Vol. VII December, 1972

THE IRAQI JOURNAL OF AGRICULTURAL SCIENCE

Published

by the

College of Agriculture, University of Baghdad

Ministry of Higher Education and Research

Abu-Ghraib, Iraq

THE IRAQI JOURNAL
OF
AGRICULTURAL SCIENCE

Published by the Editorial Board, College

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EFFECT OF MULCHING ON CORN YIELD

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(Revised MS. received 23 February 1972)

SUMMARY

Experiments in a latin square were conducted on Abu-Ghraib silty clay loam in 1964 and 1965. The treatments were clear plastic, black plastic, straw, date palm leaves, date palm fibers, and control (no mulching). The objective was to study the effect of different kinds of mulching and no mulching with and without cultivation.

Observations were taken on soil temperature, percent germination, plant height, and date of tasseling and earing. Yield data on per plant basis were analyzed statistically.

Plastic mulch induced early germination, encouraged plant growth, and early tasseling and earing. Corn under plastic mulch was harvested earlier than that under other treatments including control. Yields under plastic treatments were signiciantly higher than those under the other treatments. Weeds reduced average yield per plant. Therefore, plastic mulching with cultivation is recommended.

الخلاصـــة

لقد اجريت التجربة في مزرعة ابي غريب والتي تبعد عن غربي بغداد ٢٥كم لتحديد مدى تأثير استعمال غطاء البلاستك الشفاف والاسود على نمو وحاصـل الذرة الصفراء بالمقارنة مع الزراعة المكشوفة ومواد محلية اخرى ٠

اقيمت التجربة في عامي ١٩٦٤ و١٩٦٥ حيث عزقت الادغـال والحشائش في التجربة للسنة الاولى ولم تعزق للسنة الثانية ٠

ولقد صممت التجربة في الحقل على اساس المربعات اللاتينية (الشطرنجية) حيث استخدمت ستة معاملات وهي كما يلي : الزراعـة المكشوفة (المقارنـة) والبلاستك الشفاف والاسود والتبن وسعف النخيل والياف النخيل ٠

حللت نتائج التجربة احصائيا وان نتائج التجربة اظهرت ما يلي :ـ

١ ـ أن استخدام غطاء البلاستيك قد ساعد على التبكير من انبات الذرة الصفراء وشجع نمو النباتات وظهور المجموعة الزهـرية الذكرية والانثوية مبكرا بالمقارنة مع المعاملات الاخرى المستخدمة ٠

٢ ـ أن استعمال البلاستيك بنوعية قـد ساعد على التبكير في النضج وموعـد حصاد الذرة ٠

٣ ـ لقد ازداد حاصل الذرة زيادة احصائية مهمـة باستخدام غطاء البلاستيك بالمقارنة مع حاصل بقية المعاملات المستعملة في التجربة ٠

٤ ـ لقد اظهرت النتائج بافضلية عزق الادغال والحشائش في المناطق المكشوفة من ألياف وقصر المروز عنـد استعمال المغطيـات وبالاخص البـلاستيك بنوعيـــه ٠

INTRODUCTION

Several workers (Gopalkrishna *et al.*, 1960; Lange, 1961; Victor and Brighurst, 1961; Darby *et al.*, 1962; Willis *et al.*, 1963; and Hopen, 1965) have concluded that mulching increased yield of crops. Other workers (Victor and Bringhurst, 1961; Louis, 1962; Kohnke and Werkhoven, 1963) have used mulch materials for early crop production and against frost or low soil temperature. Literature also reveals that mulching is practiced for weed cultivation and soil moisture retention (Edminster and Staff, 1961; and Willis *et al.*, 1963). The objective of this study was to determine the effect of plastic and locally available mulch materials on growth and yield of spring — planted *Zea mays*.

MATERIALS AND METHODS

Experiment 1964:

The experiment was conducted at the Abu-Ghraib Experiment Station with a latin square design consisting of six treatments; clear plastic, black plastic, date palm leaves, date palm fibers, straw, and control (no mulching). The plot was 5×5m in dimensions. The distance between rows was 60 cm and between plants 40 cm.

All treatments were given an equal amount of 15 kg N/donum as ammonium sulfate (21% N) and 15 kg P_2O_5/donum as ordinary single superphosphate (18% P_2O_5) before planting and spreading mulch materials. Fertilizers were placed in bands 10 cm apart. Thereafter, mulch materials were spread over each row in a 30 cm band and three seeds of a local variety of corn, Laltin, were placed in hills 3 cm deep (February 25). When the plants were 20 cm tall, they were thinned to one per hill.

All other practices were similar to those used by Iraqi farmers, such as irrigation, furrow preparation, planting method, and weed cultivation.

Soil temperature readings were taken at 7 a.m., 12 noon, and 3 p.m. for the first 26 days after planting. A glass-type soil thermometer was fixed in each treatment at a depth of 5 cm to facilitate information on temperature variation during and after germination.

Date of germination and percent germination after 26 days from planting under each treatment were recorded.

After 86 days from planting average height of plant for each treatment was taken on six plants per plot.

Date of tasseling and earing were recorded.

The yield was taken from the middle two rows of each plot. Average length and weight of ears were determined to check differences among treatments. Yield data were analyzed statistically on the basis of yield per plant which was calculated by dividing total yield of treatment by the corresponding number of plants.

Experiment 1965:

Except for the following, materials and methods for this experiment were the same as described for the 1964 experiment:

1. Date of planting was March 8, 1965.
2. Unstripped date palm leaves were applied.
3. Only five treatments were applied. Date palm fiber treatment was excluded because of the difficulty in getting the material at the proper time.
4. Plot size was 5×10 m.
5. Soil temperature was recorded only in the morning and at noon.
6. Plant heights were measured twice , namely 50 and 80 days after planting.
7. No weed cultivation was done during the growing season so that we might ompare the experiments of 1964 and 1965 on the basis of cultivation and no-cultivation.

RESULTS

Experiment 1964:

Germination occurred ten days after planting under clear and black plastic and 17 days after planting under other treatments. Percent germination of corn after 26 days from planting was as follows: 98, 97, 95, 95, 91 and 83 for clear plastic, black plastic, straw, date palm fibers, date palm leaves, and costrol, respectively (Table 1). A difference of

TABLE. 1. General data, experiment 1964.

Treatments	Germination %	Ave. height/plant after 3 months (cm)	Date of tasseling	Date of earing	No. of irrigation	Days to maturity	Ave. wt./ear (g)	Ave. length of ear (cm)	Full ears %	Plants/donum	Grain yield kg/donum
Clear plastic	98	135	May 2	May 9	13	116	96.6	11.5	48	10250	464
Black plastic	97	134	May 2	May 9	13	116	91.0	11.8	55	8480	390
Straw	95	94	May 12	May 17	14	141	46.0	11.3	22	5896	244
Date fiber	95	60	May 17	May 25	14	157	20.4	8.7	—	4164	44
Date leaves	91	55	May 12	May 20	14	157	22.0	9.4	—	5239	42
Control	83	77	May 12	May 17	14	157	27.0	9.4	—	2644	39

TABLE 2. General data, experiment 1965.

Treatments	Date of germination	Germination %	Ave. height/plant (cm) 80 days after planting	Date of tasseling	Date of earing	No. of irrigation	Days to maturity	Ave. wt./ear (g)	Ave. length of ear (cm)	Full ears %	Plants/donum	Grain yield kg/of ear
Clear plastic	15-3-65	87	136.8	May 6	May 13	10	111	77.3	11.0	44.0	4775	285
Black plastic	18-3-65	91	135.0	May 12	May 17	10	117	63.7	10.7	21.3	4650	170
Straw	16-3-65	96	76.0	May 23	May 26	11	124	43.0	9.4	14.5	5350	118
Date leaves	22-3-65	40	63.4	May 25	May 29	11	128	45.6	12.2	2.5	2175	37
Control	21-3-65	68	90.0	May 18	May 23	11	130	40.6	11.8	6.0	3400	82

8-15% in germination existed between control and other treatments while the difference among mulch treatments was about 1-7%.

Differences in height of plants also occurred among treatments. The plant height was as follows: 135, 134, 94, 77, 60 and 55 cm for the clear plastic, black plastic, straw, control, date palm fiber, and date palm leaves, respectively (Table 1). There was a difference of 58 cm in plant height between control and other treatment. The shortest plants were under date palm fibers and date palm leaves treatments.

Increased plant growth under clear and black plastic resulted in tasseling and earing of plants ten days earlier than under the other treatments. At the time of flowering, several plants were damaged by corn borers under black and clear plastic.

Corn was ready to be harvested after 116 days under clear and black plastic, 141 days under straw, and 157 days under each of the date palm leaves, date palm fibers and control treatments (Table 1). In other words, corn yield was harvested 40 days earlier under plastic treatments and 25 days earlier under straw than the other treatments. Treatments varied significantly (1% level of probability) in yield per donum which was as follows: 464, 390, 224, 44, 42, 39 kg for clear plastic, black plastic, straw, date palm fibers, date palm leaves and control respectively (Tables 3 and 4).

Experiment 1965:

Germination occurred under clear plastic, black plastic, straw, date palm leaves, and control 7, 10, 8, 14 and 13 days after planting, respectively corresponding percent germinations after 26 days from planting were 87, 91, 96, 40 and 68. Differences in plant height also occurred due to treatments. Height of plants 50 and 80 days after planting was: clear plastic 23, 137; black plastic 16, 135; straw 16, 76; date palm leaves 11, 63; and control 12, 90 cm, respectively (Table 2).

Tasseling and earing were earlier by 12 and 6 days under clear plastic, and 6 and 5 days under black plastic than their controls, respec-

TABLE 3. Grain yield in grams per plant for the experiments of 1964 and 1965 comparing cultivation with non-cultivation.

Treatments	Cultivation Expt. 1964	Non-cultivation Expt. 1965
Clear plastic	1320	59.8
Black plastic	1090	36.5
Straw	620	22.1
Date palm leaves	120	17.0
Date palm fibers	120	—
Control	110	24.2
L.S.D. (0.05)	310	9.3
L.S.D. (0.01)	430	15.8

TABLE 4. Analysis of variance for corn yield (kg/plant) of experiment 1964.

Source of variation	D.F.	Sum squares	Mean squares
Rows	5	0.15	0.03
Columns	5	0.22	0.04
Treatments	5	8.78	1.75**
Error	20	1.40	0.70
Total	35	10.55	

** Significant at the 1% level of probability.

S.E. = 0.33

L.S.D. P(0.05) = 0.31

P(0.01) = 0.43

tively. On the other hand, tasseling and earing were later by 5 and 3 days under straw, and by 7 and 6 days under date palm leaves than their controls, respectively. In other words, earliest flowering occurred under plastic treatments and latest under straw and date palm leaves.

At the time of flowering corn borer damage was heavier among plants grown under the treatment of black plastic compared to the other treatments.

Corn was ready to be harvested 111 days after planting with clear plastic, 117 days with black plastic, 124 days with straw, 128 days with date palm leaves and 130 days with control (Table 2). The earliest harvests were made under clear and black plastic treatments. Yield in kilograms per donum was 285, 170, 118, 37 and 82 for clear plastic, black plastic, straw, date palm leaves and control respectively (Table 2). The difference in yield under different treatments was highly significant (Tables 3 and 5).

DISCUSSION

Germination under plastic treatments occurred in 1964 one week earlier than under the other treatments due to temperature difference. The average day-time temperature of the first month was 20°C under black and clear plastic, 15.5°C under straw, 15°C under date palm fiber, 14°C under date palm leaves, and 16°C under control. Atmospheric temperature for that period was 16.7°C. Germination in 1965 occurred 3-7 days earlier under plastics and straw than under date palm leaves and control. Average day-time temperature during the same period was 16.6°C under clear plastic, 15.7°C under black plastic, 14.3°C under straw, 13.7°C under date palm leaves, and 16.3°C under control. Average atmospheric temperature for the same period was 16.7°C.

The results showed that germination of corn seeds for the 1964 experiment under control treatment was 8-15% less than that of the other treatments. For the 1965 experiment germination under control was 8-19% less than under clear plastic, black plastic and straw, 28%

TABLE 5. Analysis of variance for corn yield (gr/plant) of experiment 1965.

Source of variation	D.F.	Sum squares	Mean squares
Rows	4	349	87.25
Columns	4	470	117.50
Treatments	4	5915	1478.75**
Error	13	924	71.00
Total	25	7658	

** Significant at the 1% level of probability.

L.S.D. P(0.05) = 9.26

P(0.01) = 15.76

higher than that of date palm leaves treatment. This variation in percent germination was due to:

1. Temperature variation in non-mulched soil was greater than in the mulched soil.

2. Non-mulched soil accumulated more salt than mulched soil because mulch materials retarded evaporation (Geraldson 1960; Edminister and Staff, 1961).

3. Birds dug out seeds from non-mulched soil in the experiment of 1964.

4. The use of unstripped date palm leaves in the experiment of 1965, was not enough to cover the tops of the ridges completely and the hills were shaded by the leaves.

Plastic mulch increased soil temperature which is believed to be beneficial to the early stages of corn growth. It was reported that on an average difference of 2°C in soil temperature at four-inch depth doubled top growth of six-week old corn plants, and that increasing soil temperature early in the season was found to be potentially beneficial (U.S.D.A., 1964). Therefore, corn plants under plastic mulch grew faster and resulted in early tasseling and earing at the time when average atmospheric temperatures were 26 and 27°C for the 1964 and 1965 experiments, respectively, which were suitable for pollination. Tasseling and earing occurred under other mulches and control at the time when the average atmospheric temperatures were 30 and 31°C in the two years respectively. Martin and Leonard (1955) stated that hot dry weather causes early shedding of pollens or that pollens dry out before they are ready to receive them. Immature ears were more numerous under non-plastic than under plastic treatments. Consequently, average yield per donum was higher in plastic than under other treatments. Yield per plant in 1965 was much lower than that in 1964 for all treatments (Table 3). This was due to weeds which were not controlled by cultivation in the 1965 experiment.

I am very much indepted to Dr. Muayyad A. Younnis, Department of Botany, College of Agriculture for reading the manuscript and offering valuable comments.

Thanks are also due to Mr. Ebrahim M. Al-Amiri who helped in carrying out the experiments.

REFERENCES

Darby, J.F., Scadder, W.T. and Whitner, B.F. (1962). Evaluation of petroleum and plastic resin spray as soil sealants and mulches for vegetables. *Proc. Fla. St. Hort. Soc.*, **75**:240-248.

Edminister, R.W. and Staff, C.E. (1961). Plastics in soil and water conservation. *Ag. Eng.*, **42**:248-249.

Geraldson, C.M. (1960). Growing tomatoes and cucumbers with high analysis fertilizer and plastic mulch. *Proc. Fla. St. Hort. Soc.*, **75**:253-260.

Gopalkrishna, N., Dea, P.V. and Bhavani, J.K. (1960). Influences of mulch on growth yield of bhokari grape. *Hort. Advance*, **4**:883-888.

Kohnke, H. and Werkhoven, C.H. (1963). Soil temperature and soil freezing as affected by organic mulch. *Soil Sci. Soc. Am. Proc.*, **27**:13-17.

Lange, A.H. (1961). Responses of solo papaya to mulching. *Proc. Amer. Soc. Hort. Sci.*, **77**:246-251.

Hopen, H.J. (1965). Effects of black and transparent polyethylene mulches on soil temperature, sweet corn growth and maturity in a cool growing season. *Proc. Amer. Soc. Hort. Sci.*, **86**:415-420.

Louis, R.A., (1962). Esso agricultural mulch products. Rev. edn. Research Division. Esso Research and Engineering Company, Lindin. New Jersey.

Martin, J.H. and Leonard, H.W. (1955). *Principles of Field Crop Production*. 7th edn., New York: Macmillian.

U.S. Department of Agriculture (1964). Corn seed beds. *Agric. Res.*, **12**:8.

Victor, V. and Brighurst, R.S. (1961). Prunning and Polyethylene mulching of summer — planted strawberries in southern California. *Proc. Amer. Soc. Hort. Sci.*, **78**:275-280.

Willis, W.O. *et al.* (1963). Soil ridges save water, boost corn yield. *Crops and soils*, **15**:14.

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EFFECT OF FEED AND WATER RESTRICTION ON LAYING HENS*

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(Received 6 April 1972)

SUMMARY

Restricting feed intake of caged layers to 97.5, 95, 90 and 85 percent of *ad-libitum* fed control groups lowered egg production, reduced egg weight, and resulted in smaller body size. No differences in mortality or egg quality traits were found between treatment groups. Limiting feeding time to 15 minutes per hour and per 1½ hour, and to 30 minutes per two hours resulted in a small but non-significant decrease in feed intake as compared to *ad-libitum* fed groups. Rate of production, egg quality, and feed per dozen eggs did not differ between treatment groups but the restriction of the feeding time reduced the average egg and body weights of hens.

The restriction of water intake of caged layers by limiting the availability of water to 15 minutes per hour, per two hours, and per three hours resulted in a decrease in the rate of egg production, a reduction in feed intake and body weights, and drier droppings under the

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cages as compared to hens receiving water *ad-libitum*. No differences were found between treatments in respect to average weight, Haugh unit, or specific gravity of the eggs, in pounds of feed per dozen eggs, or in hen mortality.

الخلاصة

ان تقليل كمية العلف المعطاة لمجاميع من الدجاج البيوض (الكهورن الابيض) الى ٩٧٫٥ ، ٩٥ ، ٩٠ و ٨٥٪ من كمية العلف المعطاة لمجاميع اخرى من الدجاج قدم لها العلف بصورة مستمرة سبب عنه انخفاض انتاج البيض وأوزان البيض وكذلك أوزان أجسام الدجاج • كما ان تقليص فترات اعطاء العلف (١٥ دقيقة علف كل ساعة أو كل ساعة ونصف و ٣٠ دقيقة علف كل ساعتين) سبب عنه انخفاض في أوزان البيض وأوزان أجسام الدجاج •

ان تقليل فترات اعطاء الماء لمجاميع من الدجاج البيوض (الكهورن الابيض) وذلك باعطائها ١٥ دقيقة فترة شرب ماء كل ساعة أو كل ساعتين أو كل ثلاث ساعات نتج عنه انخفاض في انتاج البيض ووزن الدجاج وكمية العلف المستهلك وكذلك انخفاض في كمية الماء المطروح مع البراز •

INTRODUCTION

It is common practice for poultrymen to keep feed and water before layers at all times. From the stand point of mechanics, this is probably the easiest procedure to follow, but it may not be the most profitable one. Under certain conditions, layers may consume feed and water in excess of their needs.

If hens consume more feed than utilized for body maintenance and egg production, the excess is largely converted to body fat. This body fat is not only costly to poultrymen in terms of feed cost, but may also be detrimental to the health of hens. Reproductive disorders and circulatory diseases are known to be associated with obesity. Obese hens are also more subject to heat stress during periods of high temperatures. Annual egg production may suffer as the result of over-consumption of feed.

Poultrymen are, at times, troubled with layers producing droppings that are excessively watery. This creates a number of problems in litter management. This is particularly true of layers kept in cages and during periods of high temperatures.

Several reports, based on experimental results, have been published on feed and water restriction. Fuller and Dunaho (1962) showed that egg production was higher for the groups of pullets that had been restricted from 6 to 24 weeks of age and that reduction in body weight had occurred.

Goodling *et. al.* (1963) reported that feed restriction during the laying period resulted in a reduction in egg production and egg size.

McGinnis and Dronawat (1967) found that limiting the amount of feed to 90 percent of full feed for Leghorn hens caused a reduction in egg production. Limiting the feeding time of laying hens to four or six hours per day caused 10 to 15 percent reduction in daily feed consumption and in egg size, but did not affect egg production.

Goodman (1961) reported that hens allowed to drink for 5, 10 or 15 minutes every hour drank nearly as much water and laid as well as hens that had water in front of them all day.

Davis (1966) reported that hens drink too much water if given access to all the water they want. Excess consumption resulted in loose droppings, wet poultry houses, lower feed efficiency and slightly lower egg quality.

Sunde (1967) reported that withholding water from laying hens for 30-36 hours resulted in egg production reaching its lowest level in five days, which did not return to the "normal" level for at least 30-35 days. When this procedure continued for a longer period of time, it took nine weeks for the production to reach the "normal" level. It was noticed that 10 weeks later hens that had been deprived of water laid at a slightly higher rate than did their controls.

To obtain further information regarding the effects of different levels of feed and water restriction on the performance of laying hens and to study methods of obtaining this restriction, experiments with Single Comb White Leghorn-Type pullets were conducted.

EXPERIMENTAL PROCEDURES

Experiment I:

Experiment I consisting of two trials conducted concurrently, involving 1104 Single Comb White Leghorn-Type pullets, kept two per cage, were assigned to six feed restriction treatments: full fed, and 97.5, 95, 90 and 85 percent of the full-fed group. The sixth treatment was a skip-a-day method in which the birds were not given feed one day out of each seven days. The experimental period was 287 days.

Experiment II:

In this experiment feed restriction was on the basis of limited feeding time. A total of 433 pullets, 38 weeks of age, kept two per cage, was assigned to four treatments. In addition to the full-fed (control) groups, the treatments included 15 minutes of feeding time per hour, 15 minutes of feeding time per hour and a half, and thirty minutes of feeding time per two hours. Automatic devices, operated by time clocks, were used to provide the desired feeding times. The experimental period was 210 days.

Experiment III:

A total of 480 Single Comb White Leghorn-Type pullets, 22 weeks of age, were housed two per cage and assigned to four treatments: (1) water *ad-libitum*, (2) 15 minutes of water per hour, (3) 15 minutes of water per two hours, (4) 15 minutes of water every three hours. The experimental period lasted 308 days, started on May 4th, 1967.

A corn-soybean oil meal-fish meal-type diet was used. It was calculated to contain 16.75 percent crude protein and 916 calories of productive energy per pound. The diet was considered to meet the nutritive

requirements of laying hens as given by the U.S. National Research Council. Information was recorded on egg production, egg quality, feed consumption, mortality, and body weights of all birds.

Data in each experiment were analyzed by the Analysis of Variance Method. Duncan's Multiple Range Test was used to determine significant differences between means.

Significant differences were indicated by use of superscripts. In those columns with no significant differences, superscripts were omitted.

RESULTS AND DISCUSSION

Experiment I:

Data regarding egg production and feed consumption are presented in Table 1.

Restricted feed intake by the percentage method consistently lowered egg production in both trials on both hen-day and hen-housed basis.

In general, as feed intake was reduced, egg production was also reduced. The skip-a-day treatment also resulted in lower production as compared to the *ad libitum* group.

Among the treatment means, there were no significant differences found for pound of feed per dozen eggs produced. Although in both trials the full-fed hens actually consumed less feed per dozen eggs.

The data regarding the effect of feed restriction on specific gravity, Haugh Units, egg weight, incidence of blood spots, body weight and on the percent of mortality is presented in Table 2.

Specific gravity scores of the eggs were unaffected by the treatments. Egg quality, as measured in Haugh Units, showed a significant but irrational effect. In trial I, the eggs from the skip-a-day and the 90

TABLE 1. The effect of feed restriction on egg production and feed efficiency, trial 1 and trial 2.

Feed	Percent Egg Production[2]				Pound of Feed Consumption[3]			
	Hen Day		Hen Housed		Per Hen		Per Dozen Eggs	
	Tr. 1	Tr. 2	Tr. 1	Tr. 2	Tr. 1	Tr. 2	Tr. 1	Tr. 2
ad. Lib.	78.5^{a}	77.8^{b}	74.8^{b}	72.7^{d}	70.0	56.8	3.9	3.9
97.5%	74.6^{c}	69.7^{a}	66.7^{ab}	65.1^{c}	68.3	55.2	4.0	4.3
95%	71.1^{bc}	66.6^{a}	68.1^{ab}	63.8^{bc}	66.0	53.6	4.2	4.5
90%	68.7^{b}	66.5^{a}	65.7^{ab}	60.4^{ab}	63.0	51.2	4.0	4.2
85%	64.8^{a}	63.5^{a}	60.9^{a}	57.5^{a}	59.5	48.3	4.0	4.3
6/7[1]	67.5^{ab}	66.4^{a}	64.4^{ab}	65.1^{c}	64.0	50.4	4.1	4.2

(1) No feed one day per week.

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

(3) Means in each column did not differ significantly ($P > 0.05$) when tested by analysis of variance and therefore superscripts were omitted.

TABLE 2. The effect of feed restriction on average specific gravity, average Haugh Units, average egg weight, incidence of blood spots, average body weight gains, and percent mortality.

Feed	Av. Sp. Gr.* Score		Av. H.U.[2] Score		Av. Egg Wt.* Grams		Blood Spots+ Percent		Av. Wt. Gains[2] Grams		Mortality+ Percent	
	Tr. 1	Tr. 2	Tr. 1	Tr. 2	Tr. 1	Tr. 2	Tr. 1	Tr. 2	Tr. 1	Tr. 2	Tr. 1	Tr. 2
ad. Lib.	3.1	3.6	73.0[b]	71.7	61.1	60.9	0.0	2.0	399[c]	330[b]	9.1	9.5
97.5%	3.0	3.5	71.6[a]	73.3	59.3	59.2	10.0	16.0	269[b]	143[a]	18.1	7.3
95%	3.3	3.3	72.8[ab]	73.8	59.3	58.7	2.0	10.0	169[a]	52[a]	8.0	7.4
90%	3.4	3.5	73.9[c]	73.0	59.4	58.6	10.6	8.0	171[a]	104[a]	10.3	10.4
85%	3.1	3.8	73.1[b]	74.4	58.9	58.9	6.0	4.0	141[a]	83[a]	12.3	11.5
6/7[1]	3.3	3.5	75.6[c]	74.8	60.0	59.3	12.0	2.0	239[b]	153[a]	10.2	6.3

(1) No feed one day per week.

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

(*) Means in each column did not differ significantly ($P > 0.05$) when tested by analysis of variance and therefore superscripts were omitted.

(+) Due to small numbers involved, data were not statistically analyzed.

percent groups had significantly higher Haugh Unit scores as compared to the remaining groups. In trial 2, however, none of the differences between treatments were sifinificant. There were no significant differences found in the average size of the egg laid by hens receiving the various amounts of feed. However, the average egg size tended to decrease as the feed intake decreased.

The incidence of blood spots did not indicate a relationship between this factor and the amount of feed consumed. Due to the small numbers involved, these data were not statistically analyzed.

The body weight gains were greater for the full-fed groups than for the restricted groups in both trials. Mortality levels were quite variable and non-significant.

Experiment II:

The results of feed restriction on a time basis on the percent hen-day and hen-housed production, feed consumption, specific gravity, Haugh Units, egg weight, incidence of blood spots, body weight gains and percent of mortality are given in Table 3.

There were no significant differences found between treatments in the percent of egg production. Production of hens allowed 30 minutes of feeding time per two hours was slightly higher than that of other groups. The average egg weight of the group allowed 15 minutes of feeding time per 1½ hour was significantly less than the other groups.

There were no significant differences found between treatments for pounds of feed per hen and per dozen of eggs. The body gains of hens on the various limited feeding times were significantly less than that of the full-fed hens.

Differences in the percent of mortality among the treatment groups were non-significant.

Specific gravity of the eggs was not significantly influenced by the

TABLE 3. The effect of restricted feeding time on egg production, feed consumption, average specific gravity, average Haugh Units, average egg weight, incidence of blood spots, average weight gains, and percent mortality.

	Egg Production[1]		Feed Consumption[1]							
	Hen Day	Hen Housed	Per Hen	Per Dozen Eggs	Av. Sp. Gr.[1]	Av. H.U.	Av. Egg Wt.[2]	Blood Spots*	Av. Wt. Gains+	Mortality*
Feeding Time	Percent		Pounds			Score	Grams	Percent	Grams	Percent
ad. Lib.	70.9	65.5	34.0	4.0	3.1	71.2	62.5[a]	13.6	265[b]	12.4
15min./hr.	70.3	59.4	34.0	4.4	3.3	72.7	62.4[a]	9.0	120[b]	20.1
15min./1.5hr.	69.8	61.2	32.4	3.9	3.0	71.1	60.6[b]	1.5	88[a]	19.3
30min./2hrs.	72.6	66.9	32.0	4.0	3.0	73.5	62.0[a]	4.5	138[a]	13.1

(1) Means in each column did not differ significantly ($P>0.05$) when tested by analysis of variance and therefore superscripts were omitted.

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

(*) Due to small numbers involved, these data were not statistically analyzed.

treatments. The average Haugh Unit scores of the eggs produced by the groups of hens allowed full feeding, and 15 minutes every hour and a half were significantly less than the other two groups. There appeared to be no relationship between the incidence of blood spots and restricted feeding time.

Experiment III:

Data regarding the influence of water restriction on egg production, feed consumption, average specific gravity scores, average Haugh Unit scores, average egg weight, incidence of blood spots, average weight gains, percent of mortality and water in the droppings are shown in Table 4.

Restricting the availability of water resulted in a significant reduction in hen-day egg production.

Egg production of the group receiving 15 minutes of water per hour was significantly less than that of those receiving 15 minutes of water every two and three hours. This is hard to explain. No significant differences were found in respect to egg weight. Droppings of hens receiving water 15 minutes out of each two and three hours were significantly drier than those from hens given water *ad-libitum* and 15 minutes per hour.

There was a significant reduction in feed intake as the amount of watering was reduced. A significant difference was found in respect to body weight gains with groups of hens receiving 15 minutes of water per hour having the greatest gain.

No significant differences were found in the percent hen mortality among the four treatment groups.

No significant differences were found with respect to specific gravity, average Haugh Unit scores and the incidence of blood spots.

TABLE 4. The effect of water restriction on egg production, feed consumption, average specific gravity, average Haugh Units, average egg weight, incidence of blood spots, average weight gains, percent of mortality, and percent of water in the droppings.

Watering Time	Egg Production+		Feed Consumption*		Av. Sp. Gr.*	Av. H.U.*	Av. Egg Wt.	Blood Spots*	Av. Wt. Gains*	Mortality*	Water in Droppings+
	Hen Day	Hen Housed	Per Hen	Per Dozen Eggs							
	Percent		Pounds		Score	Score	Grams	Percent	Grams	Percent	Percent
ad. Lib.	78.4[c]	66.6	76.6	4.0	3.5	75.0	59.2	18.0	385[a]	29.0	79.6[b]
15min./hr.	72.5[a]	62.4	73.4	4.0	3.5	75.1	58.6	24.0	429[b]	23.6	78.9[b]
15min./2hrs.	74.5[b]	61.3	72.6	3.8	3.4	75.0	58.7	6.0	245[a]	26.6	77.4[a]
15min./3hrs.	74.0[b]	63.0	71.5	3.9	3.5	73.5	58.8	18.0	353[a]	26.6	76.9[a]

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

(*) Means in each column did not differ significantly ($P > 0.05$) when tested by analysis of variance and therefore superscripts were omitted.

CONCLUSION

Restriting feed intake by percentage method lowered egg production, reduced egg weight, and resulted in smaller body size. Whereas, restricting feed intake by limiting feeding time reduced average egg and body weights of hens.

The restriction of water intake of caged layers resulted in a decrease in egg production, less feed consumed per bird, lower body weights and drier droppings as compared to birds receiving water *ad-libitum*.

REFERENCES

Davis, D. (1966). Restricted water to improve efficiency. *Poultry Trib.*, **72**:**6**:756.

Fuller, H.L. and Dunaho W.S. (1962). Restricted feeding of pullets: 2. Effect of duration and time of restriction on three years laying house performance. *Poultry Sci.*, **41**:1306-1314.

Goodling, A.C., Watts A.B. and Woodward R.S. (1963). Restricted studies with laying hens. *La. Agr.*, **7**:**2**:10-11.

Goodman, J.G. (1961). Water restriction for cage hens. Personal Communication.

McGinnis, J.C. and Dronawat N. (1967). Do laying hens need all of the feed they consume? *Feed stuffs*, **39**:**24**:18-22.

Sunde, M.L. (1967). Poultry nutrition. Proceedings of the 15th Annual Pfizer Research Conference 29-46.

Iraqi J. agric. Sci., Vol. VII, 1972

ULTIMOBRANÇHIAL GLANDS OF CHICKENS
I. HISTOLOGICAL STUDY

N.A.J. AL-JIBOORI[1], *A.K. AL-KHAZRAJI*[1], *A.W.R. MEHDI*[1], *H.A.A. AL-FAYADH*[2] *and K.A. AL-SOUDI*[2]

(Received 23 June 1972)

SUMMARY

Histological sections of ultimobranchial glands of male and female White Leghorn chickens were prepared and stained with hematoxylin-eosin stain. The microscopical examination revealed the absence of any parathyroid tissue within the encapsulated ultimobranchial glands. The secretory cells are grouped in three kinds of structures which are surrounded by connective tissue. These structures are:

1. cord — like groups.
2. round — shaped groups lacking central lumens.
3. follicles with distinct central lumens.

الخلاصة

لقد استعملت الغدد الصماء (Ultimobranchial) لعدد من ذكور واناث دجاج ال (Leghorn) الابيض لتحضير شرائح مجهرية • اثبت الفحص المجهري خلو هذه الغدد الصماء من أية مجموعة خلايا تعود للغدة الصماء فوق الدرقية كما اثبت الفحص المجهري أيضا انتظام الخلايا الفارزة في ثلاثة تراكيب مختلفة يحيط بها نسيجا ضاما • ان هذه التراكيب هي :

١ ـ مجاميع حبلية الشكل •
٢ ـ مجاميع دائرية الشكل خالية من فجوات مركزية •
٣ ـ حويصلات فيها فجوات مركزية واضحة •

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(2) College of Agriculture, University of Baghdad.

INTRODUCTION

Ultimobranchial (or postbranchial) glands develop embryonically from the last pair of pharyngeal pouches. In mammals, they become embedded within the thyroid glands, whereas in birds they remain free and lie in the vicinity of the thyroid and parathyroid glands (Gorbman and Bern, 1962). In birds, the paired ultimobranchial glands can be located at the common origin of the subclavian and the common carotid arteries (Figure 1).

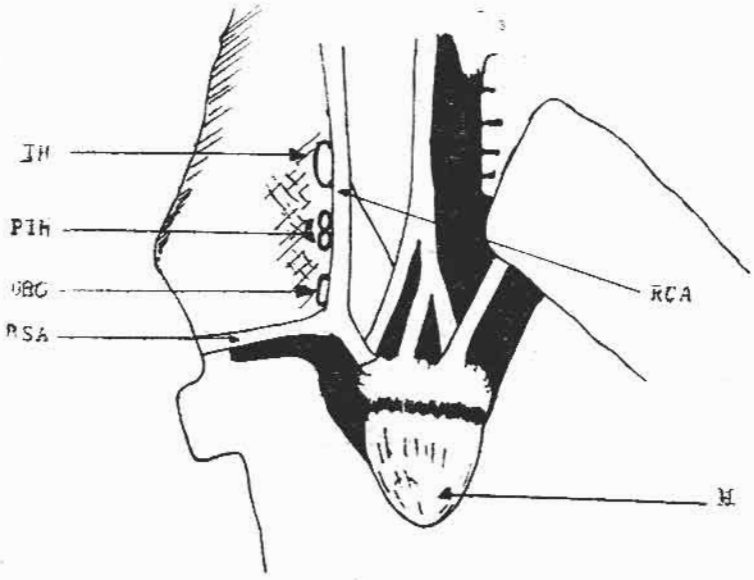

Fig. 1. Right ultimobranchial gland in relation to thyroid and parathyroid glands, heart and right subclavian artery. (Abbreviations: H, heart; PTH, parathyroid lobes; RCA, right carotid artery; RSA, right subclavian artery; TH, thyroid; UBG, ultimobranchial gland).

The name "ultimobranchial" was given to these glands by Greil in 1905 (Copp, 1969). Their function was unknown until their role in calcium metabolism was reported in 1967 (Copp *et al.*, 1967). They synthesize and release "calcitonin" which is a hypocalcemic hormone

regulating the diffusible blood calcium (Moseley *et al.*, 1968). However, Garlich (1971), claimed that surgical removal of the ultimobranchial glands did not cause any significant effect in male domestic fowl (*Gallus domesticus*).

While the available literature provides sufficient information on many aspects of the ultimobranchial glands, little is available pertaining to the histological identification. This study was carried out to further describe and clarify the histological aspects of these endocrine glands in chicken.

MATERIALS AND METHODS

A randomly selected group of male and female White Leghorn pullets (nine months old) was sacrificed and the paired ultimobranchial glands of each bird were dissected out after they were carefully located under a dissecting scope. In some cases the thyroid and parathyroid glands were removed as well. The glands were immediately placed in formalinacetic acid fixative solution (Davenport, 1961). The glandular tissues were then processed, following a procedure described by Al-Jiboori (1971) to prepare hematoxylin- eosine stained sections (ten microns in thickness). The stained histological preparations were microscopically examined and representative areas were photographed.

RESULTS

The ultimobranchial glandular tissue is completely surrounded and separated from nearby tissues by a connective tissue capsule (Figule 2). The glandular cells are mostly cuboidal in shape. In females the nuclei are vesiculated, whereas, in males the nuclei are pyknotic. The cells are arranged in three kinds of structures (Figues 3 and 4):

1. cord — like groups. This kind of structure is very abundant.
2. round — shaped groups lacking central lumens.
3. follicles with distinct central lumens filled with a granular unidentified substance. The follicles are generally regular in shape and small in size. They are the least in abundance.

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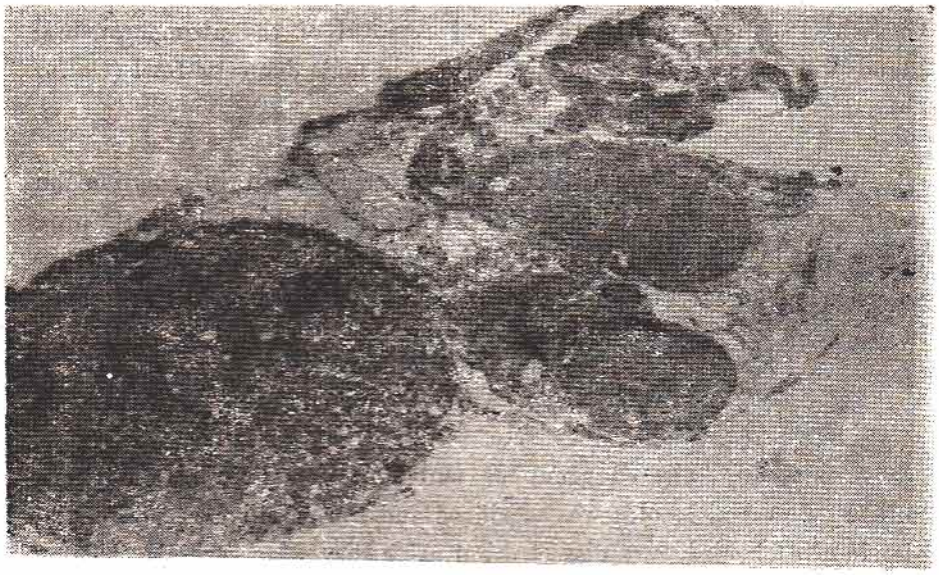

Fig. 2. Histological section showing the position of the encapsulated ultimobranchial gland in relation to thyroid and parathyroid glands.

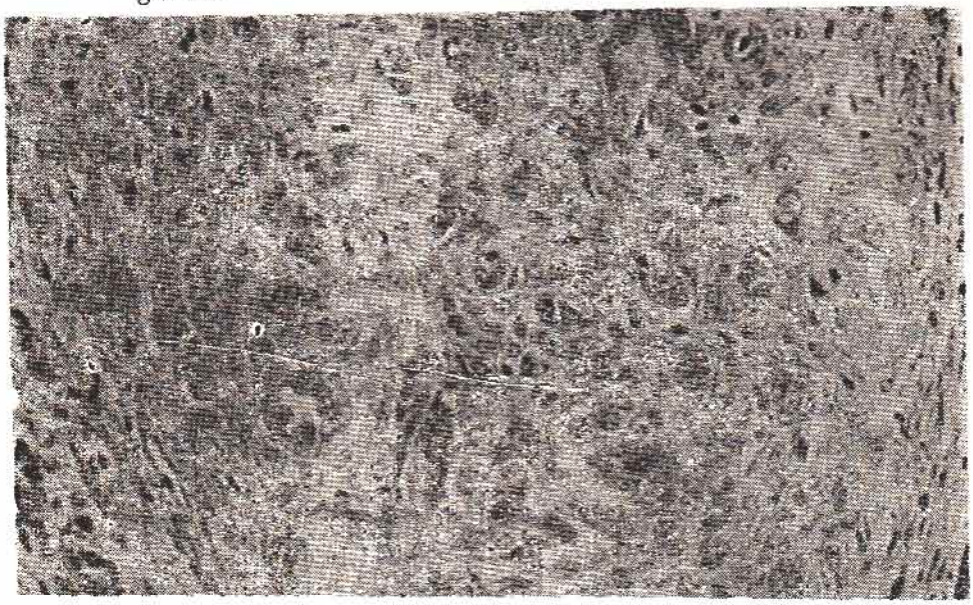

Fig. 3. Section of ultimobranchial tissue of female white Leghorn pullet. The three kinds of cellular arrangement are seen. The nuclei are vesiculated.

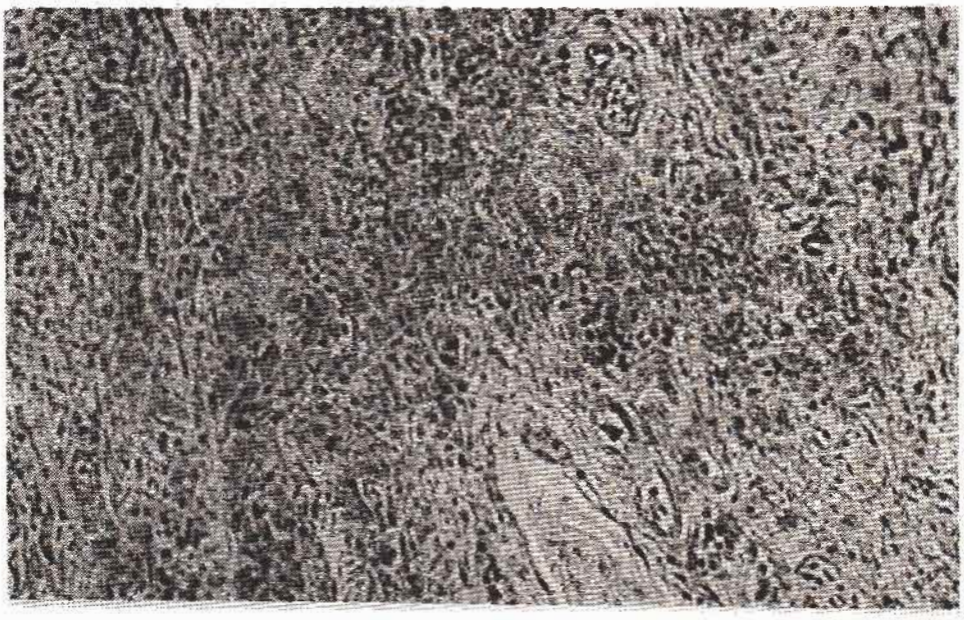

Fig. 4. Section of ultimobranchial gland of male white Leghorn pullet. The three kinds of cellular arrangement described in the text are seen. The nuclei are pyknotic.

All these structures have basement membrane and are surrounded by connective tissue. The secretory cells have light eosinophilic cytoplasm which contains fine eosinophilic granules. Few blood sinuses are also observed.

DISCUSSION

This study has proved the absence of any anatomical association between the ultimobranchial tissue and the thyroid and parathyroid tissues in chicken. Dudley (1942) reported that encapsulated grouped of parathyroid cells were often seen within the ultimobranchial glands of domestic fowls. However, close examination of the stained histological preparations in this study revealed disagreement with Dudley's findings.

In the mouse, irregularly-shaped large ultimobranchial follicles can be seen within the thyroid gland. The follicles have their central

lumens filled with granular colloid (Gorbman and Bern, 1962). The present results have shown that, in chicken, the ultimobranchial follicles are found only within the ultimobranchial glands.

The authors wish to express their appreciation to Dr. Z. Zaiden for his technical assistance.

REFERENCES

Al-Jiboori, N. (1971). *Effects of Prenatal Continuous Gamma Irradiation on the Macro- and Micromorphological Aspects of Albino Mouse Fetuses*. Dissertation, Texas A & M University, College Station, U.S.A.

Copp, D.H., Crockcroft, D.W. and Yankoon, K. (1967). Ultimobranchial Origin of Calcitoin: Hypocalcemic Effect of Extract from Chicken Glands. *Canad. J. Physiol. and Pharmacol.*, **45**:1090-1095.

Copp, D.H. (1969). Endocrine Control of Calcium Homeostasis. *J. Endocrinol.*, **43**:137-161.

Davenport, H. (1961). *Histological and Histochemical Technics*. Philadelphia: W.B. Saunders Company.

Dudley, J. (1942). The Development of the Ultimobranchial Body of the Fowl, *Gallus domesticus*. *Am. J. Anat.*, **71**:65-89.

Garlich, J. (1971). A Technique for Surgical Removal of the Ultimobranchial Glands from the Domestic Fowl. *Poultry Sc.*, **50**:700-702.

Gorbman, A. and Bern, H. (1962). *A Text Book of Comparative Endocrinology*. New York: John Willey and Sons, Inc.

Moseley, J., Matthews, E., Breed, R., Galante, L., Tse, A. and Mac Intyre, I. (1968). The ultimobranchial Origin of Calcitonin. *Lancet*, **1**:108-110.

Iraqi J. agric. Sci., Vol. VII, 1972

SOME ASPECTS OF RECLAMATION OF SALINE, ALKALI SOILS IN IRAQ[1]

ADNAN HARDAN AND ABDULLAH N. AL-ANI[2]

(Received 11 April 1972)

SUMMARY

Assumed soil conditions were used to calculate (theoretically) the amount of water needed to leach a saline-alkali soil into a normal (non-saline-non-alkali) soil.

Calculations indicate that a depth of about 26 meters of water/meter depth of soil is needed to reclaim a moderately saline-alkali soil if the sources of exchangeable Ca and Mg ions are river waters and lime. When sufficient gypsum is present, the depth of water needed is about 2.9 meters of water/meter depth of soil.

Some published information were used to check the validity of the calculation. Available data agreed very well with the theoretical consideration in the reclamation of saline-alkali soils in Iraq.

It is recommended that natural or applied gypsum is required to reduce the exchangeable sodium percentage (ESP) in saline-alkali soils. When gypsum is absent, good quality irrigation water and lime are of little value in this respect.

الخلاصة

افترضت ظروف معينة لحساب كمية الماء اللازمة لغسل تربة ملحية ـ قلوية وجعلها تربة اعتيادية (تربة غير ملحية ـ غير قلوية) .

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(1) This article was distributed to the participants in the UNESCO Seminar on Saline and Waterlogged Soil, Baghdad, Iraq, December 5-14, 1970.

(2) Assistant Professor and Instructor, respectively, College of Agriculture, Abu-Ghraib, Iraq.

تدل الحسابات على أن عمق الماء المطلوب لغسل عمق متر واحد من التربة وتحويله من تربة قلوية الى تربة غير قلوية يقارب ٢٦ متر من الماء وذلك عند استعمال ماء النهر وبوجود وفرة من كاربونات الكالسيوم والمغنيسيوم (اللايم) في التربة • اما عند وجود وفرة من الجبس فقد دلت الحسابات على أن عمق الماء المطلوب هو ٢ر٩ متر من الماء لغسل عمق متر واحد من التربة •

استعملت بعض النتائج المنشورة للتدليل على صحة الحسابات النظرية • اذ قد وجد ان النتائج العملية لاستصلاح بعض الترب الملحية ـ القلوية العراقية تتفق جيدا مع الحسابات النظرية •

وقد اقترح ان وجود الجبس بصورة طبيعية أو اضافته للتربة أساسي لاستصلاح التربة الحاوية على نسبة عالية من الصوديوم المتبادل وان جودة نوعية ماء النهر ووجود الجير في التربة ليس له أثر كبير في استصلاح التربة الملحية ـ القلوية عند عدم وجود كفاية من الجبس •

INTRODUCTION

Occurance of saline-alkali soils in the Mesopotamian Plain is widely recongnized in soil literature (Buringh, 1960; Dieleman, 1963; and Russel *et al.*, 1964).

During the leaching of saline-alkali soils there is a possibility of soil alkali development which would be indicated by changes in chemical and/or physical conditions of the soil. Chemical changes are indicated by the high ESP and high reaction of the soil whereas physical changes are indicated by the reduction in water conductivity and deterioration of soil structure.

Changes in ESP during leaching are mainly controlled by the amount of Ca+Mg ions participating in replacing exchangeable sodium ions, the SAR, the pH, and the CO_3+HCO_3 of soil solution.

The main source of Ca+Mg in the saline-alkali soils of Iraq are river water, lime, gypsum, and other soluble salts of Ca+Mg.

The available data indicate high content of lime (20-30%), presence of gypsum, favorable quality of river water, and slight alkaline soil reaction.

The good quality river water, the lime content, and the presence of gypsum lead most workers to conclude that there is neither an alkali hazard nor a need for amendment during the leaching of saline-alkali soils in Iraq.

This article intends to evaluate those conclusions using theoretical calculations and experimental evidences from published information on reclamation of saline-alkali soils in Iraq.

THEORETICAL CONSIDERATION AND CALCULATIONS

The following assumptions will be used throughout the theoretical consideration and calculations.

Considering a saline-alkali soil that has an ESP of 35 and a CEC of 25 meq/100 g soil, to recliam this soil, the ESP should be reduced to 15 or less by applying enough Ca+Mg to replace the excess exchangeable Na. Assuming highest efficiency (100%) of replacement, and an area of 1 cm^2 to a depth of 100 cm. of this soil which has a bulk density of 1.5 g/cc. The total amount of exchangeable Na to be replaced from the 150 g. of soil considered above 7.5 meq which requires 7.5 meq of Ca+Mg for replacement.

Quality of Leahing Water. Divalent cations in river water of Iraq were shown to be dominant over monovalent ones (Buringh, 1960; Dieleman, 1963; Hardan and Abdul-Halim, 1968; and Hadran, 1969).

Assuming that the average available amount of Ca+Mg for replacing exchangeable Na is 3 meq/liter of river water, the volume of water required for replacing the 7.5 meq of exchangeable Na is 2.5 liters or 2500 cm^3. This volume of water amounts to a depth of 25 meter/meter depth of soil. Such a magnificent amount of water is beyond any practical, economical or technical feasibility.

Lime Content. The role of precipitated carbonates of Ca+Mg (lime) in replacing exchangeable Na is limited by their low solubility.

The solubility of $CaCO_3$ in cold water is 0.306 meq/liter and that of $MgCO_3$ is 2.51 meq/liter (Handbook of Chemistry and Physics, 1959). Therefore, one liter of cold water would dissolve at most 2.816 meq of Ca+Mg. To dissolve 7.5 meq of Ca+Mg a volume of 2.67 liters or 2670 cm^3 of water is required. This would amount to a depth of 26.7 meter/meter depth of soil which is again not feasible.

Gypsum Content. The relatively high solubility of gypsum in water renders it very efficiently in supplying Ca ions to replace the exchangeable Na in the leaching of saline-alkali soils.

Assuming that the soil has enough natural or applied gypsum to supply 7.5 meq of Ca for the replacement of Na.

The solubility of gypsum in cold water is 25.7 meq/liter. To dissolve 7.5 meq of Ca, the amount of cold water required is 0.29 liters or 290 cm^3, which makes a depth of 2.9 meters/meter depth of soil. This is much more reasonable amount than those calculated for river waters and lime.

EXPERIMENTAL EVIDENCE

Available published information on the reclamation of saline-alkali soils of Iraq with respect to water quality, lime and gypsum contents will be considered.

Quality of Leaching Water. Water quality has been given a great importance in reducing the ESP during the leaching of saline-alkali soils in Iraq.

Figure 1 indicates that the role of river water quality in reducing ESP during leaching of Abu-Ghraib saline-alkali soil was of little importance. When 1.5 depths of water/depth of soil was drained, the change in ESP indicated in the figure was highest for Tigris water (TW) followed by distilled water (DW) and least for Euphrates water (EW). This is in agreement with the theoretical calculation of the effect of quality of leaching water.

Lime Content. Many workers generalize that the presence of lime in soil contributes significantly to the supply of Ca+Mg ions for replacing the exchangeable Na of saline-alkali soils in Iraq.

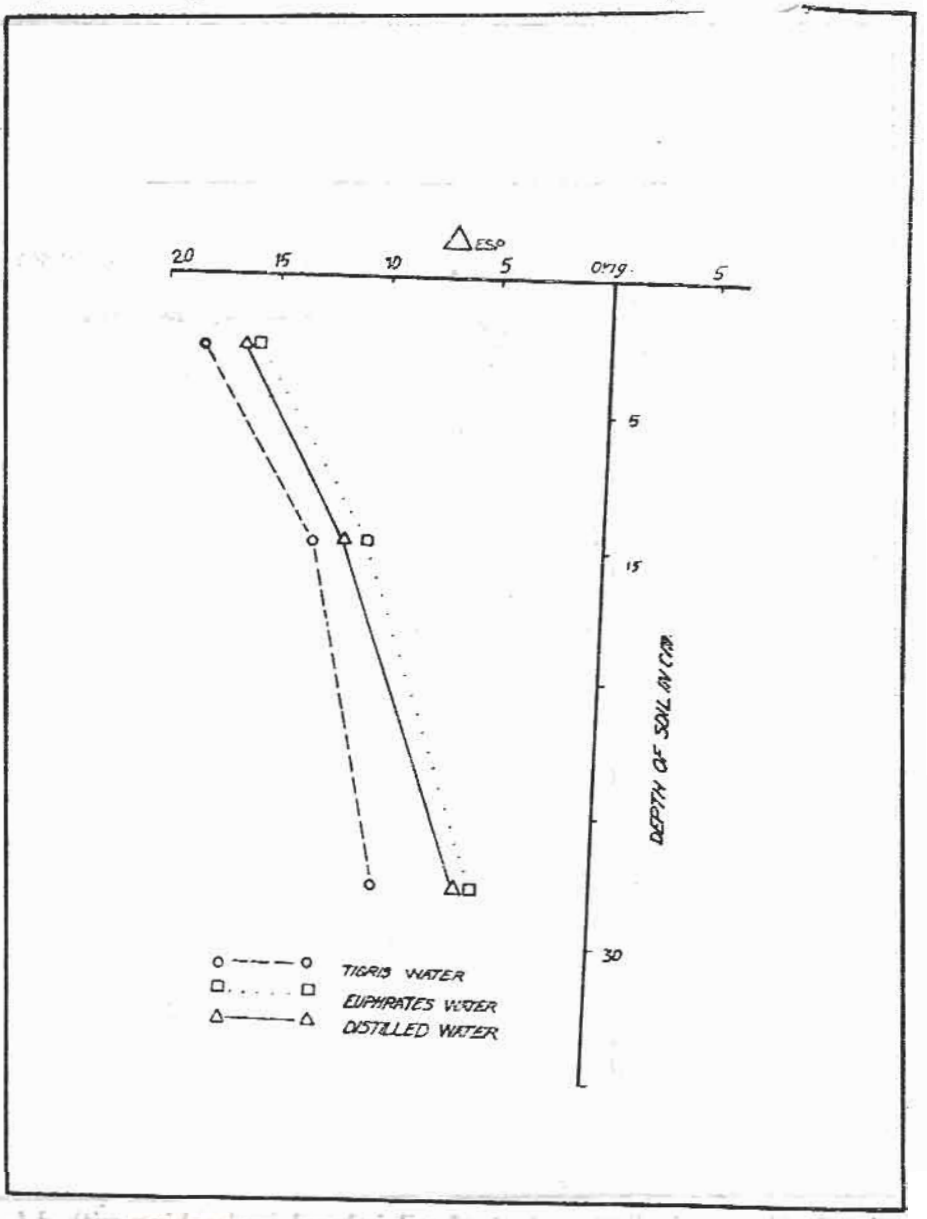

Fig. 1. Changes in ESP induced by leaching with different leaching water (Hardan 1969).

Solubility of lime is influenced by the presence of common ions (Ca, Mg. CO_3 and HCO_3) and and by the reaction of both the soil and the leaching water.

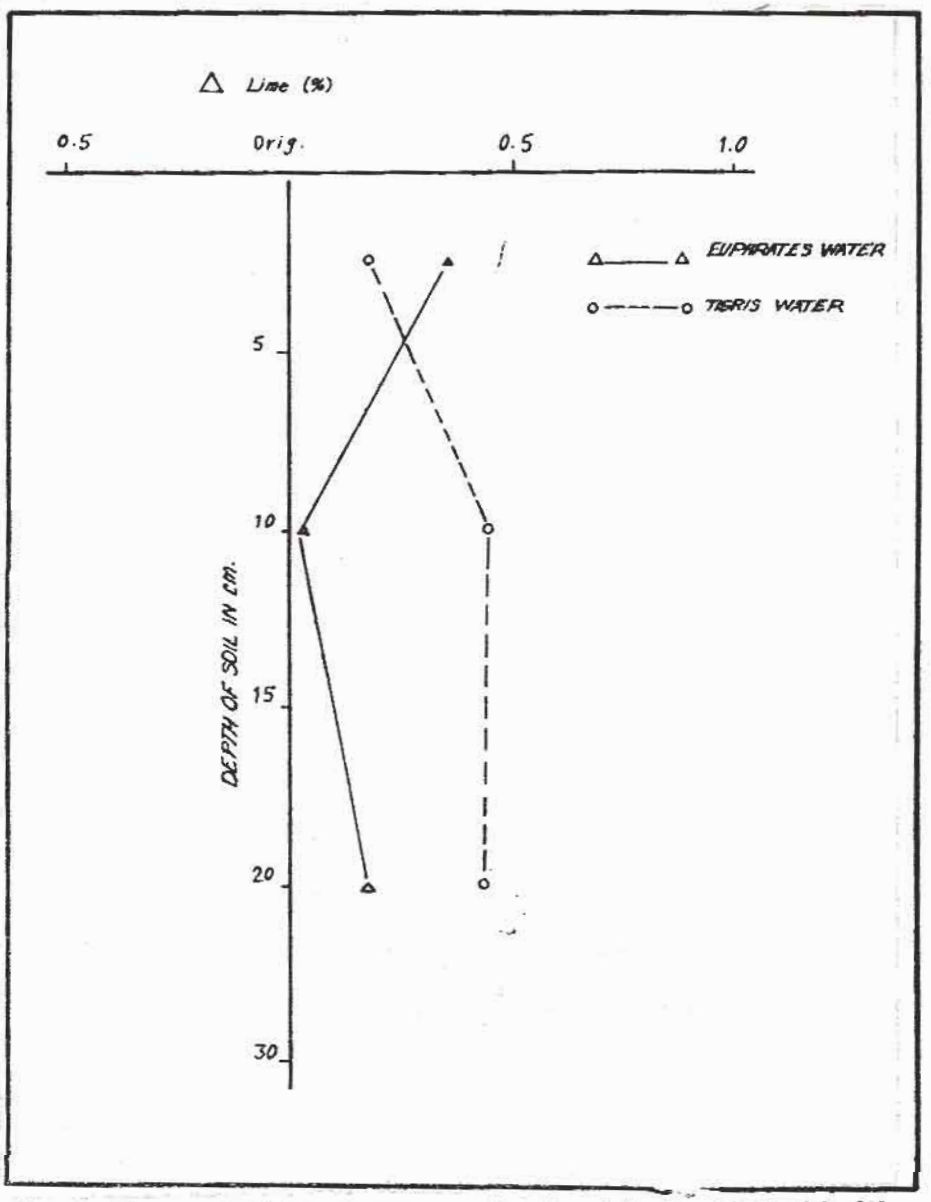

Fig. 2. Changes in lime content of soil induced by leaching with different leaching waters.

The leaching waters of Iraq are characterized by their relatively high content of Ca+Mg and CO_3+HCO_3. Therefore, a possible precipitation of lime may be induced by the increase of common ion concentration during leaching with river waters. The increase in common ion concentration is caused by evaporation of leaching water or by changes in the composition and concentration of soil solution during leaching.

Possible precipitation of lime during leaching with (TW) and (EW) was substantiated by Hardan (196) and shown in Figure 2. Therefore, if any lime is dissolved in (TW) and (EW) it would be of negligible importance in replacing exchangeable Na during the leaching of saline-alkali soils in Iraq.

Presence of Gypsum. It is generally said that the saline-alkali soils of Iraq have sufficient gypsum to replace excess exchangeable Na during leaching. However, the gypsum content of surface soil has been seen to vary from nil up to many tons/donum. The highest portion of this gypsum is often accumulated at the sub-soil (Buringh, 1960, and Dieleman, 1963).

One of the main reclamation experiments on saline-alkali soils of Iraq was conducted in the Dujailah Project and was reported by Baumans (1957) and Dieleman (1963). The results of this experiment and the reported conclusions have been used by most workers as basis for their belief that there is no danger of alkali development during the leaching of saline-alkali soils in Iraq.

A plot of the data of Dujailah experiment for the upper 60 cm of soil taken from Table 7 of Baumans (1957) and reported by Dieleman (1963) is shown in Figure 3. Careful examination of this figure indicates that when gypsum is present in sufficient amount (11 meq/100 g in the 0-30 cm soil layer) the reduction in ECe was accompanied by simultaneous and fast reduction in ESP. The ESP decreased from 34-15 when 15 cm depth of water was drained in 12 days of leaching. The ESP was further reduced to 7 when 84 cm depth of water was drained in 69 days of leaching. The figure also shows that when insufficient amount

of gypsum was present (3 meq/100g in the 30-60 cm soil layer) and after 84 cm of the good quality leaching was drained, the change in ESP

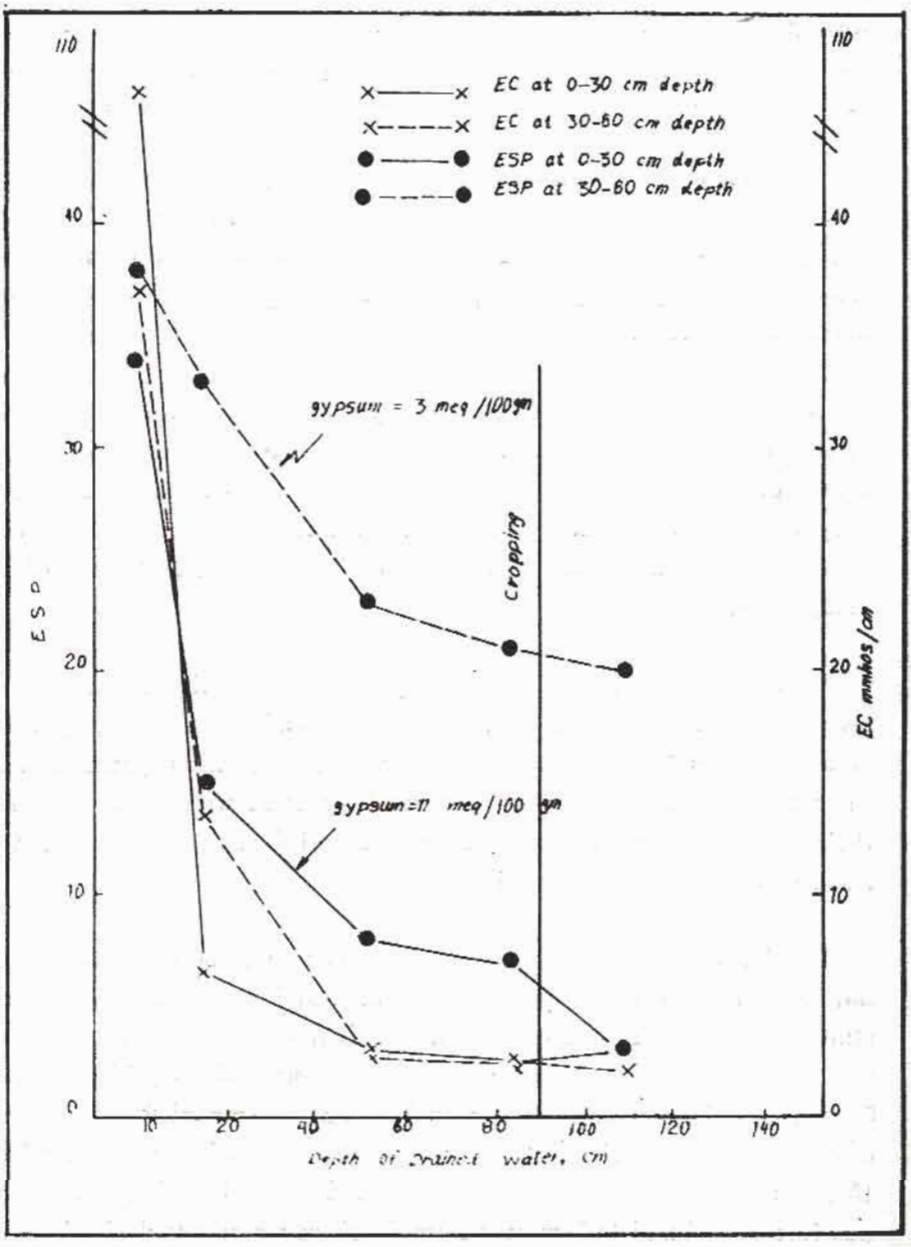

Fig. 3. Leaching of Dujailah saline-alkali soil. Data were taken from Dieleman (1963).

was only from 38 to 21 which is still higher than the critical level for alkali soil. The ECe of this soil layer at this stage of leaching was 2.2 mmhos/cm indicating the development of a non-saline-alkali soil during leaching.

Infiltration Rate and Presence of Gypsum. Refering to the rate of infiltration of the Dujailah soils, Dieleman (1963) stated that "There are marked divergencies between the average infiltration rates of the various tests. No correlation was found between infiltration rate and texture nor could the infiltration rate be correlated to the exchangeable sodium figures". "In most cases, the infiltration rate remained practically constant throughout the observation period. In some cases, a decrease was observed but this was not very serious and was probably due to arising subsoil water table during the observation period rather than to a structural deterioration".

Dieleman (1963) based his conclusions on the data of Table 12 in his report. The table shows that only six of the plots had continuous measurement of infiltration rate for a period of time that exceeded 2 weeks. Out of the 6 plots, three has shown a clear reduction in the infiltration rate, one showed a reduction followed by an increase, and only two plots have maintained practically constant infiltration rate.

It is unfortunate that no information on gypsum content of those plots are available and that the statement of no deterioration of soil structure was not substantiated or confirmed by any measurement of the size and stability of soil aggregates.

Baumans (1957) using the data of the Dujailah experiment concluded that "The infiltration rate as shown in Table 8 remained practically constant throughout the whole observation period for each location. This proves that infiltration over a long period did not cause a decrease of the soil permeability or a deterioration of the soil structure". It should be noted that the period of observation (156 hours) was not long enough to leach the excess salts out of the surface soil since Baumans himself reported that after 12 days of leaching, the ECe of the 0-30 cm soil layer was 6.5 mmhos/cm. Perhaps after 6 days of leaching,

gypsum and salts contents were high enough to maintain the favorable structural conditions.

Hardan and Abdul-Halim (1968) studied the influence of gypsum on percolation rate with undisturbed columns of Abu-Ghraib saline-alkali soil which contains 3 meq/100 g of gypsum. Figure 4 indicates that after 6 days of leaching, very little reduction in percolation was noted but a greater reduction in the rate of percolation has been thereafter established. It also shows that gypsum was added, the percolation rate remained without any significant reduction. With the addition of organic

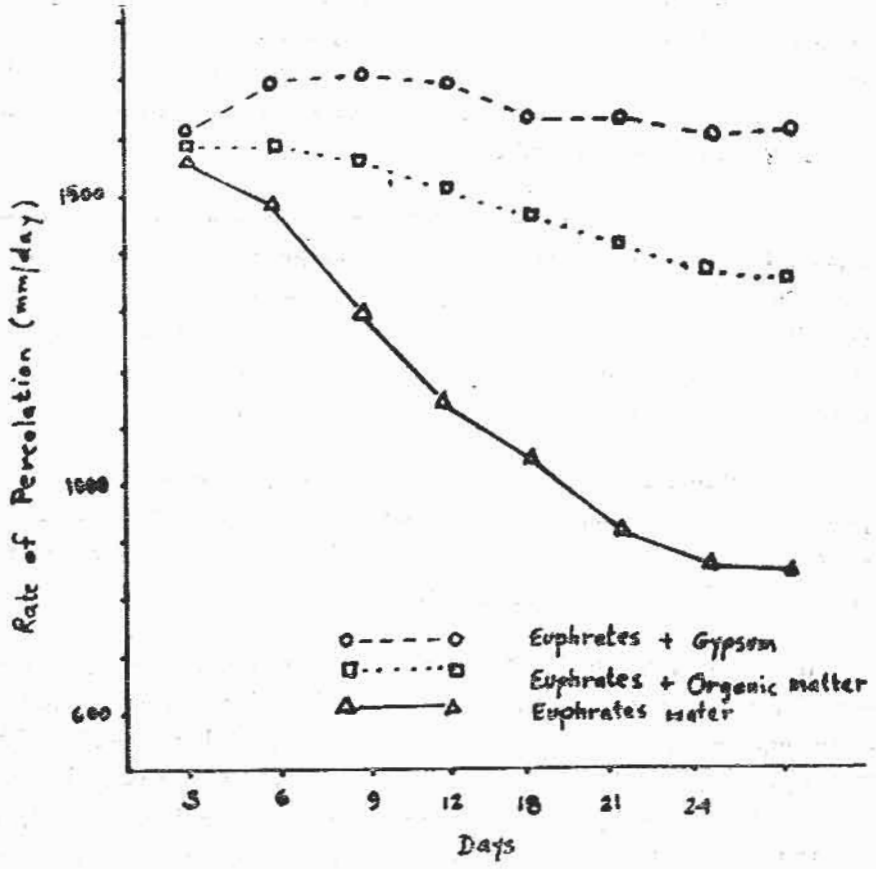

Fig. 4. Changes in the percolation rate with time of leaching as influenced by gypsum and organic matter during leaching with Euphrates River water.

matter to the soil, there was some reduction in percolation rate but not as much as when neither gypsum nor organic matter were applied. Analysis of the soil of the experiment after leaching showed that continuous leaching until all excess salts were removed (4 weeks for Tigris River water and 5 weeks for Euphrates River water) had also reduced the ESP values from 20 to 11 with Tigris water and from 20 to 14 with Euphrates water. However, when gypsum was applied under the same conditions, the ESP values were reduced from 20 to 6 with Tigris water and from 20 to 8 with Euphrates water.

The above findings demonstrate the need for amendments in reclaiming the saline-alkali soil of Iraq even when good quality river water is used for leaching.

Delver (1962) stated that most of salt affected soils of middle Euphrates and Tigris have silt+sand content of more than 65%. This indicates that these soils are highly subjected to deterioration of physical properties and require careful management (Mazurak *et al.*, 1962).

CONCLUSION

Reports on the limited leaching studies of saline-alkali soils in Iraq indicate a tendency to generalize some of the results to be applicable to all saline-alkali soils of the country. As the soils of Mesopotamia are highly stratified and possess great variation in their physico-chemical properties (Schilstra, 1962) such a generalization should not be applied.

The current study demonstrated that:

(a) although the favorable quality of river water in Iraq does not induce alkalinity, its advantages in reducing ESP is negligible,

(b) unless a source of CO_2 and/or an acidifier is present in the soil during leaching, the solubility of lime is too low to contribute significantly to the replacement of exchangeable sodium.

(c) gypsum is the only natural constituent of saline-alkali soils of Iraq that could contribute significantly to the replacement of excess exchangeable sodium. In the absence of sufficient amount of natural gypsum, amendments should be applied during leaching. Studies on the amounts of gypsum required and the method of application and their economy are needed.

REFERENCES

Baumans, J.H. (1957). Dujailah Drainage Experiments. Report No. 4, Development Board, Iraq.

Buringh, P. 1960. Soils and Soil Conditions in Iraq. The Ministry of Agriculture, Baghdad, Iraq.

Delver, P. (1962). Properties of saline soils in Iraq. *Netherlands J. Agric. Sci.*, **10**:194-210.

Dieleman, P.J. (Editor) (1963). Reclamation of Salt Affected Soils in Iraq. Publ. 11. Inter. Inst. for Land Reclamation and Improvement. The Netherland.

Hardan, A. and Abdul-Halim R.K. (1968). Effect of gypsum and organic matter on leaching of undisturbed saline-alkali soil columns. *Iraqi J. agric. Sc.*, **3**:13-27.

Hardan, A. (1969). Removal of salts from undisturbed saline-alkali soil columns by different leaching waters. American Univ. Beirut Symposium. Man, Food and Agriculture in the Middle East, pp. 409-341.

Mazurak, A.P. and Ramig, R.E. (1962). Aggregation and air-water permeabilities in chernosem soil cropped to perennial grasses and fallow-grain. *Soil Sci.*, **94**:151-157.

Russel, J.C., Kadry, L. and Hanna, A.B. (1964). Sodic soils in Iraq. Budapest Symposium on Sodic Soils.

Schilstra, J. (1962). Irrigation as a soil relief-forming factor in the Lower Mesopotamian Plain. *Netherland J. agric. Sci.*, **10**:179-193.

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EFFECTS OF WATERING FREQUENCY ON SURVIVAL AND HEIGHT GROWTH OF SHADED FOREST TREE SEEDLINGS

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(Revised MS. received 17 May 1972)

SUMMARY

Due to increased rate of forest tree planting in Iraq and since watering of seedlings while still in the nursery plays a key role in the production of sound and vigorous seedlings an experiment was designed to determine the optimum length of watering frequency for each of the species used.

From the analysis of data, it is evident that height gain of *Euclayptus* seedlings was highly significant when watering was at 1-day interval in comparison with longer intervals used. *Acacia* and *Gleditsia* seedlings also showed significance in height gain for 1-day watering interval. While *Catalpa* and *Cupressus* seedlings survived at 1-day interval only, survival rate of *Pinus* seedlings declined as watering interval was shortened.

الخلاصة

نظرا لزيادة فعاليات تشجير الغابات في العراق ولان فترات ري الشتلات أثناء تربيتها في المشاتل تقرر لحد بعيد مدى قوة ونشاط الشتلات النامية فقد صممت هذه التجربة للتوصل الى معرفة فترات الري المثالية لكل نوع من الشتلات المستعملة .

ولقد دلت احصائيات النتائج بأن هناك فرقا مهما جدا في مقدار النمو الطولي لشتلات اليوكالبتوس لفترة الري اليومية بالمقارنة مع الفترات الاخرى الاطول .

كما ان كلا من اكاسيا وكلاديشيا أظهرتا فرقا مهما في النمو الطولي لصالح فترة الري اليومية • وفي الوقت الذي لم تعش شتلات الكتالبا والسرو سوى على فترة الري اليومية يلاحظ ان احتمالات بقاء شتلات الصنوبر حية تتضاءل كلما قصرت فترات الري •

INTRODUCTION

Planting success depends largely on the quality of planting stock. Consequently, nursery practices play a key role in rendering such a success possible. One of the most important operations in forest nurseries is that of supplying water to seedlings. Seedlings differ in their demand to water according to species. What seems to be the optimum level of water to some species could not provide adequate growth to others and it may be in excess and detrimental to certain other species. It is, therefore, necessary to know the amount of water each species requires for good growth at seedling stage in a specified length of time. Thus, nursery seedlings must be segregated as to species and each watered optimally. Otherwise, great mortality rate will result and much loss to the nursery owner will be inevitable. The present study was designed to clarify the role of watering and its frequency on survival and rate of height growth of seedlings of the more commonly used tree species in the Iraqi forest planting projects.

MATERIALS AND METHODS

Seedlings of *Acacia cyanophylla*, *Casuarina equisetifolia*, *Eucalyptus camaldulensis*, *Gleditsia triacanthos*, *Pinus brutia*, *Catalpa speciosa and Cupressus sempervirens* used in this experiment were grown in the green house of the College of Agriculture, Baghdad University at Abu-Ghraib. Four watering intervals with five replications were dealt with for each of the species in a randomized block design. In total, there were twenty seedlings involved for each of the species tested.

On 8 April 1971, seedlings were obtained and planted in black polyethylene bags (height 20 cm and diameter 8 cm) filled four-fifths of their height with a mixture of sand and river sediment in a ratio of

2:1 respectively. The lower one-third of the bags had twelve holes to drain excessive water. Bags were watered one day prior to planting and a hole was made later at the center of each to accomodate the roots. On the planting day, seedlings were distributed to treatments and replications and watered thoroughly. Their initial heights were measured and recorded (Table 1). Following planting day, seedlings were 250 cc. of water each at 1,2,3,7-day interval. Throughout the experiment, seedlings were kept in the fortest nursery shade at Ameriyah Experimental Farm providing shade of 66%. On 25 October 1971, a tally of survival and height growth was made and recorded (Table 1).

RESULTS AND DISCUSSION

Net gain in height of seedlings for the four watering intervals used in this experimant is shown in Table 1. Seedlings of *Acacia cyanophylla*, *Casuarina equisetifolia*, *Gleditsia triacanthos* and *Eucalyptus camaldulensis* had wide range of adaptability to soil moisture levels under shade conditions. There seemed to be differences in net height gain in favor of one-day interval for the first three mentioned species. This was evident from the least significant difference test at $t = 0.05$ conducted on the treatments means (Table 2). As for the seedlings of *Eucalyptus camaldulensis*, on the other hand, the analysis of variance showed highly significant differences in net height gain between watering intervals and that one-day interval was highly superior in that respect. *Catalpa* and *Cupressus* seedlings seemed to survive only at daily watering interval. Survival rate of *Pinus* seedlings tended to decline as watering interval was shortened.

While the above results may be taken as a trend, further trials are needed for the determination of optimum amount of water to be applied and the length of watering frequency to be followed for each species when seedlings are grown in direct sun light.

Appreciation is extended to Mr. Muammar Ahmad. Assistant specialist in charge of the forest nursery and planting at the College of Agriculture, Abu-Ghraib, for his kind help in providing seedlings and planting material used in this experiment.

TABLE 1. Initial heights and net height gain of seedlings for replications and watering frequencies of 1, 2, 3 and 7-days.

Species	Average Initial Height (Cm)	Replicates	Watering Interval in Days 1	2	3	7	Remarks
			Net Gain in Height (Cm)				
Acacia cyanophylla	4	1	103	68	47	68	L.S.D. = 27.95
		2	126	66	58	83	
		3	86	49	62	37	
		4	61	96	55	108	
		5	91	52	56	63	
		Total	467	331	278	359	
		Mean	93.4	66.2	55.6	71.8	
Casuarina equisetifolia	10	1	67	27	20	35	L.S.D. = 17.04
		2	20	53	25	33	
		3	47	48	34	46	
		4	20	50	24	17	
		5	30	30	21	17	
		Total	184	190	124	148	
		Mean	36.8	38.0	24.8	29.6	
Eucalyptus camaldulensis	10	1	50	67	56	62	L.S.D. = 19.70
		2	127	60	80	43	
		3	100	42	56	33	
		4	68	50	49	44	
		5	90	55	69	45	
		Total	435	274	310	227	
		Mean	78.0	54.8	62.0	45.4	

TABLE 1. Continued.

Species	Average Initial Height (Cm)	Replicates	Watering Interval in Days 1	2	3	7	Remarks
			Net Gain in Height (Cm)				
Gleditsia triacanthos	11	1	13	0	16	23	L.S.D. = 22.41
		2	25	25	17	5	
		3	65	53	13	0	
		4	36	33	14	5	
		5	47	0	19	18	
		Total	186	111	79	51	
		Mean	37.2	22.2	15.8	10.2	
Pinus brutia	6	1	7	6	3	1	
		2	0	3	4	1	
		3	0	4	5	4	
		4	0	0	4	5	
		5	0	0	0	0	
Catalpa speciosa	10	1	22	0	0	0	
		2	20	0	0	0	
		3	41	0	0	0	
		4	5	0	0	0	
		5	0	0	0	0	
Cupressus sempervirens	3	1	5	0	0	0	
		2	4	0	0	0	
		3	3	0	0	0	
		4	2	0	0	0	
		5	2	0	0	0	

TABLE 2. Summary of the analysis of variance and the least significant difference between watering intervals means.

Species	D.F.	F	L.S.D.
Acacia cyanophylla	3.12	2.56	22.41
Casuarina equisetifolia	3.12	7.78**	19.70
Eucalyptus camaldulensis	2.12	1.26	17.04
Gleditsia triacanthos	3.12	3.08	27.95

** P ′0.01.

REFERENCES

FAO. (1963). *Tree Planting Practices for Arid Zones.* FAO Forestry Development paper No. 16. Rome.

Stoeckler, J.H. and Jones, G.W. (1957). *Forest nursery practice in the lake States.* Agriculture Handbook No. 16. Washington, D.C., U.S.A.: U.S. Forest Service.

Toma, A.K., (1969). Some observations on the tolerence to drought of some evergreen tree species at establishment stage. *Tropischen und subtropischen landwirtschaft and tropenveterinarmedizin.* 7. Jahrgang. Heft. 3. Karl-Marx University, Leipzig.

Iraqi J. agric. Sci., Vol. VII, 1972

EFFECT OF NUMBER OF WEEDING ON YIELD AND YIELD COMPONENTS OF FLAX (*LINUM USITATISSIMUM* L.) VARIETIES

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(Received 18 December 1971)

Three flax-seed varieties Moroccan 10 (local), Moroccan 50 and Indian 68 adapted to the middle irrigated region of Iraq were planted in a split plot design by using different numbers of weeding at monthly intervals.

The flax varieties varied significantly in components of yield only. Number of weeding affected seed yield, number of capsules per plant, number of seeds per capsule and oil percentage significantly. The number of weeding resulted in an increase in seed yield, number of capsules per plant, number of seeds per capsule of each flax variety and an increase in oil percentage of Moroccan 50 and Indian 68.

Seed yield and number of capsules per plant of the flax varieties responded differently in different years. Seed yield, number of capsules per plant, and number of seeds per capsule resulted from different numbers of weeding varied significantly according to years.

The scientific and common English names of the weeds found in the plots that were not weeded according to their distribution were also reported.

It is recommended to use three weedings at monthly intervals for each flax variety because it increases yield as well as some other traits.

الخلاصة

زرعت ثلاثة أصناف من كتان البذور هي مراكش ١٠ (محلي) ، مراكش ٥٠ ، وهندي ٦٨ الملائمة للمنطقة الاروانية الوسطى في العراق بتطبيق تصميم الالواح المنشقة واستعمال ثلاثة مواعيد للتعشيب على فترات شهرية ٠

اختلفت أصناف الكتان احصائيا في مكونات الحاصل فقط ٠ أعطت مرات التعشيب تأثير معنوي على حاصل البذور ، عدد الثمار (العلب) للنبات ، عدد البذور للثمرة (العلبة) ونسبة الزيت المئوية ٠

انتجت عدد مرات التعشيب زيادة في حاصل البذور ، عدد الثمار (العلب) للنبات ، عدد البذور للثمرة (العلبة) لكل صنف من أصناف الكتان وزياده في نسبة الزيت المئوية للكتان المراكشي ٥٠ وهندي ٦٨ ٠

تجارب حاصل البذور وعدد الثمار (العلب) للنبات لاصناف الكتان بصورة مختلفة في السنين المختلفة ٠ اختلف حاصل البذور ، عدد الثمار (العلب) للنبات وعدد البذور للثمرة (العلبة) الناتج من مرات تعشيب مختلفة معنويا حسب السنين ٠

ان الاسم العلمي والانكليزي للادغال التي وجدت في اللوح غير المعشب حسب توزيعها مذكورا أيضا ٠ يوصي باستعمال ثلاثة مرات تعشيب على فترات شهرية لكل صنف من أصناف الكتان لانه يزيد الحاصل وصفات اخرى ٠

INTRODUCTION

Flax (*Linum usitatissimum* L.) is the only winter oil crop planted in Iraq. More than 90 per cent of the crop planted by farmers is in the middle irrigated region. Weeds are one of the major problems in flax fields. Most of the Iraqi farmers do not cultivate flax weeds and only few use hand implements.

There are no data on the interval effect of hand weeding on yield, yield components and oil percentage of flax-seed varieties. In this study an attempt was made to collect such data on two promising flax-seed varieties, Moroccan 50 and Indian 68, which are adapted to the middle irrigated region of Iraq in comparison to the local variety Moroccan 10. Similarly, data on losses in flax seed yield under irrigation due to weed

competition is not available. Whereas, Alessi and Power (1970) had stated that weed growth under dryland in Mandan, N.D., U.S.A. may reduce flax seed yield from 26 to 53 per cent. Friesen and Shebeski (1960) in Manitoba, Canada reported that losses due to weeds were lower for flax than for grain, but Bell and Nalewaji (1967) showed yield reduction was higher for flax.

MATERIALS AND METHODS

The experiment was carried out in a clay loam soil using the split plot design with four replications in 1968-1969, 1969-1970 and 1970-1971 at the Abu-Ghraib Experiment Station, College of Agriculture, University of Baghdad, which represents the middle irrigated region of Iraq. The flax seed varieties Moroccan 10 (local), Moroccan 50 and Indian 68 were used as main plots, while the weeding treatments with hand tools, one weeding after one month from planting, two and three weedings at monthly intervals, and no weeding were used as sub plots. The rate of seeding was 30 kg/ha and the date of seeding was during the first week of November of each year. The trials had been conducted in the same field in different years and each replicate or block occupied the same area in the three years.

Each sub treatment was planted in 2×6 m plot, using six rows 5 m long and 30 cm apart. The plots were irrigated three times during the vegetation period and 2-3 times during the heading and maturation periods. The seed yield was harvested from the central rows during the second week of May each year. The components of yield (number of capsules per plant, number of seeds per capsule and 1,000 seed weight in grams) were studied from a 30 cm distance of any two central rows randomly. The oil percentage was calculated, using the Thimble Goldfisch Fat Extractor. The seed yield, components of yield and oil percentage were analysed statistically.

RESULTS AND DISCUSSION

The scientific and common English names of the weeds which were found annually in the no weeding treatment in each flax seed variety according to their distribution were as follows (Hassawy *et ad.* 1968):

Scientific Name	English Names
Avena fatua L.	Wild oats, Oat grass.
Lolium rigidum Gaud.	Rigid ryegrass.
Lolium temulentum L.	Darnel, Tares; Annual darnel.
Phalaris minor Retz.	Lesser canary grass; Mediterranean canary grass.
Silybum marianum (L.) Gaertin.	Milk thistle; St. Mary's Holy thistle; Lady's thistle.
Beta vulgaris L.	Wild beets.
Centurea pallesens Del.	Pale centaury; Pale star thistle.
Convolvulus arvensis L.	Field bind weed; Small bind weed; European bind weed.
Melilotus indicus (L.) All.	Indian melilot; Sweet clover.
Lathyrus annus L.	Two flowered vechling.
Plantago lanceolata L.	Buckhorn Plantain; Narrow-leaved Plantain; Ribgrass; Ribwort Plantain.
Cardaria draba (L.) Desv.	Hoary cress; White top, white weed; Perennial peper grass.
Medicago hispida Caertin.	Tooth medic; Bur clover.
Daucus carota L.	Wild carrot; Bird's nest.
Hordeum marinum L.	Wild barley; Ball barley.
Malva parviflora L.	Small flowered mallow; Cheese weed; Cheeses.
Malva rotundifolia L.	Dwarf mallow, Low mallow, Running mallow, Button weed.

The flax-seed varieties varied significantly in yield components, but did not vary in seed yield and oil percentage (Table 1). Indian 68, Moroccan 50 and Moroccan 10 produced significantly highest number of capsules per plant, number of seeds per capsule and 1,000 seed weight, respectively.

Weeding at monthly intervals, resulted in significant differences in seed yield, number of capsules per plant, number of seeds per capsule and oil percentage (Table 1). Three weedings at monthly intervals gave significantly the highest seed yield, oil percentage and number of capsules per plant. But both two and three weedings at monthly intervals gave significantly the highest number of seeds per capsule.

Thus three weedings at monthly intervals starting from planting is recommended to be used, because they gave 127, 1.40, 151 and 26% increase in seed yield, oil percentage, number of capsules per plant and number of seeds per capsule in comparison to non weeding, respectively.

The variety × number of weeding showed non significant differences for any trait studied (Table 2). However, there was an obvious increase in seed yield, number of capsules per plant and number of seeds per capsule by increasing the number of weeding, where the three weedings applied to Moroccan 10, Moroccan 50 and Indian 68 produced 165, 134, 95% increase is seed yield, 161, 162, 137% increase in number of capsules per plant and 40, 22, 19% increase in number of seeds per capsule in comparison to non weeding respectively. Also, both Moroccan 50 and Indian 68 produced the highest oil percentage by using three weedings.

The results obtained showed clearly that the use of three weedings at monthly intervals for each flax variety would lead to the highest seed yield, number of capsules per plant, number of seeds per capsule and oil percentage of Moroccan 50 and Indian 68. The 1,000 seed weight of each flax variety and the oil percentage of Moroccan 10 was not affected by number of weeding.

Table 1. Seed yield, yield components, and oil percentage of 3 flax seed varieties and 4 weeding treatment (average 1969, 1970 and 1971).

Plant characteristic	FLAX VARIATIES					WEEDING TREATMENT					
	Moroccan 10	Moroccan 50	Indian 68	L S D 5%	at 1%	No weeding	One weeding	Two weedings	Three weedings	L S D 5%	at 1%
Seed yield (Kg/ha)	520.00	572.00	577.00	N.S.		339.00	437.00	679.00	770.00**	190.02	257.81
No. of capsules per plant	3.35	3.47	4.52	1.02	1.39	2.19	2.86	4.57	5.50**	1.61	2.14
No. of seeds per capsule	6.30	7.06*	6.38	0.76	1.03	5.73	6.22	7.14**	7.24**	0.72	0.96
1,000 seed weight (g)	8.86*	8.16	8.22	0.53	0.72	8.41	8.55	3.37	8.33	N.S.	
Oil percentage	41.50	42.03	42.39	N. S.		41.39	41.47	42.24	42.79*	139.00	1.85

N.S. No significant difference.

* significant at 0.05 level.

** significant at 0.01 level.

TABLE 2. Seed yield, components of yield and oil percentage of 3 flax seed varieties treated with 4 weeding treatments (average of 3 years 1969, 1970 and 1971).

Variety	*Weeding treatments*				
	No weeding	One weeding	Two weedings	Three weedings	LSD at 5% 1%
	Seed yield (kg/ha)				
Moroccan 10	267	405	701	708	N.S.
Moroccan 50	357	364	629	836	
Indian 68	393	442	706	767	
LSD at 5%	N.S.				
1%					
	No. of capsules per plant				
Moroccan 10	1.81	2.66	4.20	4.72	N.S.
Moroccan 50	1.96	2.78	4.03	5.13	
Indian 68	2.81	3.13	5.47	6.66	
LSD at 5%	N.S.				
1%					
	No. of Seeds per capsule				
Moroccan 10	5.30	5.17	7.30	7.42	N.S.
Moroccan 50	6.12	7.39	7.29	7.46	
Indian 68	5.76	6.09	6.82	6.85	
LSD at 5%	N.S.				
1%					
	1,000 *Seed Weight (g)*				
Moroccan 10	9.05	9.13	8.54	8.71	N.S.
Moroccan 50	7.97	8.24	8.36	8.07	
Indian 68	8.23	8.27	8.16	8.21	
LSD at 5%	N.S.				
1%					
	Oil Percentage				
Moroccan 10	41.24	40.87	42.73	41.15	N.S.
Moroccan 50	41.48	41.86	41.25	43.54	
Indian 68	41.45	41.69	42.73	43.69	
LSD at 5%	N.S.				
1%					

N.S. No significant difference.

TABLE 3. Mean square values for the yield and yield components of the various sources of variation in flax.

Source of variation	D.F.	Yield kg/ha	No. of bolls per plant	No. of seeds per plant	1,000 seed Weight (g)	Oil percentage
Year	2	11403493.50**	186.09**	14.98**	13.38**	19.21
Variety	2	47332.00	19.92*	6.89*	7.18*	19.67
Year × variety	4	506387.50**	13.03*	0.63	0.69	17.99
Error (a)	27	69239.41	4.49	1.08	0.57	9.04
Weeding	3	1468552.00**	82.64**	17.05**	0.33	16.08*
Year × weeding	6	481819.00**	14.42*	3.05*	0.48	9.05
Variety × weeding	6	26187.50	1.48	1.73	0.97	8.95
Year × variety × weeding	12	1620.67	3.43	0.58	0.27	5.58
Error (b)	81	53543.49	3.94	0.79	1.81	4.79

** Significant at 0.01 level.

* Significant at 0.05 level.

Table 3 showed that seed yield and components of yield had responded differently in different years but oil percentage was consistent. Seed yield and number of capsules per plant of the flax varieties varied significantly according to years, but number of seed per capsule, 1,000 seed weight and oil percentage did not vary significantly each year. Seed yield, number of capsules per plant and number of seeds per capsule resulted from using different number of weeding responded differently in different years, but 1,000 seed weight and oil percentage responded similarly each year.

REFERENCES

Allessi, J. and Power, F.J. (1970). Influence of row spacing, irrigation and weeds on dryland flax yield quality, and water use. *Agron. J.*, **62**: 635-637.

Bell, A.R. and Nalewaji, J.D. (1967). Wild oats cost more to keep than to control. *North Dakota Farm Res.*, **25**: 7-9.

Friesen, G. and Shebeski, L.H. (1960). Economic losses caused by weed competition in Manitoba grain fields. I. Weed species, their relative abundance and their effect on crop yields. *Canad. J. of plant Sci.*, **40**: 457-67.

Hassawy, G.S., Tammimmi, S.A. and Al-Izzi, H. (1968). Weeds in Iraq. *Tech. Bul. No.* 167, Ministry of Agriculture, Baghdad, Iraq.

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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