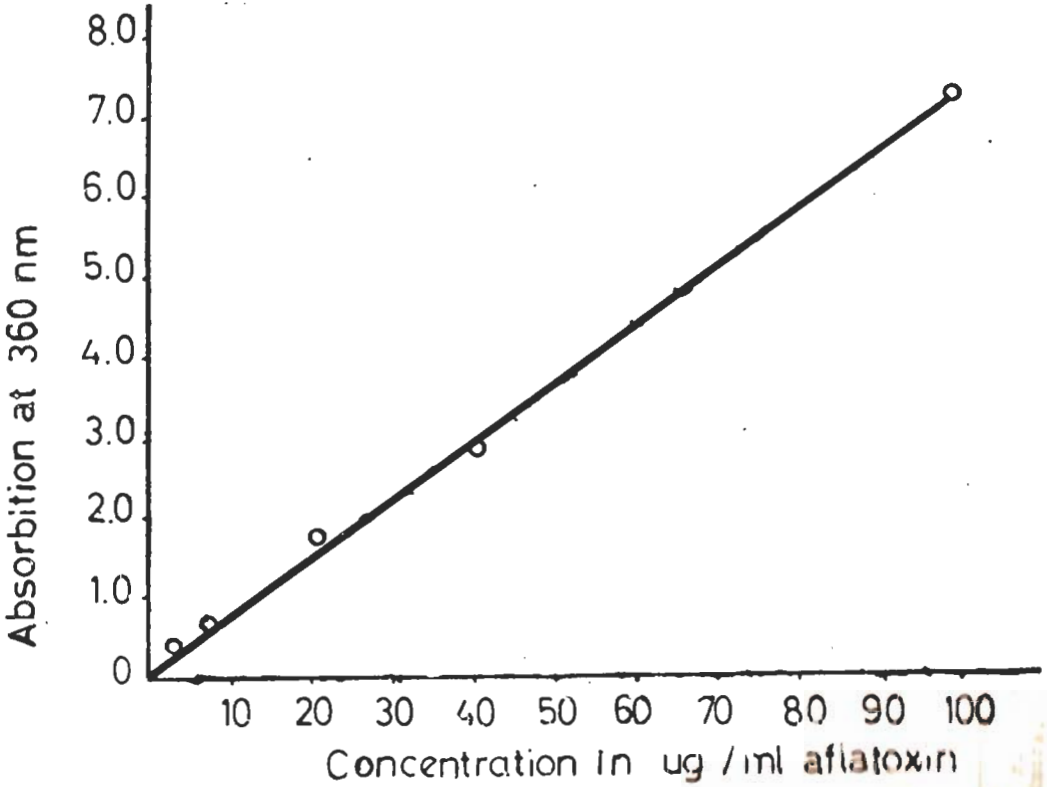
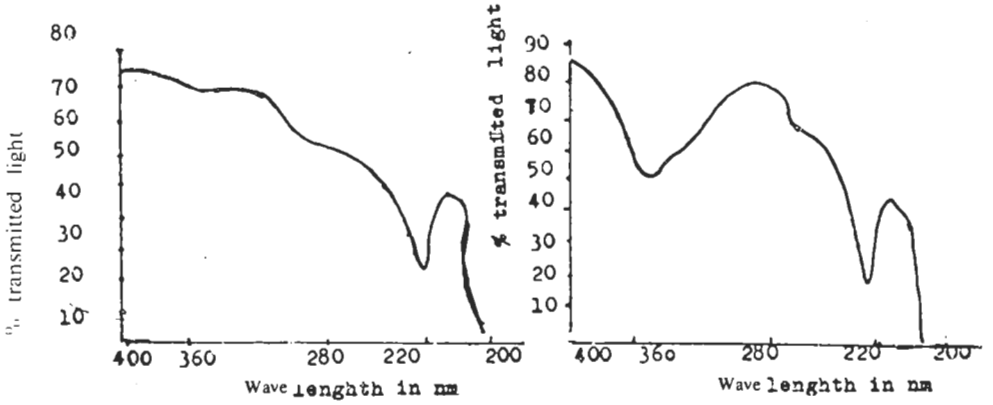


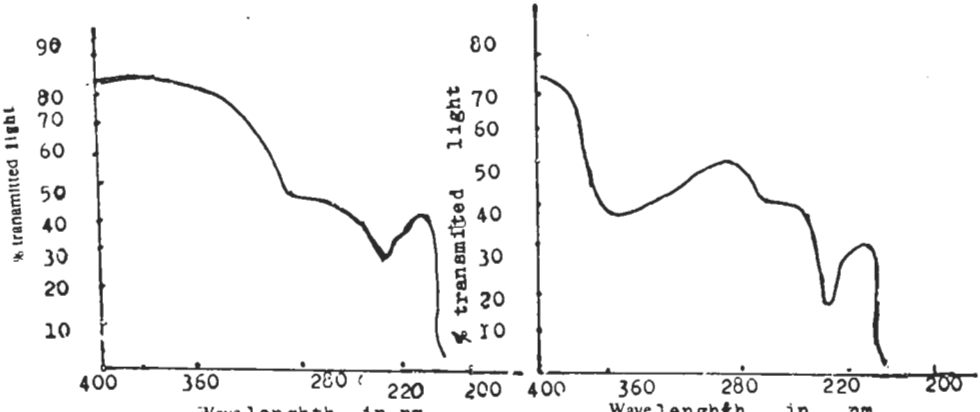
Fig. 1 Standard curve.

Fig 2 Ultraviolet absorbition as a fortification test for aflatoxin B



a. Spectrum of YES medium

b. Spectrum of YES medium fortified with aflatoxin B standard.



c. Spectrum ofnon aflatoxin producer isolate

d. Spectrum of aflatoxin producer isolate

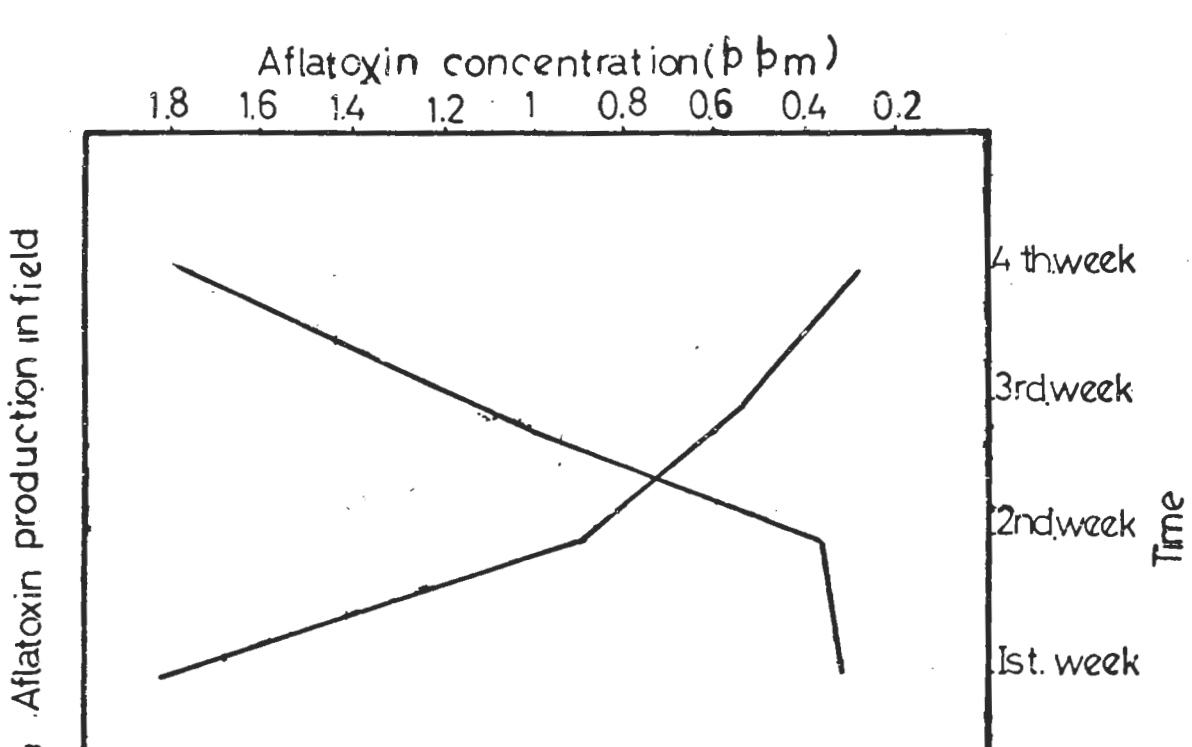

Aflatoxin concentration(ppm)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
4 th week
3rd week
2nd week
1st. week
Time
40
38
36
34
32
30
28
Water content (%)
Aflatoxin production in field

Fig 3 .

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CONTROL OF MOULD CONTAMINATION OF STORED CORN BY PHYSICAL AND CHEMICAL MEANS

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SUMMARY

In this some study physical and chemical methods to control corn deteriorating fungi in storage were evaluated. The results indicated that ventilation of stored corn was very effective in prevention of fungi growth as a result of lowering the moisture content of the grains. Further, it was found ventilated corn contained very low amounts (if any) of aflatoxin and zearalenone compared to nonventilated stored corn. On the other hand, chemical treatments with Luprosil and Tecto were also found to be effective in controlling fungi and their mycotoxins.

الخلاصة

تم تقييم بعض الطرق الفيزياوية والكيمياوية في مكافحة الفطريات المؤدية الى تدهور صفات بذور الذرة الصفراء المخزونة . دلت النتائج الى ان تهوية البذور المخزونة تؤدي الى انخفاض نسبة الرطوبة فيها وبالتالي تكون طريقة ذات فعالية كبيرة في منع النمو الفطري . كما وان كمية الافلوتوكسين والزيرالينون كانت منخفضة للغاية لدى البذور المخزونة الخاضعة للتهوية مقارنة بالبذور التي لم يخضع خزنها للتهوية . كما كانت المعاملة الكيمياوية باللوبروسيل والتكتو فعالية في السيطرة على الفطريات ومايكوتوكسيناتها .

INTRODUCTION

Considerable published research data have indicated the important role of fungi in the deterioration of stored corn. Several fungi were isolated from the stored grains (Al–Heeti *et al.* 1977; Assawah and Elarosi, 1960; Barron and Lichtwardt, 1959; Bothast *et al.* 1974; Christensen and Cohen, 1950; Koehler, 1957; McMohan *et al.* 1975). In addition, several mycotoxins were detected in stored corn particularly aflatoxin and zearatenone (Al–Heeti *et al.* 1977; Anderson *et al.* 1975; Ciegler and Aji, 1971; Davis *et al.* 1966; Detory *et al.* 1971; Hesseltine *et al.* 1966; Rambo *et al.* 1972; Romer, 1973; Shotwell *et al.* 1964, 1970; and 1972).

Consuming grains or grain products contaminted with fungi and toxins are likely to cause health hazards and therefore effective steps to prevent mould growth and the production of the mycotoxins in agricultural commodities are to be taken urgently. Among the different chemical and physical methods available for the control of mould growth on corn is the application of propionic acid which has shown high promise in protecting the stored grains from molds and other fungi and at the same time has enhanced their nutritive value as animal feed (Jones *et al.* 1970, 1970; and Sauer *et al.* 1950).

Also providing adequate aeration was found to be effective in protecting grains from fungal invasion (Christensen and Kaufmann, 1968; Converse *et al.* 1974; and Kelly, 1940).

The present work was undertaken to evaluate some chemical and physical means of controling mould growth on stored corn under conditions obtained in Iraq.

A- The effectivness of aeration in suppressing the fungal growth and mycotoxin production. (was tested).
B- The effectivness of two chemicals, Tecto (60%)
2- (4 – Thiazylol) – benzimidazole and Luprosil (99.5% Propionicacid) in preventing fungal growth and inhibiting mycotoxins was evaluated.

MATERIALS AND METHODS

Aeration methods (Physical control):

In these experiments two tightly closed experimental wooden silos (1.5 × 1 × 0.5 m) were used and placed in the abu-Ghraib store center of corn. Each silo was provided with two openings alternate in positions, one upwards (for air entrance) in the right and the other downwards (for air exit) in the left. One of these silos was provided with an electric ventilator (8 inch) fixed at the upper opening. With the aid of an attached timer, the ventilator was operated and turned off alternatively after every six hours. The second silo was left without this type of arrangement. These two silos were filled with fresh harvestev corn to a height of 120 cm. The moisture

content (28.5%) of the grains was determined by the oven method before tney were placed in the silos. This experiment was carried out for 173 days. After this period grain samples were taken from the top layer (0-40 cm), middle layer (40-80cm), and bottom layer(80-120 cm), for mould estimation and mycotoxin extraction.

Chemical methods:

In these experiments two chemicals including Luprosil* and Tecto were used. Three kilograms of cobbed and decobbed grains were checked for their moisture content (26.43%) by oven method and treated with the chemicals. Four concentrations of Luprosil (0, 6.5×10^3, 11×10^3, and 20×10^3 ppm) were used directly with grains and four concentrations of Tecto (0,1438.8, 2877.8 and 5035.8 ppm) were used by immersing the grains in each concentration for 15 mins and then exposing them to sunlight for 2 hrs. The treated grains were kept in metal bags and were kept at the Abu-Ghraib store center of corn for 173 days.

Sample evaluation:

Grain discoloration was evaluated on the basis of colur change induced by infection, and the moisture content was measured by the oven method which consisted of drying 100 gm at 103 C°for 72 hrs in forced-draft oven. While the losses in the dry weight of the grains was determined by weighing 500 cc of grain after drying.

Isolation of fungi:

Grains were surface sterilized by 1% NaOCl then washed twice with sterilized distilled wated and placed separately on acidified czapeks agar. The petridishes were incubated for 5-7 days at 25 C°+ 3. The associated moulds and other fungi were identified and the percentage of infection was determined.

Detection of mycotoxin:

Fifty grams from each sample were extracted and cleaned up according to the method described by Seitz and Moher (1976). All extracts were examined for the occurence of aflatoxin and zearalenone by thin layer chromatography. Glass plates were coated with silica gel (0.25 mm) and spotted plates were developed in chloroform: Methanol (97:3). Spots were detected under UV lamps 9 (256,365 nm).

RESULTS

Physical control:

Moisture content, discoloration percent, and dry weight: The results indicated that there was a decrease in moisture content in the ventilated silo

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99.5 % propionic acid supplied by BASF Company.

60% 2-(4-Thiazyiol)-benzimidazol supplied by MSD Company.

as compared to the non-ventilated one. Also there were significant variations in the moisture content among the layers in a silo. Further grain discoloration was observed markedly in the non-ventilated silo and the dry weight of grain decreased more in the non-ventilated silo as compared to the ventilated one (Table 1).

Mould development:

In both silos *Aspergillus flavus* link ex. fries, *A. niger, A. fumigatus, Fusarium moniliforme, Rhizopus* sp., *Penicillium* spp. were the fungi that were isolated. However, there was a clear difference in the percentage of infection between the two silos. High percentage was noticed in the non-ventilated silo. The areation had decreased the percentage of infection with *F. moniliforme* from 44.6 % in non-ventilated silo to 13.66% in the ventilated one (Table 2). Also it had same effect on the growth of *Penicillium* spp and *Rhizopus* spp.

Aflatoxin and Zearalenone production:

Chemical analysis of grains from both types of silos indicated the presence of zearalenone with a high concentration in the grains from non-ventilated silo. On the other hand, aflatoxin was not detected in the grains from either siloes (Table 3).

Moisture content, discoloration percent, and dry weight:

Moisture content of grains markedly decreased in cobbed grains (7.2 %) as compared to the decobbed grains (10.01 %). The percentage of discoloration grain was high in the non-treated grains as compared to the chemical treated grains (Table 4). Furthermore, the dry weight of grains decreased more in the non-treated grains as compared with the treated.

Mould development:

The dominant fungi that were isolated from the corn grain samples were *Aspergillus flavus* link ex. Fries. *A.niger, Aspergillus fumigatus, Trichothecium roseum, Fusarium moniliforme, Penicillium* spp. and *Rhizopus* spp. However, their infection percentages were varied according to the treatment. The highest infection percentage was found in the nontreated grains, followed by Tecto treated and Luprosil treated grains. Concerning chemical activity, Tecto was not effective against *Rhizopus* spp. regardless of the concentration used (Table 5).

Aflatoxin and Zearalenone production:

In all tested samples zearalenone was not detected, on the other hand, aflatoxin was detected in the non-treated grains. Decobbed grains were treated with 1438.8 and 2877.8 ppm of Tecto (Table 6).

DISCUSSION

Concerning the physical means used in this investigation, the results showed that there was a difference in the moisture content between the two silos which might have resulted from different ventilation conditions prevailing in them. However, the difference in the moisture content between the different layers of ventilated silo may have resulted from a lack of air flow uniformity provided by the ventilator. This is in agrreement with the results of Christensen *et al.* (1950) and Convers *et al.* (1974). On the other hand, little decrease in the moisture content of the non ventilated silo was observed, parlicularly in the middle and bottom layers, because it was not in contact with the surrounding environment. In a closed environment water is usually accumulated and provides a favorable condition for fungal growth. However, ventilation usually changes the environment and decreases the water content and the temperature that suppresses the fungal growth. Many researches have reached the same conclusion (Christensen *et al.*, 1950, Christensen and Kaufman, 1968; Convers *et al.*, 1974; and Kelly, 1940). In the non-ventilated silo the activity of fungal growth was related to discoloration and loss in dry weight.

Aflatoxin could not be detected in either silo. This can be explained by the fact that the isolates of *A. flavus* were not produced or the conditions were not favorable for toxin production. Competition between *A. flavus* and other microorganisms may have an important role in suppression or decomposition of the produced aflatoxin. This phenomenon was observed by Jarvis (1971) and Goldblatt (1969). However, Zearalenone contamination was high in the nonventilated silo, because the favorable conditions for fungal growth and toxin production were available. These results were in agreement with the results of Eugenion (1970).

Concerning the chemical treatment, both luprosil and Tacte were recomended, because of their safety to animals (Jones *et al.* 1970, 1974; Sauer *el al.* 1950; and Thomas, 1975). Treatment with low concentrations (6.5×10^3 ppm) of luprosil showed high effectivity to prevent corn deterioration caused by fungi for a period of 173 days. Similar results were obtained by several researchars (Jones *et al* 1970, 1974; and Sauer *et al.* 1950).

Also production of aflatoxin was reduced by chemical treatment with luprosil and Tecto. However, luprosil was superior in all concentrations used (6500, 11000, 20000), as no aflatoxin was detected. Tecto elimlnated the production of aflatoxin totally only at the highest concentration (5038.8 ppm). Therfore luprosil can be recommended for stored corn. Beside its high effectivity it is considered a safe chemical and increases the digestibility of treated corn by the cattle (Jones *et al* 1970,1974; and Sauer *et al.* 1950).

The effects of these chemicals on zearalenone production could not be assessed in these studies because the samples used appeared to be free from this mycotoxin.

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TABLE 1. Effect of aeration on moisture content, discoloration and dry weight of corn.

	Aerated silo			Non aerated silo		
Location in Silo	Moisture content %	Discolorated grain %	Waight of 500 cc grain (gm)	Moisture contont %	Discolorated grain %	Weight of 500 cc grain (gm)
Top layer	9.75 b*	0.5 b	199.76 c	10.6 b	11.75 b	139.7 d
Middle layer	11 c	13.25 c	189.8 b	15.5 d	49.5 c	168.5 c
Bottom layer	10.25 bc	10.75 c	185 b	14.5 c	50 c	155 b

* Means followed by the same letter are not different at p. 0.05.

TABLE 2. Effect of aeration on fungi and their percentage of infection in stored corn.

	Percentage of grain infection					
Treatment	*Aspergillus flavus*	*Aspergillus niger*	*Aspergillus fumigatus*	*Fusarium moniliforme*	*Rhizopus* spp.	*Penicillium* spp.
Aerated silo						
Top layer	4	9	5	10	0	0
Middle layer	22	6	8	17	0	0
Bottom layer	13	13	4	14	4	0
Average	13	9.33	5.6	13.66	1.33	0
Non aerated silo						
Top layer	4	6	4	14	0	1
Middle layer	28	26	0	52	25	0
Bottom layer	25	28	8	68	15	5
Average	19	18	4	44,66	13.33	2

TABLE. 3. Effect of aeration on mycotoxin production in stored corn.

Treatment	Aflatoxin	Zearalenone
Aerated silo		
Top layer	-	-
Middle layer	-	+
Bottom layer	-	-
Non aerated silo		
Top layer	-	-
Middle layer	-	+
Botom layer	-	++

+ Intensity

TABLE 4. Effect of chemical treatment on grain discoloration and dry weight of stored corn.

	Treatment	Grain discoloration (%)	Average	Weight of 500 cc grains (gm)	Average
Decobbed corn grain *Tecto (ppm) Luprosil (ppm)*	Non treated	41 f	41	176.75 a	176.75
	6500	18.06 cde		182.4 cd	
	1100	7.1 ab	9.35	185.2 def	187.1
	20000	2.9 b		193.73 g	
	1430.8	17.35 bcde		179.5 ab	
	2887.8	13.7 bcd	14.3	179.7 abc	180.7
	5305.8	110.95 abc		183.1 cde	
Cobbed corn grain *Tecto (ppm) Luprosil (ppm)*	Non treated	15 f	15	210.32 a	210.32
	6500	4.3 abcd		217 b	
	11000 0.75 ab	1.7	218.1 b	216.6	
	20000	0.15 a		217.8 b	
	1438.8	5.55 bade		217.2 b	216.8
	2887.8	4.95 ab	3.94	215.6 b	
	5305.8	1.32 abcd		217.8 b	

- Means followed by the same letter are not different at p : p > 0.05

TABLE 5. Effect of chemical treatments on fungi and their percentage of infection.

Treatment	*Percentage of grain infection*													
	Aspergillus flavus		*Aspergillus niger*		*Aepergillus fumigatus*		*Fusarium moniliforme*		*Trihothecium roseum*		*Rhizopus Spp.*		*Penicillium spp.*	
	*A**	*B***	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*
Untreated	60.5	34	28.16	19.5	4.4	0.5	2.5	5.5	3.33	5.5	16.91	14.5	3	2.75
Tecto (ppm) 1438.8	29.75	12	21.5	13.75	0.5	0.25	0	0.25	0	0.25	15.16	16	0.5	3.5
2887.8	25.08	9.5	15.08	7.0	0.33	0	0	0	0	0	33.91	6.25	0.04	0.25
5035.8	14.08	5.5	8.5	6.5	0.25	0	0.33	0	0	0	1808	2.5	0	1.25
Luprosil (ppm) 6500	20.9	9.5	12	12	0.5	0	0.08	0	0	0	1.16	1.25	0	0
11000	11.8	4.25	6.5	0	0.16	0	0	0.25	0	0	0	0	0	0
20000	6.6	2.75	4.5	3.8	0.08	0	0	0	0	0	0	0	0	0

* decobbed corn grain, ** cobbed corn grain.

TABLE 6. Effect of chemical treatment on Aflatoxin and Zearalenone production.

Treatment		Decobbed corn Aflatoxin	Zearalenone	Cobbed Aflatoxin	corn Zearalenone
Untreated		+++	–	+	–
Tecto (ppm)	1438.8	+	–	–	–
	2887.8	+	–	–	–
	5038.8	–	–	–	–
(Luprosil (ppm)	6500	–	–	–	–
	11000	–	–	–	–
	20000	–	–	–	–

+ intensity

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Short Communication

FIRST RECORD OF WHITE MOULD DISEASE ON BEAN PLANTS IN PLASTIC HOUSE

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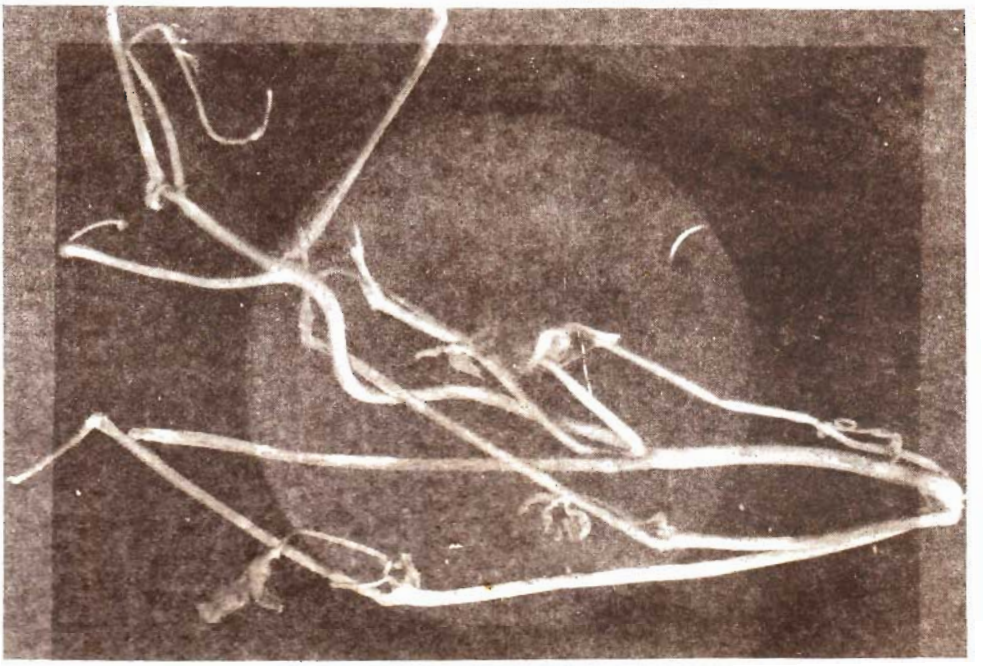
(Received 30 November 1980)

Bean (*Phaseolas vulgaris* L.) is one of the important vegetable crops in Iraq. Usually it is grown in covered plastic houses in winter. A disease in April 1980 was observed at Radhwamyia, Baghdad. The disease was characterized by brown necrotic patches on leaves and branches, and water-soaked lesion with white growth on pods at different stages of developments (Fig. 1). Along with mycelium numerous black or brown sclerotia were observed. Eventually the infected plants died.

According to our identification the fungus was identified as *Sclerotinia sclerotorium* (Lib.) de Bary (Fig.2).

As it is well known white mould is cosmopolitan in distribution (Young, 1936; Anderson, 1941; and Zaumeyer *et al.*, 1949), and has the ability to persist in soil as resistant sclerotia. It is very difficult to control this fungus (Tanrikut and Vaugh 1951).

Although, white mould disease on beans had not been reported earlier in Iraq, but El-Behadli and Al-Azawi (1977) first reported this fungus on cucumber.



a

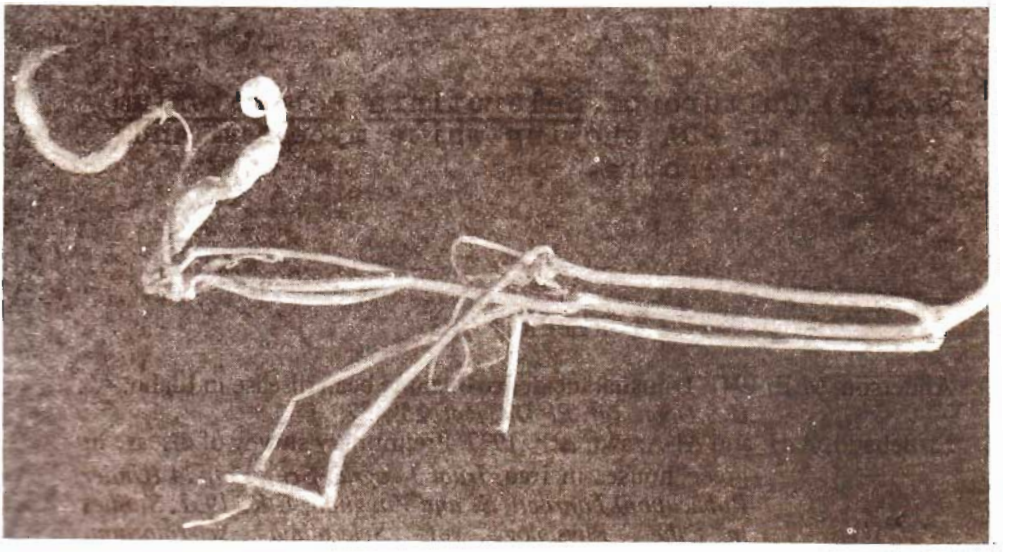


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Fig.(1). Infected bean plant with Sclerotinia sclerotorium

a. branches
b. pods

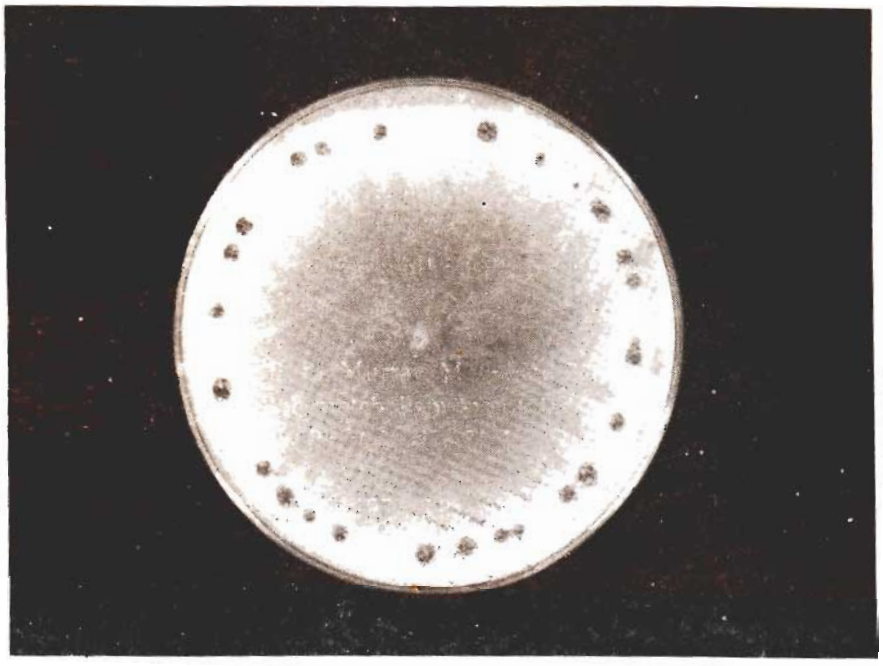

Fig.(2).Culture of Sclerotinia sclerotorium on PDA showing white mycelium and sclerotia.

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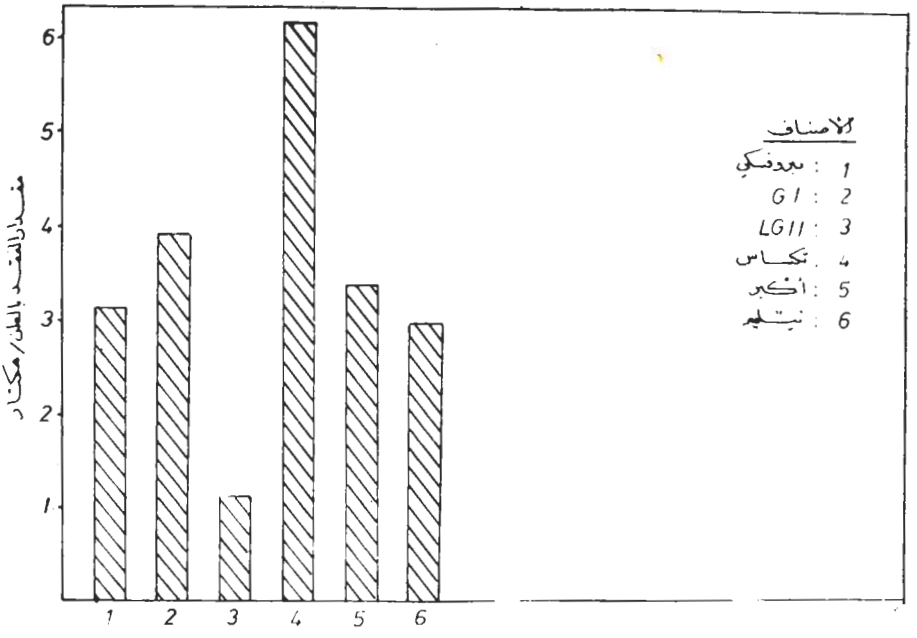
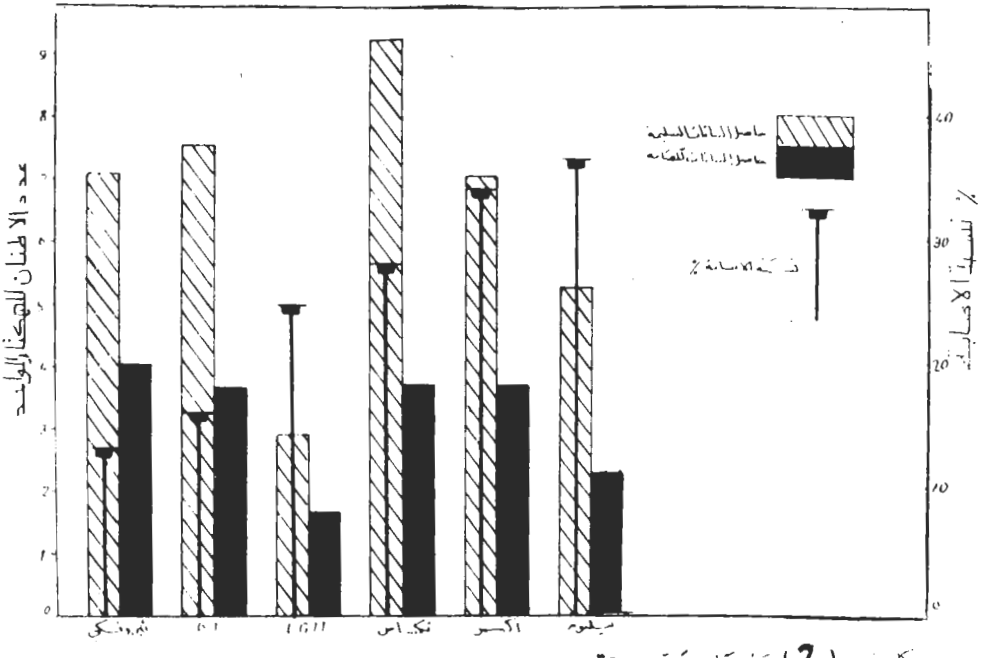


شكل رقم (3) يوضح العلاقة بين مقدار الفقد بالطن/هكتار والاصناف المختلفة بعد اضافة عشار سنافي الذرة

مما تقدم وعلى اساس النتائج السابقة يمكن الاستنساخ بان الصنف بروفسكي كان اكثر الاصناف مقاومة للحشرة وتميز بحاصل عال نوعما ، ولكن حبوب هذا الصنف بيضاء وهذا يقلل من استخدامه في تحضير علائق الحيوان في حين يمكن ان تكون ملائماً لصناعة النشا اضافة الى امكانية الاستفادة من صفة المقاومة للحشرة في هذا الصنف ونقلها الى اصناف اخرى مرغوبة من الذرة الصفراء عن طريق برنامج يهدف الى نقل صفة المقاومة من هذا الصنف الى الاصناف الاخرى بالاضافة الى امكانية تطوير صنف بروفسكي من حيث الحاصل والنوعية عن طريق الانتخاب او طرق تربية النبات الاخرى .

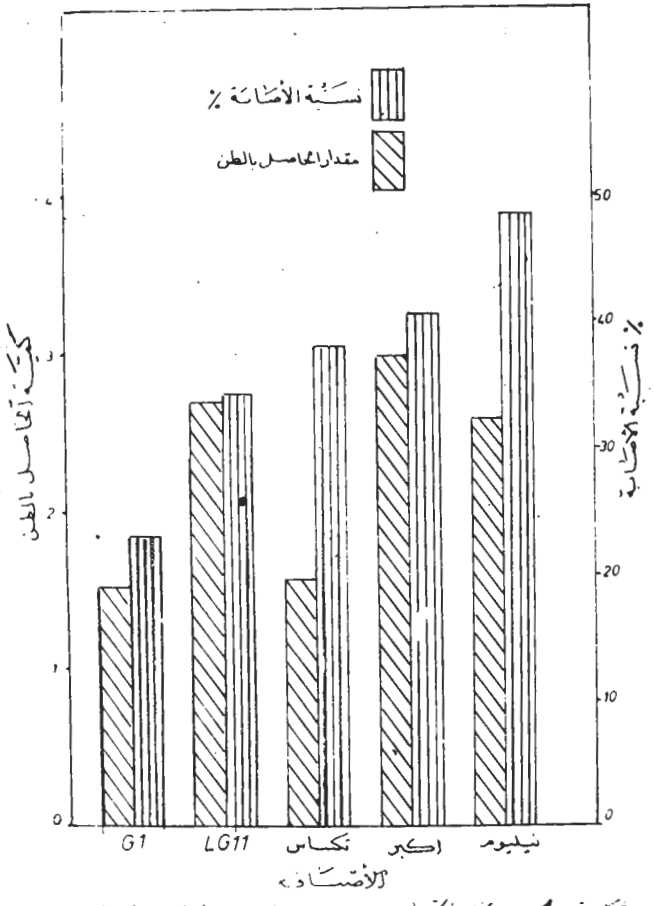
ومن تقدير حاصل الحبوب يلاحظ من الشكل رقم 1 بان الصنف اكبر قد اعطى اعلى حاصل حبوبي وهو 2.97 طن / هكتار بالمقارنة ببقية الاصناف . اما الصنف LGII فقد اعطى حاصلاً مقداره 2.70 طن / هكتار وبعد هذا الصنف متفوقاً نوعما في العروة الربيعية نظراً لقصر موسم زراعته . ان التفاوت في حاصل الحبوب للاصناف المختلفة في العروة الربيعية يقع تحت تأثير عوامل متعددة منها نسبة الاصابة والتبكير في التزهير والنضج بالاضافة الى التركيب الوراثي للصنف . فالاصناف اكبر ونيليم تعد من الاصناف التركيبية (Synthetic varities) والصنف Texas 34 هو هجين زوجي ومتأخر في نموه اما الصنف LGII فهو هجين فرد Single cross وملائم للزراعة في العروة الربيعية حيث يبكر في التزهير والنضج مما يقلل من ضرر ارتفاع درجات الحرارة والتي تعيق عملية الاخصاب . اما دراسة العروة الخريفية فقد تناولت تحديد حساسية الاصناف للحشرة بالاضافة الى تقدير مقدار الخسارة التي تسببها الحشرة للتراكيب الوراثية المختلفة كما هو موضح في الشكل (2) . ان الصنف بروفسكي والذي اضيف في العروة الخريفية كان اقل



شكل رقم (2) رسم بياني يوضح علاقة الحاصل للاصناف بحالة الاصابة وعدم الاصابة (عروة خريفية)

النتائج والمناقشة

اظهرت نتائج العروة الربيعية عام 1978 بان الاصناف (التراكيب الوراثية) المختلفة من الذرة الصفراء قد اختلفت في نسبة اصابتها بحشرة حفار الساق شكل رقم (1) وان اختلاف في نسب الاصابة انعكس على الحاصل عند مقارنة معدلات النسبة المئوية للاصابة ويلاحظ بان الصنف نيليوم كان اكثر الاصناف حساسية للاصابة بالحشرة حيث بلغت نسبة الاصابة % 48.55 ويليه اكبر % 40.68 ثم الصنف تكساس % 38.20 والصنف ونسبة اصابته % 34.45 ويعتبر الصنف GL اقل الاصناف حساسية للاصابة بالحشرة حيث بلغت نسبة الاصابة % 23.03



شكل رقم (1) رسم بياني يبين علاقة المحاصيل بالطن للهكتار مع نسبة الاصابة (عروة ربيعية) للاصناف

المواد وطرق البحث

لقد طبقت هذه الدراسة في حقل كلية الزراعة ـ جامعة بغداد وللموسمين الربيعي والخريفي في عام 1977 تم مقارنة تراكيب وراثية من الذرة الصفراء في العروة الربيعية وهي Neelum (صنف تركيبي) و Akbar (صنف تركيبي) Texas34 (هجين مزدوج) وLGll,Gl(هجن فردية) . اما في العروة الخريفية فقد أضيف تركيب وراثي آخر هوDIN – Profesky(صنف مفتوح التلقيح) ادخلت هذه التراكيب الوراثية بتصميم القوالب العشوائية الكاملةRCBDوباربعة مكررات في تربة غرينية طينية .

تم زراعة الاصناف في العروة الربيعية بتأريخ 18 آذار وفي العروة الخريفية في 30 تموز من عام 1977 وتمت الزراعة باعتماد كثافة نباتية 46 الف نبات / هكتار . تمت مقارنة حساسية التراكيب الوراثية المدروسة على أساس اصابة نباتات الصنف بحفار ساق الذرة بالجيل الاول للحشرة وذلك عن طريق حساب عدد النباتات المصابة من مجموع عدد نباتات الخطين الوسطيين وفي نهاية الموسم اقتلعت عشرة نباتات بصورة كاملة وبشكل عشوائي من الخطين الوسطين لتقدير ارتفاع النبات ومحيط الساق وعدد الثقوب الموجودة على الساق وعدد الاوراق المتضررة وتحديد موقع وجود اليرقات في الساق اضافة الى تقدير الحاصل . تم تحليل البيانات احصائياً باستعمال طريقة تحليل التغاير Analysis of varianc كما ذكر (Steel and Torrie).

ـ المقدمة Introduction

لقد ازداد محصول الذرة الصفراء (*Zea mays* L.) أهمية في القطر العراقي في السنوات الأخيرة خاصة بعد التوسع في مشاريع الانتاج الحيواني ومحور الاهتمام تركز على زيادة المساحة المزروعة بهذا المحصول بالاضافة الى تحقيق في الانتاجية (Grain yield Potenial)

ان التوسيع في زراعة محصول مالا يخلو من المشاكل التي قد تؤثر على انتاجيته او نوعيته ففي العراق تتعرض الذرة الصفراء للاصابة بحشرة حفار الساق والتي لا يمكن بدون مقاومتها انتاج المحصول بشكل اقتصادي ، وبالرغم من خطورة هذه الحشرة في العراق نجد ان الابحاث العلمية المتعلقة بالحد من اضرارها قليلة في حين اجريت بعض الدراسات لتشخيص الحشرة ودراسة دورة حياتها ومناطق انتشارها فلقد أشار Wiltshire (1967) الى وجودها في المناطق السهلية والمناطق غير المرتفعة ومهاجمتها لمحاصيل الحبوب وخاصة الذرة الصفراء والقصب السكري . كما ذكر Domlane (1967) في ليبيا و Yuraten (1971) في تركيا بان لهذه الحشرة اربعة اجيال كذلك قدرت نسبة الاضرار التي تحدثها في اقطار مختلفة وتراوحت ما بين 5 ـ 77 % حسب اختلاف الاصناف المستخدمة من الذرة الصفراء . ففي مصر وجد Hosny,EL - Sadany (1970) بان الحشرة تصيب نباتات الذرة الصفراء في عمر 18 يوماً واعلى اصابة سجلت عندما كان عمر النباتات 39 يوماً ، واستنتجا ان الخسارة في الحاصل تكون اكبر في حالة الاصابة المبكرة عنها في الاصابة المتأخرة وفي السودان درس Badawy (1968) حساسية 13 صنفاً من الذرة الصفراء لحشرة حفار الساق *S. cretica Led.* ووجد اختلافات في معدل نسبة الاصابة بين هذه الاصناف وكانت اقل من 50 % في اربعة اصناف في حين ارتفعت الى 70 % في صنف آخر . كذلك وجد Atanasor (1964) في يوغسلافيا بان يرقات حفار ساق الذرة قللت من حاصل الاصناف الهجينة من الذرة الصفراء بنسبة اعلى مما هو عليه في الاصناف المحلية . مما سبق يتضح ان لهذه الحشرة ارتباط مباشر بحاصل الذرة الصفراء لذلك استهدف هذا البحث مقارنة درجة مقاومة وحساسية بعض اصناف الذرة الصفراء للاصابة بحفار ساق الذرة .

THE SUSCEPTIBITITY OF SOME CORN CULTIVARS TO CORN STEM BORER *(SESAMIA CRETICA LED)*

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

SUMMARY

A field experiment on corn (*Zea mays* L.) was conducted for two seasons (spring and autumn) in 1977 at the Agricultural Experiment Station, University of Baghdad. The main objective of the study was to compare the susceptibility of different cultivars of corn namely Neelum, Akbar, Texas 34, Pride of Saline, GI, LG 11, and Din-Profesky to corn stem borer *(Sesamia cretica* Led.) which has been the most destructive insect of corn in Iraq. A randomized complete block design was used with three replications in a silt clay loam soil.

Field evaluation of selected corn cultivars indicated the susceptibility to stem borer. In order of their susceptibility, Neelum was the most susceptible cultivar in both seasons in comparison with other cultivars. However, the cultivar Din-Profesky had low percentage of infestation. Several factors might be responsible for the tolerance of cultivars to this pest including variation in the genetic constitution which cause differences in the level of toxic secondary substances such as HCN or morphological charactersitics (plant height or leaf thickness and roughness).

دراسة حساسية بعض التراكيب الوراثية في الذرة الصفراء لحشرة حفار ساق الذرة *Sesamia cretica* Led.

عبد المحسن مونس
د . خالد محمد العادل
د . حميد جلوب علي

(تأريخ التسلم ١٣ / ١٢ / ١٩٨٠)

الخلاصة

طبقت هذه الدراسة في الموسم الربيعي والخريفي من عام ١٩٧٧ في محطة التجارب الحقلية التابعة الى كلية الزراعة ـ جامعة بغداد لدراسة حساسية بعض اصناف الذرة الصفراء الى حشرة حفار الساق Sesamia cretica

تم مقارنة تراكيب وراثية في الذرة الصفراء(*Zea mays L*) في العروة الربيعية وهي Neelum (صنف تركيبي) و Akbar (صنف تركيبي) و Texas 34 (هجين مزدوج) و LGII, GI (هجن فردية) . اما في العروة الخريفية فقد أضيف تركيب وراثي اخر هو Din-Profesky (صنف مفتوح التلقيح) . ادخلت هذه التراكيب الوراثية بتصميم القوالب العشوائية الكاملةRCBDوبأربعة مكررات في تربة غرينية طينية .

تمت مقارنة حساسية التراكيب الوراثية على اساس اصابة نباتات الصنف بحفار ساق الذرة بالجيل الاول للحشرة وتبين من نتائج الدراسة بان التراكيب الوراثية من الذرة الصفراء قد اختلفت في نسبة اصابتها بحشرة حفار الساق وهذا الاختلاف قد انعكس على حاصل الاصناص . وظهر بان الصنف نيليوم كان اكثر الاصناف حساسية للاصابة بالحشرة والصنف بروفسكي اقل الاصناف اصابة بحشرة حفار ساق الذرة ويعود السبب الى صفاته المورفولوجية او وجود سموم طبيعية تعمل كمواد ضارة للحشرات .

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* جزء من رسالة ماجستير مقدمة الى كلية الزراعة جامعة بغداد . Dr. Hameed Chaloob Ogron.

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المناقشة

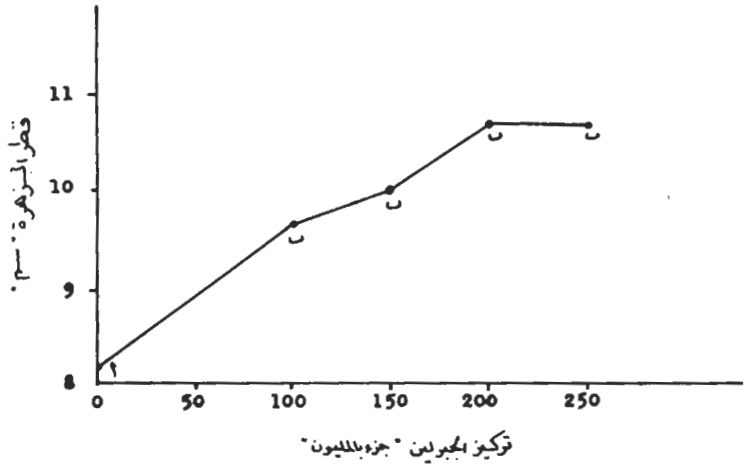
ان تأثير الجبرلين على استطالة الساق او الحامل الزهري يتفق مع اغلب الابحاث التي اجريت على نباتات الزينة ومن ضمنها الجبرانيوم (Gian fagna, 1958) و (Pudlo *el al*: 1967) والداودي (Cathey, & Stuart, 1958) و (Cabler, 1965) وان هذه الزيادة ناتجة من تأثيره على طول السلاميات في الساق وليس على عددها (Poole & Ying, 1966) . وقد يكون هذا التأثير على الاستطالة نتيجة حث المرستيم تحت القمى وهي المنطقة الفعالة في تطور انسجة الساق (Sacks *et al.* 1959) . وعموماً فالجبرلين يؤثر على زيادة النمو بمنطقة الاستطالة وان كان لايمكن اعفاؤه من التأثير المنشط للانقسام الخلوي المايتوسي في النسيج المرستيمي القمي وتحت القمى (حفنى ، 1972) .

اما عدم الحصول على زيادة في ارتفاع النباتات نتيجة استعمال التركيز الاعلى من حامض الجبريليك (250) جزء بالمليون ، فلربما يعود لكون تأثير الجبرلين المنشط للنمو الخضري هو تأثير مؤقت وحدوث الزيادة في السطح الخضري في هذه الفترة القصيرة مع عدم وجود مايقابلها من زيادة في المجموع الجذري يؤدي الى عدم الامداد بالعناصر المعدنية ومن ثم بالمواد العضوية الممثلة مما يؤدي الى بطء في سرعة النمو الى درجة تقل احياناً عن مثيلتها في النباتات غير المعاملة (حفنى ، 1972) .

ان ظهور الاصفرار على الاوراق المعاملة بالجبرلين ربما يعود الى حركة الكلوروبلاست من الجدر الجانبية للخلايا الى مؤخرتها بعيداً عن الضوء (Bagaceva, 1961) . ويمكن تفسير هذه الظاهرة ايضاً بعدم مقدرة الكلوروفيل على التعويض والتناسب مع تمدد الخلايا في الانسجة فيصبح ذو تركيز أقل عما هو في النباتات غير المعاملة (Stuart & Cathey, 1961)

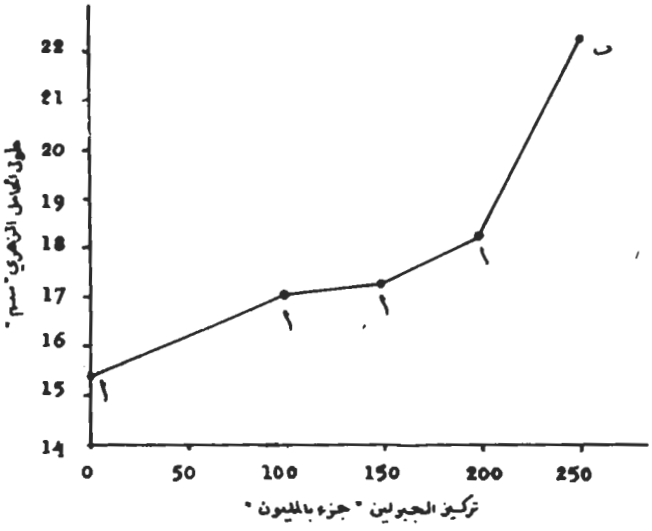
ان تأثير الجبرلين المعنوي على حجم الازهار يتفق مع بحث (Iert, 1959) الذي اجرى على نباتات الداودي وبحث (Varga, 1963) على الجبرانيوم . وربما يكون هذا ناتجاً من تشجيعه للانقسام الخلوي المايتوسي في البرعم الزهري (Cathey, 1959) او نتيجة استطالة الحوامل الزهرية في الزهرة مع كبر حجم البتلات وبالتالي التأثير على حجم النورة نفسها (Stuart & Cathey, 1959) . أو قد ترجع هذه الزيادة الى تشجيع الجبرلين لانتقال المواد الغذائية باتجاه قمم الساق (Harris *et al*, 1969)

التأثير لم يكن معنوياً ماعدا التركيز الأعلى (250) جزء بالمليون الذي كان له التأثير الجوهري الوحيد مقارنة بالاختبار الضابط والتراكيز الاخرى المستعملة . ورغم ان اعلى طول للحامل الزهري كان في النباتات المعاملة بتركيز (250) جزء بالمليون وبمعدل (22.3) سم مقارنة بالاختبار الضابط الذي كان بمعدل (15.4) سم فان هذه الاستطالة كانت مقترنة بضعف واضح في الحامل الزهري المنتج مما ادى الى انحنائه نتيجة لعدم تحمله ثقل النورة . في حين لم تلاحظ هذه الظاهرة في النباتات المعاملة بالتراكيز الاخرى من حامض الجبريليك .



شكل "2" تأثير الرش بحامض الجبريليك "GA_3" على أقطار الازهار فى نباتات الجيرانيوم*

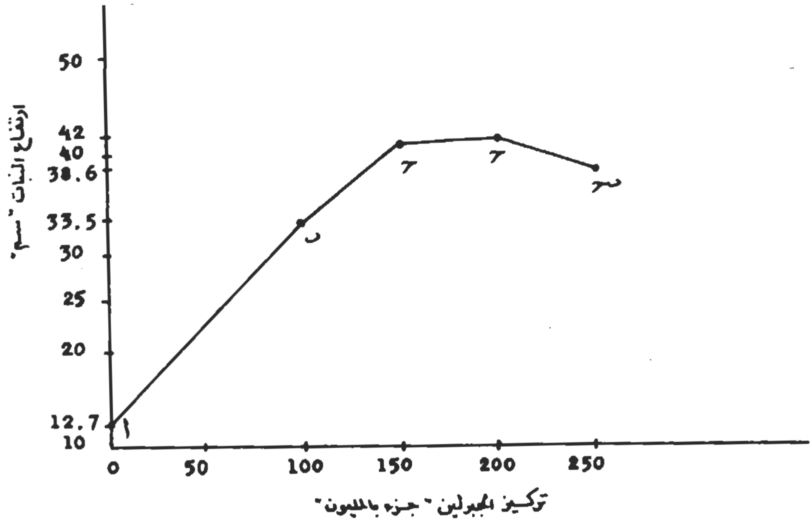
* النقاط التي يأسفلها نفس الحرف الابجدي لا تختلف عن بعضها جوهريا حسب اختبار أقل فرق الجوهري الاصغر (L.S.D.) وعلى مستوى احتمال (5٪)



شكل "3" تأثير الرش بحامض الجبريليك "GA_3" على طول الحامل الزهري فى نباتات الجيرانيوم*

* النقاط التي بأسفلها نفس الحرف الابجدي لا تختلف عن بعضها جوهريا حسب اختبار أقل فرق الجوهري الاصغر "L.S.D." وعلى مستوى احتمال "5٪"

يشير الشكل (1) الى وجود فروق احصائية معنوية بين معدلات ارتفاع النباتات نتيجة تأثير تراكيز الجبرلين المستعملة وعلى مستوى (5 %) . وقد كان الارتفاع متناسباً بصورة طردية مع التركيز المستعمل الآ في حالة التركيز الاعلى الذي استعمل في التجربة وهو (250) جزء بالمليون ، حيث ابتدأ عنده معدل ارتفاع النباتات بالانخفاض . لقد حصل على أعلى ارتفاع وبمعدل (41.9) سم عند استعمال التركيز (200) جزء بالمليون مقارنة بنباتات الاختبار الضابط التي بلغ معدل ارتفاعها (12.7) سم فقط .



شكل "1" تأثير الرش بحامض الجبرليك "GA_3" على الارتفاع النهائي لنباتات الجيرانيوم *

* النقاط التي تحملها نفس الحرف أو الحروف لا تختلف عن بعضها جوهريا حسب اختبار الفرق الجوهري الأصغر "L.S.D" وعلى مستوى احتمال "5%" .

اما معدل اقطار الأزهار ، فقد ادى الجبرلين الى زيادته بصورة معنوية في جميع التراكيز المستعملة مقارنة بالاختيار الضابط على مستوى (5 %) مع عدم وجود فروق جوهرية بين هذه المعدلات نتيجة لاختلاف التراكيز (شكل 2) . لقد كان أعلى معدل لاقطار الازهار (10.67) سم في النباتات المعاملة بأحد التركيزين (200) أو (250) جزء بالمليون مقارنة بالاختبار الضابط الذي كان (8.17) سم مع عدم ملاحظة أي تشويه أو صفات غير مرغوبة على الازهار المنتجة في النباتات المعاملة بحامض الجبريليك .

وبالنسبة للصفة الثالثة المدروسة وهي طول الحامل الزهري ، فقد ادى الجبرلين الى زيادة طول الحامل الزهري في جميع التراكيز المستعملة (شكل 3) . الآ أن هنا

المواد المستعملة وطريقة العمل

اجريت التجربة في الظلة الخشبية التابعة لقسم البستنة ـ كلية الزراعة / أبو غريب وابتدأ البحث في الخامس عشر من شهر شباط عام 1979 . اختيرت نباتات متجانسة النمو من الجيرانيوم صنف (Light Red) بعمر شهرين كانت قد كثرت لاجنسياً بطريقة العقل الغضّة Soft Cuttings وزرعت بعد نجاحها في اصص (سنادين) فخارية قطرها (20) سم .

كانت التجربة عاملية Factorial Experiment واستعمل تصميم القطاعات الكاملة المعشاة (RCBD) بثلاثة قطاعات Blocks في التجربة وكان كل قطاع عبارة عن خمس معاملات احتوت كل منها على ثلاث اصص .

استعمل حامض الجبريليك GA_3 (90 ـ 91 %) بخمسة تراكيز هي (0 ، 100 ، 150 ، 200 ، 250) جزء بالمليون . واضيفت بضع قطرات من المادة الناشرة Tween – 20 بتراكيز (1 %) للمحلول . وقد تم رش المحلول على الجزء العلوي من النبات مع تركيز الرش على الجزء المحصور ضمن الـ (10 ـ 15) سم قرب القمة النامية (Pudlo *et al*, 1967) اجريت الرشة الاولى بتاريخ 15 ـ 4 ـ 1979 وقد كرر الرش ثلاث مرات وعلى فترة أمدها عشرة ايام بين رشة واخرى وأخذت المعلومات بعد ثلاثة اسابيع من موعد انتهاء الرشة الثالثة . وقد شملت الصفات المدروسة تأثير حامض الجبريليك على كل مما يلي :

1 ـ ارتفاع النبات النهائي .
2 ـ طول الحامل الزهري .
3 ـ قطر الازهار .

النتائج

لقد ادى الرش بحامض الجبريليك الى زيادة الارتفاع والنمو الخضري للنباتات المعاملة به وقد لوحظ هذا بعد كل رشة من الرشات الثلاث . كما لوحظ ظهور اصفرار بسيط في الاوراق بعد الرش اختلفت شدته ومدى استمراره حسب التركيز المستعمل ، الا ان هذا الاصفرار عموماً لم يستغرق مدة تزيد على اليومين أو الثلاثة ايام التي اعقبت عملية الرش .

المقدمة

تعتبر نباتات الجيرانيوم *(Pelargonium zonale)* من النباتات الشائعة والمرغوبة من قبل الكثير من هواة الازهار في العراق نظراً لامكانية زراعتها مباشرة في احواض الازهار أو لاستعمالها كنباتات أصص (سنادين) .

ان من اهم الميزات الرئيسية لهذه النباتات هو كبر حجم النورات الزهرية وجمال شكل نموها الخضري . وان مرحلة اكتمال النمو الخضري تستغرق فترة طويلة نسبياً لدى مربي هذه النباتات وذلك للوصول الى مرحلة التزهير (Ripeness to flower) وللحصول على احجام كبيرة من الازهار في آن واحد . وان لهذه الظاهرة اهميتها التسويقية لدى اصحاب المشاتل التجارية . ومن المعروف بأن حامض الجبريليك (GA_3) له تأثيرات فسيولوجية على حجم النمو الخضري والازهار معاً وقد ذكر ذلك من قبل باحثين عديدين ، فقد اشار (Gianfagna, 1958) الى حدوث زيادة في حجم البتلات واقطار ازهار الجيرانيوم بعد المعاملة بالجبرلين .

كذلك ذكر (Pudlo *el al,* , 1967) بأن رش نباتات الجيرانيوم بحامض الجبريليك ادى الى زيادة في حجم النباتات والنورات الزهرية مع تقصير الفترة اللازمة للوصول الى الحجم الصالح للتسويق ، كما بين (Blswas & Rogers, 1963) بأن استعمال حامض الجبريليك ادى الى زيادة في حجم النورات الزهرية لنباتات الجيرانيوم وكان هذا عائداً بصورة رئيسية الى زيادة حجم البتلات والحوامل الزهرية .

ان الغرض من اجراء هذه الدراسة هو معرفة تأثير الرش بحامض الجبريليك (GA_3) على نباتات الجيرانيوم المزروعة تحت ظروفنا المحلية ومدى استجابة هذه النباتات بالنسبة الى طول الحامل الزهري ، حجم الازهار ، والفترة التي تستغرقها للوصول الى الحجم الملائم للتسويق .

EFFECT OF GIBBERELLIC ACID (GA_3) ON VEGETATIVE CHARACTERS AND FLOWERING OF GERANIUM *(PELARGONIUM ZONALE)*

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SUMMARY

A study was conducted on *Pelargonium zonale* to investigate the effect of GA_3 on the vegetative growth and flowering characters. The investigation was carried out inside the lath-house of the Horticulture Department, Agriculture College, Agu-Ghraib. GA_3 was applied as sprays on the foliage on April 15 and 25, 1979, and third time on May 5, 1979, on both vegetative growth and Flowers. The applied concentrations were 0, 100, 150, 200, and 250 ppm.

The results have shown that there were significant differences among the heights of the plants, and were in direct proportion to the increased concentration except in the last treatment. The highest increase in plant height was obtained in 200 ppm treatment. Also significant differences were obtained in flower diameter, and the maximum effect occured in 200/250 pp. treatment. Non significant differences were seen in lengths of flower stems, except in the ppm 250 treatment, which has shown a significant difference.

In view of the results obtained here, geranium plants should be treated with 200 ppm of GA_3. Such treatment warrants marketable pots with flowers of good quality and size.

زيادة في معدلات اطوال الحاصل الزهري الا أن هذه الزيادة لم تكن معنوية ، ماعدا التركيز 250 جزء بالمليون الذي أدى الى حدوث زيادة معنوية في طول الحامل الزهري .

من ذلك نستنتج ، ولأجل الحصول على نباتات صالحة للتسويق خلال فترة قصيرة من التوصل الى حجم جيد للازهار ، ان تعامل نباتات الجبرانيوم بحامض الجبريليك (GA_3) بتركيز 200 جزء بالمليون .

تأثير حامض الجبريليك (GA_3) على صفات النمو الخضري والتزهير في نباتات الجيرانيوم (Pelargonium Zonale, W.)

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(تاريخ التسلم ٢٧ / ٥ / ١٩٨٠)

الخلاصة

اجرى البحث في الظلة الخشبية التابعة لقسم البستنة ـ كلية الزراعة / ابو غريب لدراسة تأثير حامض الجبريليك (GA_3) على صفات النمو الخضري والتزهير في نباتات الجيرانيوم *Pelargonium zonale,* صنف «Light red» وقد استخدمت خمسة تراكيز من حامض الجبريليك هي صفر ، 100 ، 150 ، 200 و 250 جزء بالمليون رشاً على الاوراق وذلك في موعدين هما الخامس عشر والخامس والعشرون من شهر نيسان وعلى الاوراق والازهار معاً في الموعد الثالث وذلك في الخامس من شهر مايس .

لقد دلت نتائج التجربة على ان هنالك فروقاً احصائية معنوية بين معدلات النمو الخضري للنباتات المعاملة وعلى مستوى ٥ % وكان الارتفاع متناسباً بصورة طردية مع التراكيز المستعملة عدا التركيز الاعلى المستعمل في التجربة . وقد حصل على أعلى ارتفاع في التركيز 200 جزء بالمليون . كذلك أدت المعاملات الى زيادة اقطار الازهار زيادة معنوية في جميع التراكيز المستخدمة وقد حصل على أعلى معدل باستعمال احد التركيزين 200 أو 250 جزء بالمليون . وقد أدت جميع المعاملات الى

inserted lightly and clearly in soft pencil on the drawing. Tables and figures should not reproduce the same data. The approximate position of tables and figures should be noted in the text.

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