FINAL REPORT The Joint Study Project on Improvement of Arid Land Agriculture in the United Arab Emirates September, 1985—March, 1989

Faculty of Agricultural Sciences/U.A.E. University

The Japan International Cooperation Agency

March, 1989

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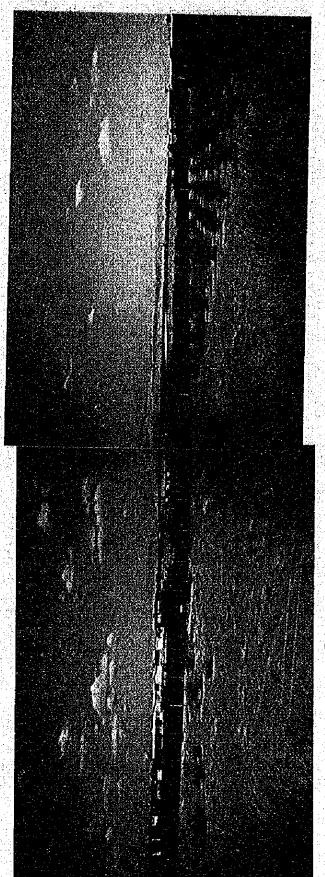
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I. INTRODUCTION

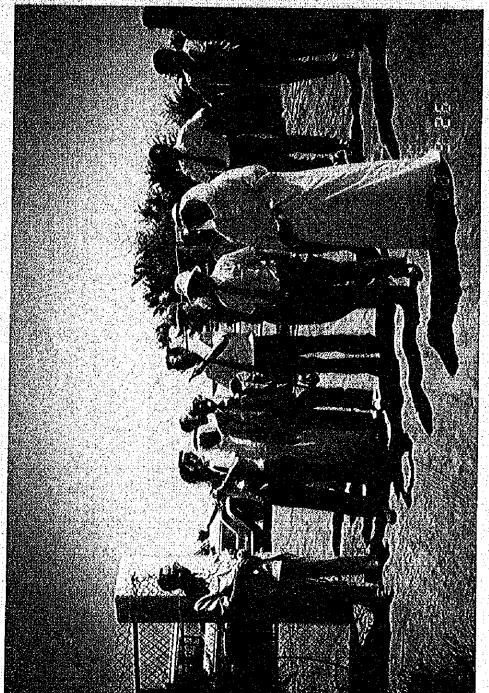
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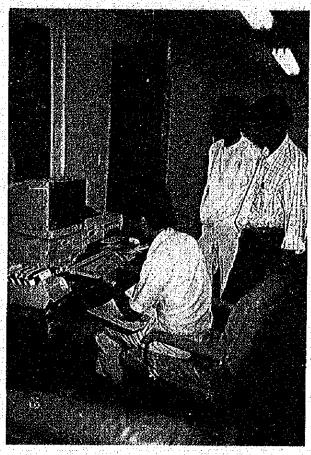
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Recent aspect of the Agricultural Research and Education Center (AREC), Faculty of Agricultural Sciences, UAE Nniversity



Mr. Katakura, the Japanese Ambassador, and Prof. Kobori visiting the AREC to observe the joint study



Japanese researchers in the computer room of the ARB

I. INTRODUCTION Massacratic and the state of the state of

It is said that approximately one third of land in the world is occupied by the desertic arid area. The high temperature, drought, scarce rainfall, strong wind, drifting sand, movement of sand dune, and high salinity of the soil, of which peculiarities are common to almost all arid lands, are obstructing the agricultural production. It is essential to improve and develop the agriculture in arid lands by overcoming the aforesaid meteorological and environmental conditions through the research. Especially the greening of the arid lands in countries holding the proper areas is a very important national themse which exerts an influence upon the advance in future of countries concerned.

On the basis of the agreement signed between the United Arab Emirates (UAE) University and the Japan International Cooperation Agency (JICA), the Joint Study Project on the improvement of arid land agriculture in UAE was implemented from September 1985 to March 1989 by both Faculties of Agriculture, UAE and Shizuoka Universities. The results obtained during the first and the second years were already reported in the Annual Reports of the Joint Study Project (1/2) by JICA.

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This final report mainly describes abstracts of experimental results, which include also those obtained during the third and the fourth years, conducted by the Project teams of both Universities.

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REFERENCES

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- The Japan International Cooperation Agency, 1987: The Annual Report of the Joint Study Project on Improvement of Arid land Agriculture in United Arab Emirates (September, 1985-August, 1986), pp.1-96
- The Japan International Cooperation Agency, 1988: The Annual Report of the Joint Study Project on Improvement of Arid Land Agriculture in United Arab Emirates (September, 1986-August, 1987), pp.1-232

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II. RESEARCH CONDUCTED

1. Theme A: STUDIES ON SAND DUNE FIXATION BY METHOD OF REVEGETATION WORK WITH CIVIL ENGINEERING

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Introduction

ઉપલંતુ મહુરા મિંહનું મહિલા હતા. કહેવા મહુરા મહિલા દેવા મોલા કોલા છે. તેમાં મોલા વધુ કરો માં મોલા કોલા કેટલા મે

Natural features in semi arid land are mainly little rainfall and high temperature. These two features correlate each other and cause a lot of phenomena. Typical phenomena are aridity, promotion of physical weathering and salt accumulation. Aridity is the result of unbalance of water economy, lots of sand produced by physical weathering become a source of sand dunes and salinity in the soil is accumulated on to the surface without being leached.

As a result, these phenomena cause much difficulties for people's activities. For example, many parts are often buried by sand along the road side where is no vegetation and many farms are always faced with dangers of burying by sand dunes, especially in Liwa Oasis.

The Government are making effort to overcome these difficulties, lots of places along the road side have been already afforestated, above all, it is very successful in Abu Dhabi and Al Ain road. Furthermore, afforestation works on the natural sand dunes are being tried to fix the movement of dunes in Slimat area in Al Ain.

When we foresee the certain future of the country, lands where should be protected by revegetation works will expand more and more. Therefore the establishment of more safety, certain, rapid and suitable afforestation technique in each land conditions will be necessary and required.

Sub-Theme of the Study

We set up the following sub-theme to establish proper and adaptable afforestation technique in The United Arab Emirates.

- (1) Observation of Natural Sand Done Movement
- (2) Model Experiment of Sand Dune Fixation
- (3) Effects of Dates-Fronds-Mat Pence on Brosion Control, Microclimate and Tree Growth
- (4) Effects of Mulching and Water Holding Materials on Tree Growth

(1) OBSERVATION OF NATURAL SAND DUNB MOVEMENT

A typical natural sand dune was selected to observe the dune movement in the neighboring area to the Agricultural Research and Education Center (AREC) of The UAE University. The size of the dune was 190 meters in length and 4 meters in height.

Short term topographic change and amount of shifting sand were measured every 10 days from December 1986 to October 1987. Long term topographic change was measured once a year, those were December 1986, December 1987 and March 1989:

Results: Results of long term observation are shown in Fig. 1. Movement of the top of dune was recognized on NO. 1, NO. 2, NO. 7 and NO. 8 measuring lines. Their moving distances were approximately 3 to 6 meters from south to north. Their height of the top of dune showed a tendency to become lower. There was little movement in NO. 3, NO. 4 and NO. 6 lines. Although the top of dune in NO. 5 line did not move in the first year, it moved approximately 3 meters from north to south in the second year. Inclination of the slope of the dune was gentle in its windward side and steep in its leeward side in general.

Results of short term observation are shown in Table 1 and Fig. 2. Topographic change was recognized in all lines and points. The amount of topographic change showed maximum on the top and on the next point to the leeward side. The amount reduced as the distance went away from the top of dune. As a result, the figure showed nearly the normal distribution which was biassed a little to the leeward side. The actual topographic change was shown in Fig. 3.

The amount of captured sand in each site and point on the natural sand dune and the accumulative wind distance are shown in Table 2. Total amount of captured sand during the observation period was respectively 74552.5 g/100sqcm., 7452.7 g/100sqcm.1.3 g/100sqcm. at 20 cm, 50 cm, 150 cm high from the ground on the top of dune. The amount of sand captured on the top of dune was 82006,5 g/sqcm. Its value showed approximately seven times more than those of north foot of dune. Monthly maximum amount of captured sand was 28932.7 g/100sqcm. in April at 20 cm high from the ground on the top of dune. The rate was approximately 39% of the total. Southerly wind distance prevailed through the observation period.

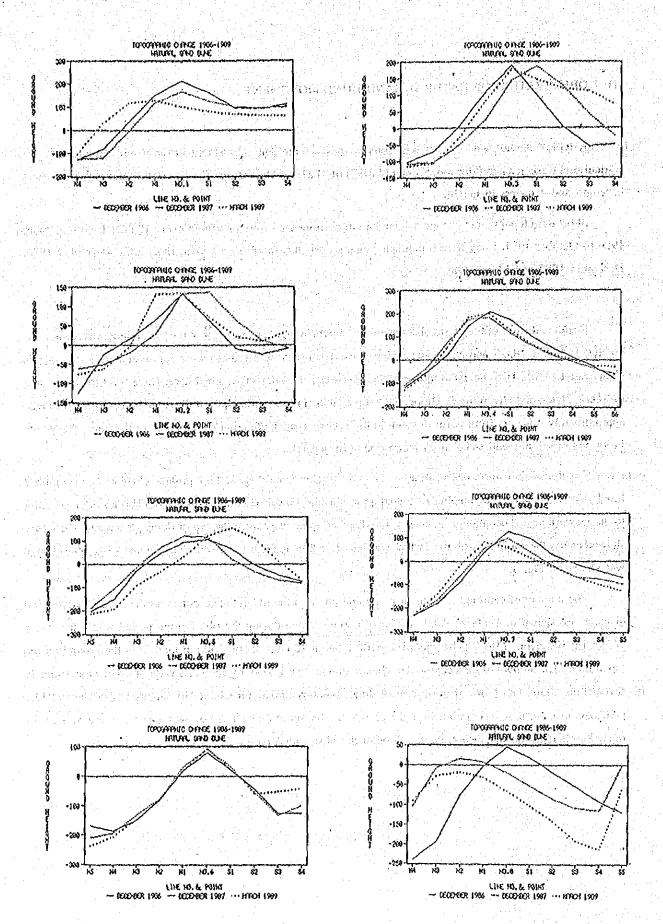


Fig. 1 Topographic change of the natural sand dune by the long term observation

Table 1 Accumulative length of the topographic change on the natural sand dune (Dec. 1986-Oct. 1987)

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DIRECTION MEASUREMENT		TH SIDE Novaro)	TOP OF DUNE	NORTH SLOE (LEEWARD)	
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NO.3	38.8 53	1.158 8,181 8.	393.6	287.1 117.0 83.2	31.1
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# NO.6		.9 58,6 257 9	359.5	258.3 319.3 157.1	114.2
NO.8		4 190 0 247.4	391.9	400.8 131.9 73.1	59.1
NO.8	1 2 1 1 1 1 1 1	8 129 1 318.1	295.4	464.3 130.0 29.1	48.0
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Accumulative length(cm) = ABS(A) + ABS(E): ABS(A) = Accumulative length of accumulation : ABS(E) = Accumulative length of erosion

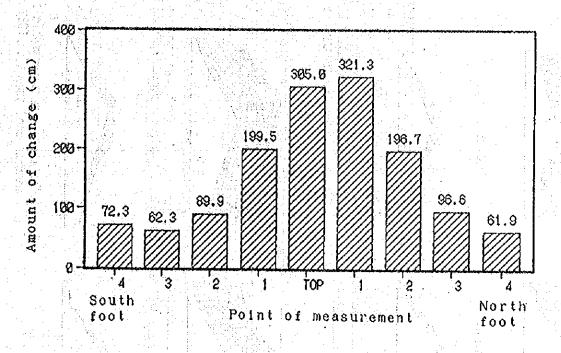


Fig. 2 Topographic change of the natural sand dune (Dec. 1986 - Oct. 1987)

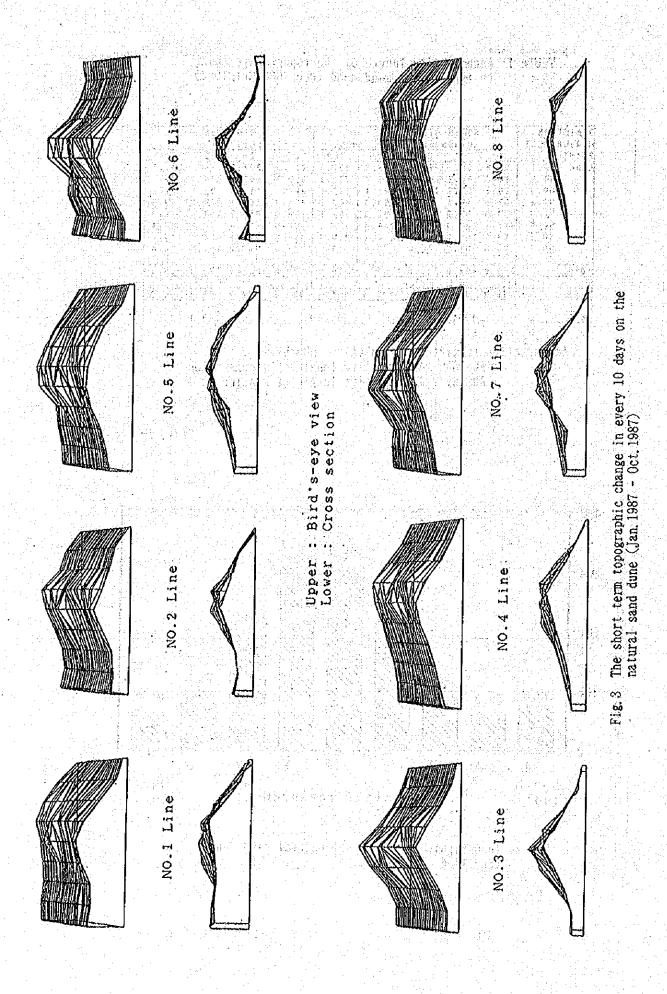


Table 2 Monthly amount of captured sand in each site and point on the natural sand dune and the accumulative wind distance (January 1987 - December 1987)

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(2) MODEL EXPERIMENT OF SAND DUNE PIXATION

An artificial sand dune was constructed in ARBC in order to establish the technique of sand dune fixation. The dune was 180 meters in length and 4 meters in height. It was nearly the same size of natural sand dunes around there.

This experiment consists of three stages as follows,

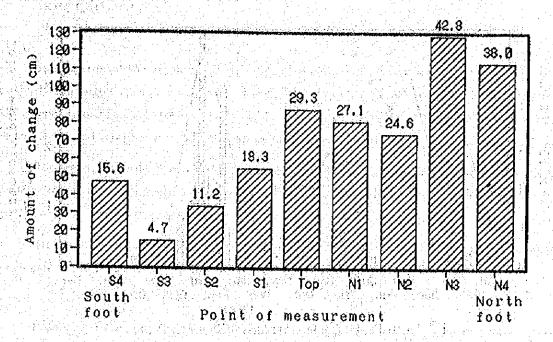
First stage: The construction of artificial sand dune was completed in September 1986 and a bamboo fence was set up on the top of dune in October 1986. It was because the stabilization of the top of dune was the most important factor to fix sand dune.

Second stage: The bamboo fence on the top of the dune was removed in October 1987 because of the damages by heavy sand storm (approximate maximum wind speed was 40 m/s).

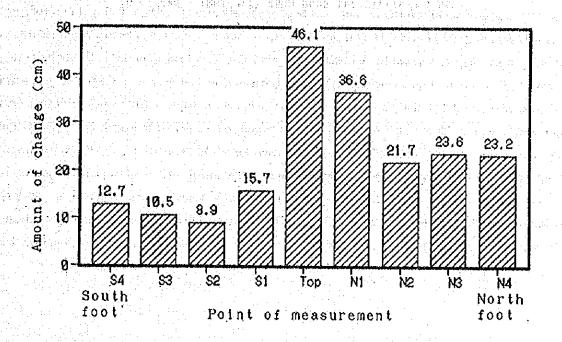
Third stage: Whole area of the dune was covered with synthetic resin emulsion to control wind erosion and revegetated with five local species to keep the lasting stabilization of the dune.

Short term topographic change was measured every 10 days in each stages. Long term topographic change was measured once a year, those were December 1986, December 1987 and March 1989. Shifting sand was collected and weighed every 10 days in each stages. Wind speed and the growth of revegetated species were observed in the third stage.

Results: Short term topographic change of the first and the second stage are shown in Fig. 4 and Fig. 5. The amount of topographic change at the top of dune was not always less than those of other points and the changes of north foot points were greater than those of others because of much accumulations in the first stage. In the second stage, the amount of topographic change was the greatest at the top of dune. It was considered that the reason why the bamboo fence was removed from the top of dune. We also studied on the amount of shifting sand and the wind distance as shown in Fig. 6. In spite of the longer wind distance, the amount of shifting sand was not so great in the first stage. On the contrary, the amount of shifting sand changed in proportion to the wind distance, especially at the top of dune, in the second stage,



Pig. 4 Topographic change of the artificial sand dune with bamboo fence (Dec. 1986 - Jun. 1987)



Pig. 5 Topographic change of the artificial sand dune without bamboo fence (Oct. 1987 - Mar. 1988)

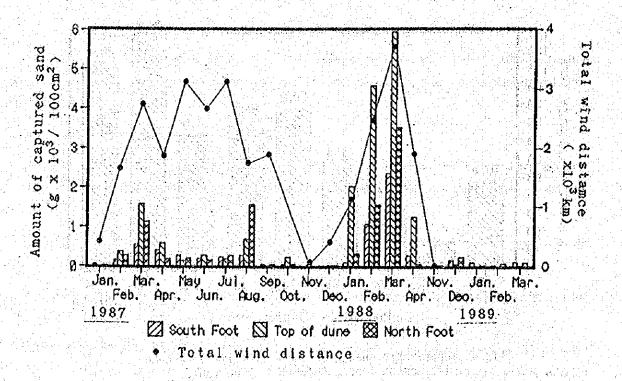


Fig. 6 Total wind distance and the amount of captured sand on the artificial sand dune (Jan. 1987 - Mar. 1989)

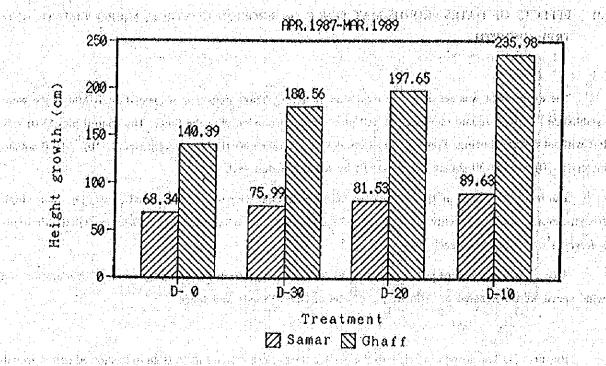
(3) EFFECTS OF DATES-FRONDS-MAT FENCE ON EROSION CONTROL, MICROCLIMATE AND TREE GROWTH

The experiment was set up at the west side of AREC. Three densities of Dates-Fronds-Mat fence were established in 60x60 square meters plots. All plots were surrounded with the fence. The control plot(D-0) was left without further fencing. Treated plots were devided further into 10x10 square meters(D-10), 20x20 square meters(D-20) and 30x30 square meters(D-30) by fencing within each plot.

The fence was made of Dates (*Phoenix*, spp)-Fronds-Mat with woody stakes and bars at one meter high from the ground surface. Seventy two scedlings of one year-old of each Samar (*Acacia tortilis*) and Ghaff (*Prosopis spicigera*) were planted in each plot.

Tree growth, amount of shifting sand at 20 centimeter high from the ground, amount of evaporation and wind speed were measured to estimate the effects of Dates-Fronds-Mat fence.

Results: (1) The growth in height of the planted trees are shown in Fig. 7. Both trees showed better growth in D-10, D-20, D-30 and D-0 plot in order. Especially the growth of Ghaff tree was approximately 1.7 times in D-10, 1.4 times in D-20 and 1.3 times in D-30 better than that of D-0 plot. The growth was significant among each plots in Ghaff tree according to the test for equality between two means. The change of the height growth was shown in Fig. 8. The height growth was more rapid from June to October in the first year and from March to October in the second year. On the contrary, it was very slow from October to March. But the change of height growth was not so clear in Samar tree. (2) Covering ratio (The ratio of the sum of each crown occupation area in the plot) of Samar tree was always higher than that of Ghaff tree in every plots as shown in Fig. 9. Total covering ratio after two years of afforestation in each plot was 19.5% in D-0, 28.8% in D-30, 31.8% in D-20 and 37.9% in D-10 plot. The change of covering ratio showed nearly the same tendency to the change of height growth as shown in Fig. 10. (3) As the result of the measurement described above, following results can be considered. There was an effect of Dates-Fronds-Mat fence on tree growth. Higher density of the fence was more effective on their growth. Ghaff tree was superior to Samar tree in the upward growth, on the contrary, Samar tree was superior to Ghaff tree in the horizontal expansion. (4) There was an effect of Dates-Fronds-Mat fence on microclimate and erosion control as the same as height growth and covering ratio as shown in Fig. 11 and Fig. 12.



Rig. 7. The effect of the fence on height growth and the second

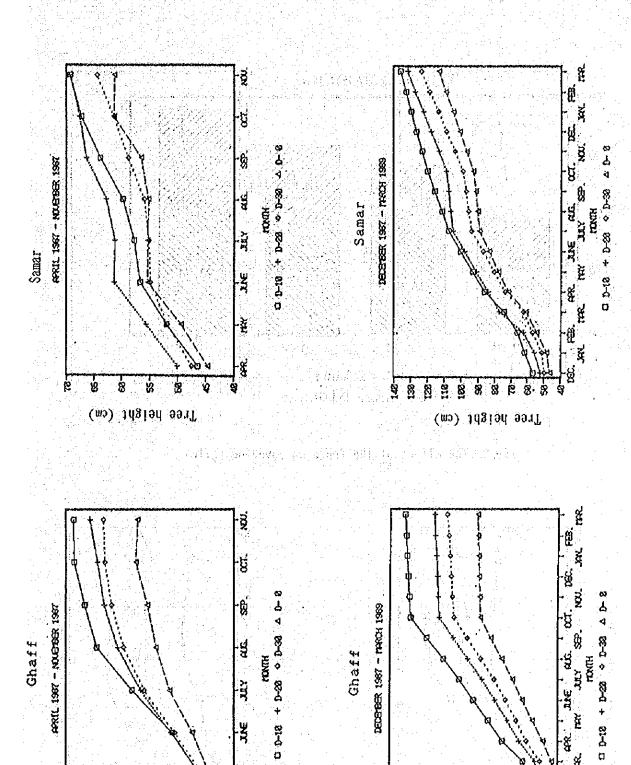


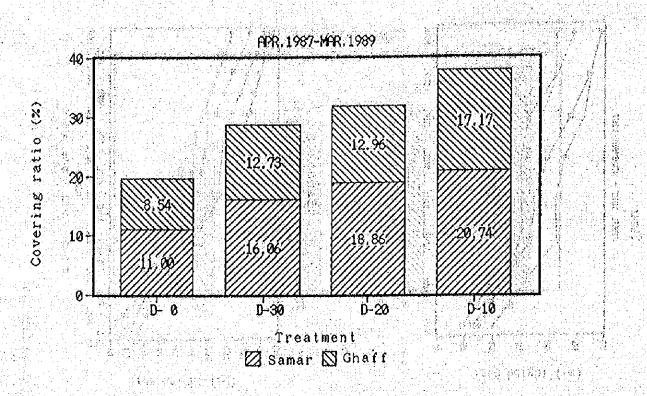
Fig. 8 The change of tree height in each plot

Tree helght (cm)

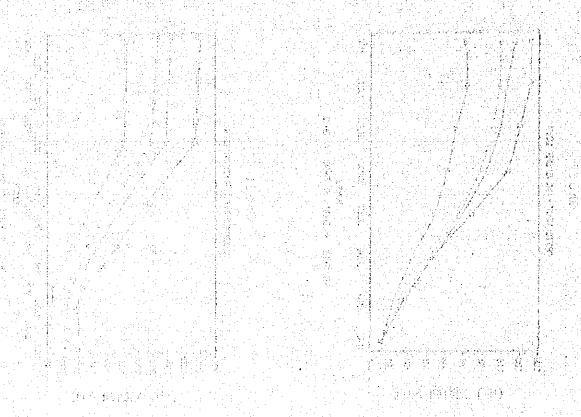
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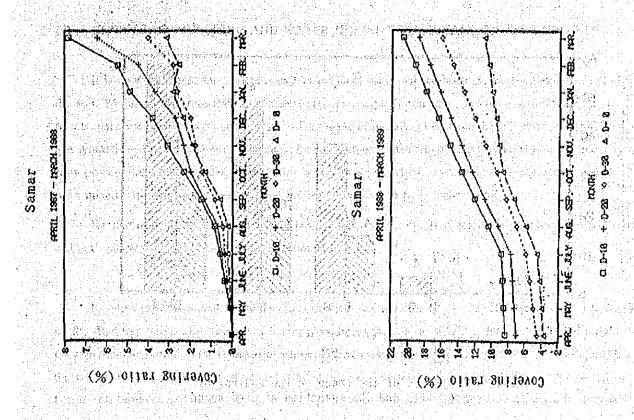
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Tree height (cm)



Pig. 9 The effect of the fence on covering ratio





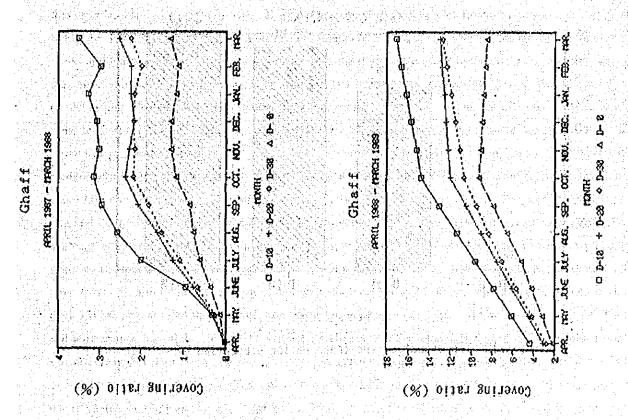


Fig. 10 The change of covering ratio in each plot

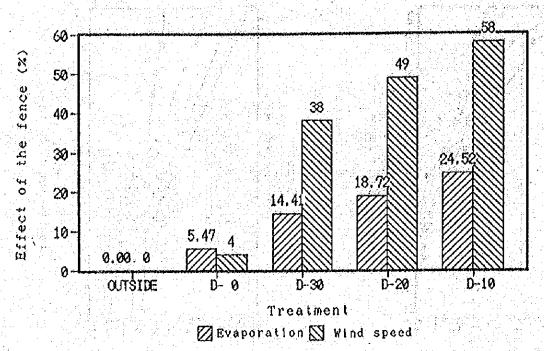
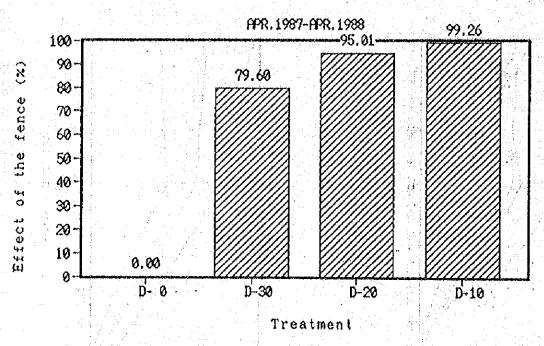


Fig. 11 The effects of the fence on the control of evaporation and the reduction of wind speed



Pig. 12 The effect of the fence on the prevention of shifting sand

(4) BEFECTS OF MULCHING AND WATER HOLDING MATERIALS ON TREE GROWTH

It is very important for planted trees that irrigated water will be lastingly kept without downward loss in the soil. We chose five materials to control water loss. Asphalt emulsion, synthetic resin emulsion and Datesfronds-mat were chosen as the materials which save the evaporation loss from the soil surface. Asphalt emulsion and synthetic resin emulsion were sprayed on the soil surface. Dates-fronds-mat was put around the trees. Synthetic resin powder and soft ceramics were chosen as the materials which save water loss into deeper ground. Those were mixed with sand and buried around the root zones when trees were planted.

Randomized block design with three replications was set up. Tree growth, consumption of soil moisture and soil temperature were measured and estimated,

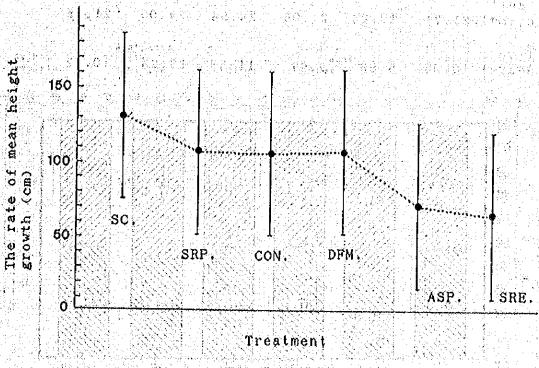
Results: (1) We studied firstly the effect of each treatment on tree growth as shown in Fig. 13. We picked up the final tree height, the amount of height growth and the rate of height growth to the initial height during the experimental period as the statistics to estimate the effect on free growth. There was little correlations between these statistics and the initial tree height. Normal analysis of variance was studied. The height growth was the best in soft ceramics and those of synthetic resin powder, control and Dates-fronds-mat plots were approximately the same. The height growth of asphalt emulsion and synthetic resin emulsion plots were lower than those of other plots, as the results of the estimation of population means. But there was no significance statistically between these statistics and tree height growth. (2) We studied next the effect of each treatment on soil moisture as shown in Fig. 14. The initial amount of soil moisture, the amount of water consumption and the rate of water consumption to the initial amount of soil moisture were chosen as the statistics to estimate the effect on soil moisture. Initial amount of soil moisture showed maximum value in Dates-fronds mat plot and minimum value in synthetic resin emulsion plot. Besides there was statistically significance between them. Amount of water consumption had a same tendency to the initial amount of soil moisture. The rate of water consumption showed maximum value in control plot and minimum value in synthetic resin emulsion plot. But the significance was not statistically recognized among each treatment. Mean initial amount of soil moisture of all treatments after two hours of irrigation was 22.03 mm and means amount of water consumption of all treatments after five days of irrigation was 9.81 mm and the mean rate of water consumption of all treatments after five days of irrigation was 44.3%. We also studies the pattern of water consumption in each depth from the soil surface as shown in Fig. 15. The rate of water consumption showed maximum in the 20-40 cm depth. Its means value was 40.1%. It was realized that three-fourth of initial amount of soil moisture were consumed in the 0-40 cm depth from the ground during five days. (3) We also studied the effect of each treatment on soil temperature as shown in Table 3 and 4. The mean soil temperature was higher in asphalt, synthetic resin emulsion, control and dates-fronds mat plot in order. It was always higher than those of other treatments in asphalt plot. But there was no significant difference between asphalt and control plot in the diurnal range. The temperature in synthetic resin emulsion plot was higher than that of control plot in summer, but its degree was lower than that of asphalt plot. There was no difference between

them in winter. The diurnal range was narrower than that of control plot in summer, but the difference between them was not recognized in winter. The diurnal tange was also no difference comparing with it of control plot in dates-fronds mat plot, but the diurnal tange had a tendency to be narrower than those of other treatments. Typical changes of soil temperature in 20 and 40 cm depth from the ground surface were shown in Fig. 16 and Fig. 17.

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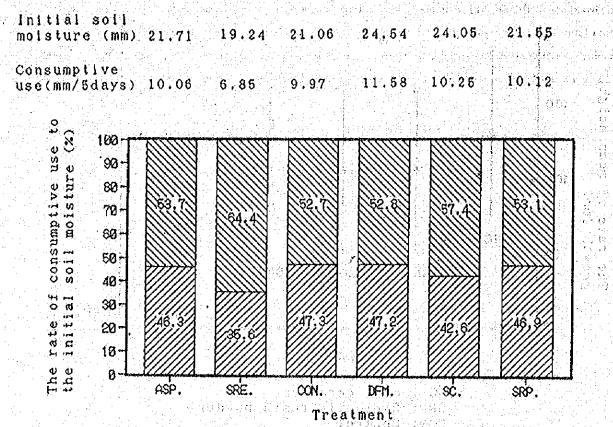
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SC: Soft ceramics
SRP: Synthetic resin powder
CON: Control
DFM: Dates-fronds mat

ASP: Asphalt emulsion SRE: Synthetic resin emulsion राष्ट्री है जिसे हैं कि मोहि । हो है जिसे कि जिस्का का हुई जि

Fig. 13 The rate of tree height growth in each treatment (April 1988 - March 1989)



The rate of consumptive use

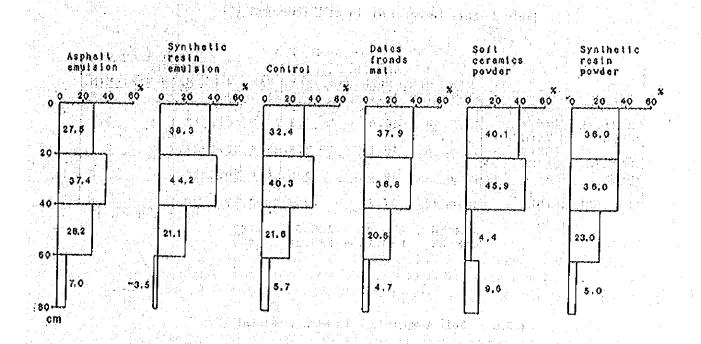
e lange of Filler 2. This is ASP : Asphalt plot

SRE: Synthetic resin emulsion plot

CON: Control plot

DFM: Dates-fronds mat plot SC: Soft ceramics plot SRP: Synthetic resin powder plot

Fig. 14 The rate of consumptive use to the initial soil moisture in five days



Horizontal axis : Rate of consumptive use (%)
Vertical axis : Depth from the soil surface (cm)
Value : Rate of consumptive use(%) in each soil layer

Fig. 15 Distribution of the rate of consumptive use in each soil layer

Table 3 Soil temperature in each treatment (1)

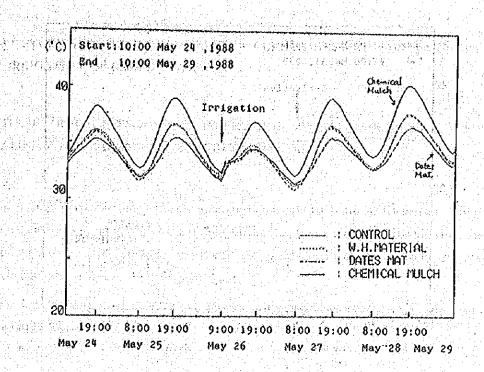
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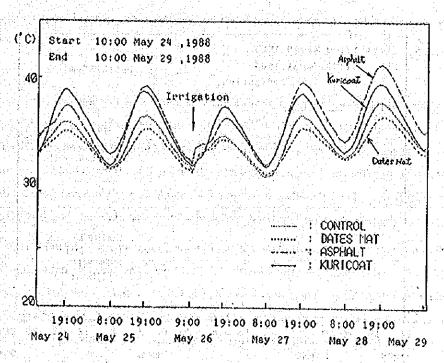
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Table 4 Soil temperature in each treatment (2)

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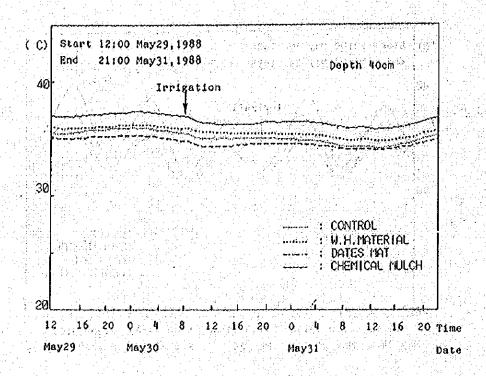
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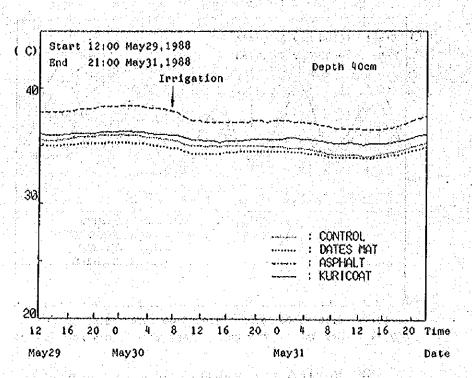




* KURICOAT: Synthetic resin emulsion

Fig. 16 The change of soil temperature (depth: 20cm) in each treatment





* KURICOAT : Synthetic resin emulsion

Fig. 17 The change of soil temperature (depth: 40cm) in each treatment

2. Theme B : STUDIES ON THE IMPROVEMENT OF CULTIVATION METHODS FOR CROP PRODUCTION UNDER IRRIGATION OF SALINE WATER

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(1) STUDIES ON THE EFFECT OF A SUBSURFACE COMPOST LAYER ON WATER PRESERVATION, SALINITY AND YIELDS OF CROPS IN SANDY SOIL.

The main problems limiting agricultural production in and lands are the unavailability of irrigation water and accumulation of salt on the soil surface. Soil salinity imposes a stress on growing crops and may lead to a low crop yield of a complete crop failure. Hence, saving irrigation water and reducing salt accumulation are of prime importance in arid or dry land agriculture.

The objectives of present studies are to investigate the effect of a subsurface compost layer on crop yields under conditions of UAB.

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(i) Effects of compost layer in subsurface soil on water preservation and yields of crops under sweet water irrigation

The experiment was laid out in a completely randmized design with three replications (20 m²/plot). The treatments were thick layer application in the subsurface soil (T), whole layer application (W), and without application of the bark compost (20 tons/ha). Thick and whole layers are forms of the compost applied. The compost layer in T-treatment was laid down the soil to a depth of 15 cm in form of sheets while the compost in W-treatment was mixed with the top layer of the soil. After the treatment of different levels of irrigation, the fresh weight of alfalfa (cv. Omanl) and the grain weight of wheat (cv. Mexipak) were respectively measured.

From results obtained, T-treatment increased the yields of alfalfa and wheat compared to those of the other two treatments under high and low irrigation levels for alfalfa and high irrigation level for wheat. Alfalfa tops in T-treatment absorbed higher amounts of N, P, K, Ca, Mg and Na than in the other treatments under both irrigation levels. Such increase in yields results from the remarkably high moisture retention in the subsurface compost layer which supplies crops with enough water and prevents water infiltration down the sandy soil (Fig. 1 and 2).

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मुक्तिके विद्वार हो। अस्ति के अनुवेद को इन्हरू पहुँ सामिक्ति है। अस्ति करा करा स्वरूप करा स्वरूप है।

क्लानेके के के मुंद्री के एक प्रकेश के के किया का मानेता है करता है किया और महिला का कार अवस्था का कर कर कर की

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(ii) Effects of two kinds of compost and their application method on water conservation and the yield of cabbage under sweet water irrigation

The main objective of this study is to determine the role of the compost layer and to compare the effects of the Al-Ain compost and the bark compost on the growth and yield of cabbage (Brassica oleracea, capitata group).

There was no significant difference in the average head weight between two kinds of compost. However, significant difference in average head diameter between two kinds of compost was observed. Significant difference in head weight, head diameter, and head hight were also observed between the control plot and compost applied plots in both compost treatments.

Regarding the soil analysis, the third layer (15-30cm from the soil surface) in T-treatment which was containing the compost layer showed the higher soil moisture content than the other layers. The second layer (1-15cm from the soil surface) in T-treatment also showed rather high moisture content than the equivalent layers in the other treatments. The EC value of the surface layer was higher than those of lower layers and was increased during the growing period.

According to results of the soil moisture measured by the tensionmeter, the pF value at 20cm depth in T-treatment generally showed lower value than those of W-treatment and control. It was considered that the thick layer of the compost was effective to retain the irrigated water in its upper soil layer.

The root system in T-trealment was well developed in the compost layer to form the carpet-like root mat. Such formation of active root mat was also considered as one of the reason for the better plant growth in T-treatment.

It was supposed that the main roles of the compost layer are to retain the irrigated water in the compost layer and also in its upper soil layer and to develop active root system in its layer (Table 1, Fig. 3 and 4).

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(iii) Effects of compost layer in subsurface soil on the yield of spinach irrigated with saline water

The main objective of this study is to investigate the effect of compost layer on the yield of spinach (Spinacia oleracea, Orient, Sakata) in relation to salinity hazard under saline water irrigation.

The estimated yields (ton/ha) were generally higher in low salinity plots than in high salinity plots. The comparative yield in high salinity against low salinity was highest in T-treatment. Similar trends were observed in the leaf length, the root length, and the dry weight of the plant.

There were significant differences in the fresh weight and the root length between low and high salinity levels. The fresh weight, the leaf length, and the root length in T-treatment were significantly higher than those

in the other two treatments (control and W-treatment).

The soil moisture in the third layer of T-treatment was higher than those of the other layers. The soil pH was generally higher in high salinity plots than in low salinity plots. The soil pH of the third layer in T-treatment was lower than the other two treatments. The BC value of saturation extract (BCe) in the surface layer was always higher than those in the other layers. The BCe of the surface layer increased at the 2nd sampling and decreased at the 3rd sampling. This was because of the heavy rain fall between these samplings. On the contrary, the BCe of 2nd and 3rd layers increased during the cultivation period. The 3rd layer of T-treatment showed extremely high BCe specially in high salinity plots. This would be explained that the salt accumulated in the surface layer was leached down to the lower layer with rain water and held by the compost layer in T-treatment.

The composition of cations in the irrigation water and in plant leaves were studied. Although concentration of divalent cations such as Ca and Mg in the high salinity water were 4-5 times more than those in the low salinity water, their contents in plant leaves were almost similar in both high and low salinity plots. In the irrigation water Na concentration was higher than those of Ca and Mg, but its content in plant leaves was lower than those of Ca and Mg. Na content in plant leaves was 2-3 times higher in high salinity plots than in low salinity plots. Also Na content in W-treatment was lower than those in control and T-treatment at both low and high salinity plots. As for potassium, in spite of very low concentration in the irrigation water, its content in plant leaves was higher than all the other cations. And K contents in plant leaves were higher in low salinity plots than those in high salinity plots. Consequently, K/Na and K/Ca+Mg balances were generally higher in low salinity plots than in high salinity plots and also they were higher in W-treatment than in the other treatments at both low and high salinity plots. According to the cation balance in plant leaves mentioned above, W-treatment may be more effective than T-treatment against the absorption of excess salt by the plant.

The function of the compost layer can be summarized as follows. The compost layer is effective to retain the irrigation water in its layer and in its upper soil layer. At the same time, the compost layer can hold some of the inorganic salts leached down from the upper layer. The compost layer was also effective to develop the longer root system than the other treatments. Consequently, although W-treatment seems more effective than T-treatment against the absorption of excess salt by the plant, the yield in T-treatment was higher than those in the other two treatments. Furthermore, the reduction rate of the yield due to salinity was lower in T-treatment than in the other two treatments. These results suggest that T-treatment would be useful not only for saving water but also for reducing salt hazard (Table 2, Fig. 5 and 6).

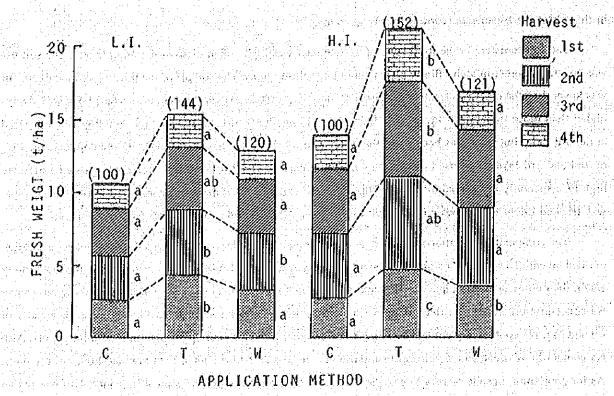


Fig. 1 Relationships between fresh weights of alfalfa and application methods of bark compost under irrigation of sweet water. Figures in parentheses are indexes for 100 of control. C:Control;T:Thick layer application;W:Whole layer application. L. I. Low irrigation; II. I. High irrigation. Columns shown by the same letter are not significantly different by LSD at 5 % level.

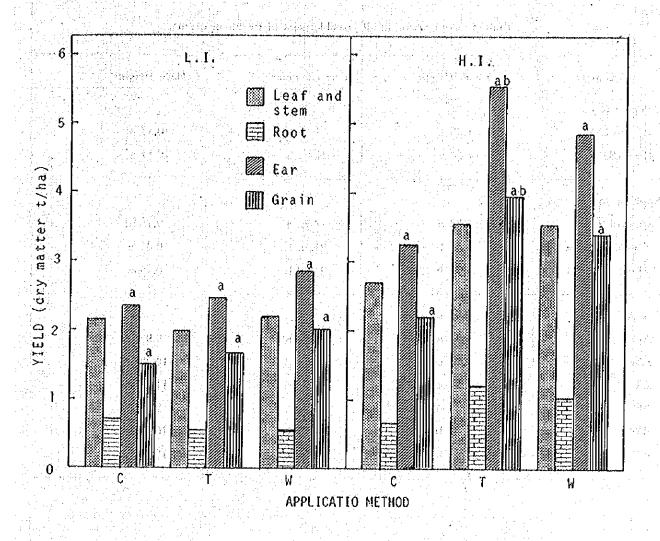


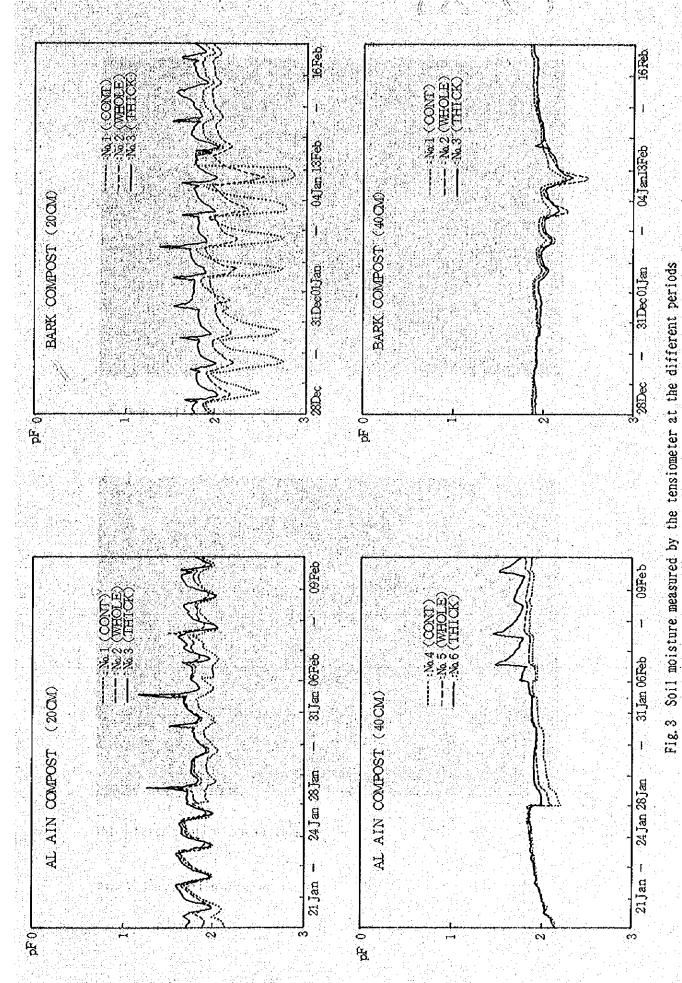
Fig. 2 Relationships between yields of wheat and application methods of bark compost under Irrigation of sweet water. Columns shown by the same letter are not significantly different by LSD at 5 % level.

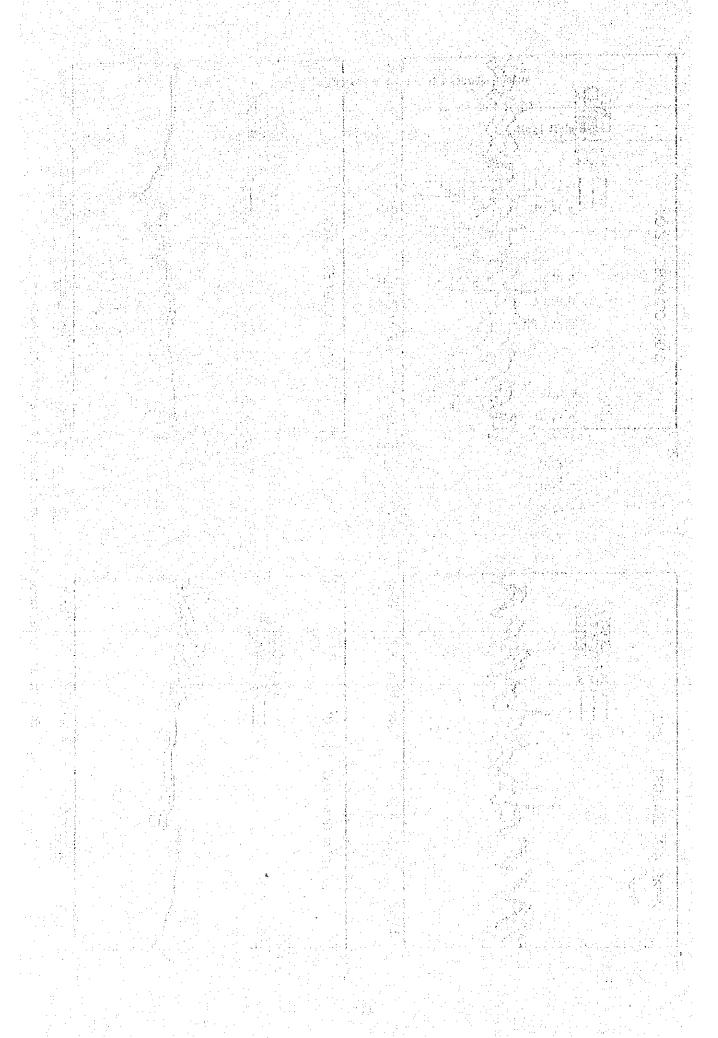
Table 1 Comparison in all possible pairs of treatment means

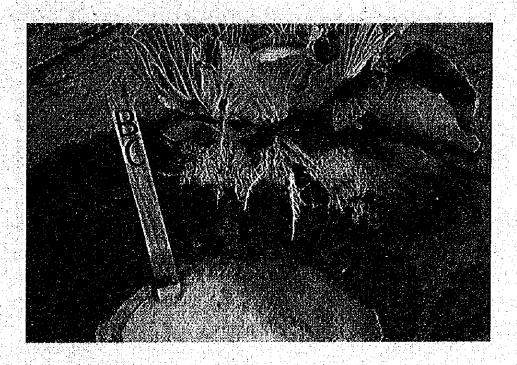
				<u> </u>
Treatment	Head Weight	Head Diameter	Head Height	
Compost (C)				
Al Áin (A)	1.88 a	21.56 a	10,57 a	
Bark (B)	1.54 a	19:71 b	10.11 a	
Application (A)				
Control (C)	133 a	18.78 a	9.78 a	
Whole layer (W)	i.83 b	21.14 b	10,49 b	
Thick layer (T)	1.97 b	21,99 6	10.75 в	
Z x A				
AC	1.34 a	19,06 ab	9,93 ab	
AW	2.04 c	22.29 d	// 2 / 10.77 d	
AT	2.27 c	23,33 d	11.02 d	
BC	1.32 a	18.50 a	9,63 a	
BW.	1,62 b	19.98 bc	10.22 bo	
BT	1.67 b	20.64 c	10,49 cd	

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Without application of compost



Thick Layer Application of compost

Fig. 4 Observation of root system

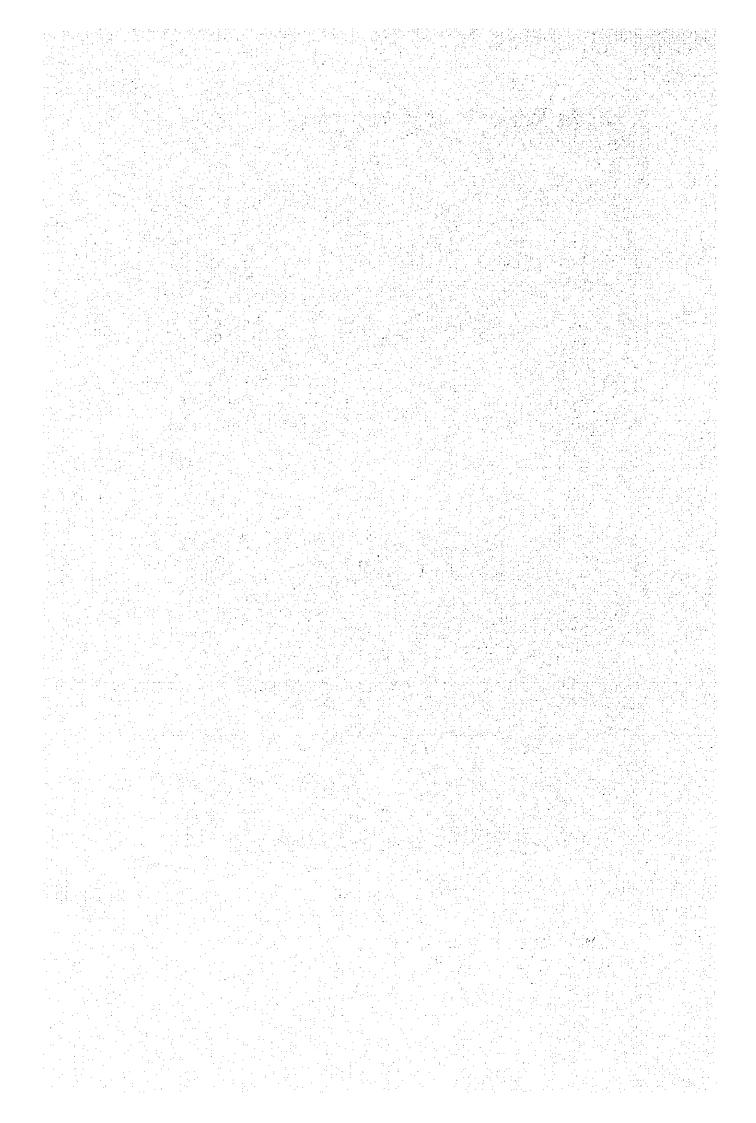


Table 2 Comparison in all possible pairs of freatment means

Treatment	Presh Weight	Leaf Length	Root Length	
Salinity (S)				
Low (L)	77,70 a	29.69 a	17.12 a	
High (H)	62.32 b	25.58 a	15.39 b	
Application (A)				-
Control (C)	52.94 a	24,28 a	14.51 a	
Whole layer (W)	71.78 в	27,44 b	15,28 a	
Thick layer (T)	85.32 c	31,33 e	18,97 Ь	
×A				
LC	59,31 a	26,29 bc	15.78 bc	F 14
LW	81.20 c	29.79 cd	16.23 c) i
LT.	92.60 c	33.29 d	19.34 d	
НС	46.58 a	22,27 a	13.23 a	
HW	62.35 ab	25.10 ab	14.33 ab	
HT	78.04 bc	29.37 с	18.61 d	

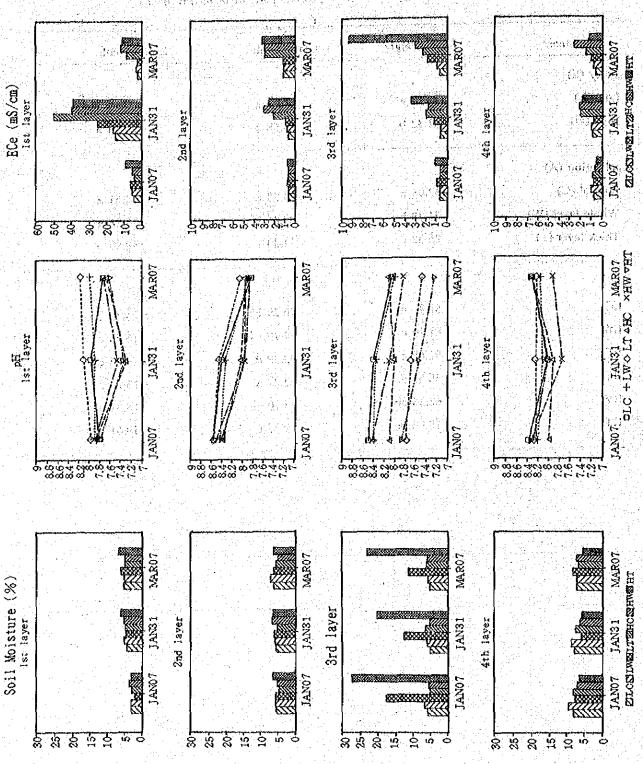
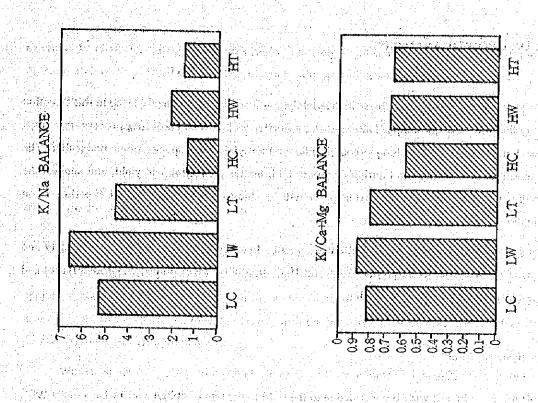


Fig. 5 moisture, pH, and EC of sample soils



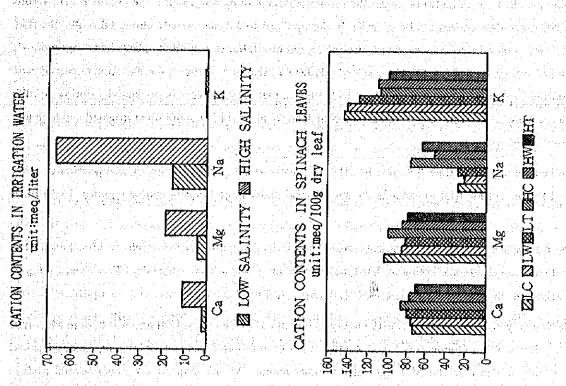


Fig. 6 Composition of cations in irrigation water and in plant leaves with some cation balance

(2) STUDIES ON GROWTH ANALYSIS

There may be some possibilities to increase in the yield per unit area in UAE. The first step in this direction is to answer exactly the following questions: (1) how much productivities and what productive processes do crops have under the local and standard cultivation method?, (2) how do the yields of crops determine under that? The answers to both questions will clarify the limiting factors to both matter production and yield, and suggest the ways to improve the cultivation methods. In next step, we will be able to conduct the factorial experiments on the cultivation methods using these suggestions.

In this study, we conducted wheat and alfalfa experiments. In wheat, we examined the productivity and productive process of the winter cropping in both 1986 and 1987. In alfalfa, we examined the productivities and productive process for two years after the seeding.

(i) Growth analysis of Alfalfa

Seeds of alfalfa (cv. Omani) were broadcasted onto the field at the rate of 40kg/ha on 14 December 1986. Sward management was described previously. Two plots, CUTTING and REGROWTH(B5), were set up, and CUTING plot was divided into sub-plots with standard irrigation (B6) and with high irrigation(B4). Each area was 24.7 x 33.0m.

There may be two methods to increase the yield of alfalfa: cutting schedule and cutting times. The results of CUTTING plots showed that alfalfa grew fastly during April to July but slowly during other months (Fig. 1). Pastly growing months corresponded to flowering season of alfalfa, so that alfalfa plants had long internode and developed well layers of leaves. The result of REGROWTH plot also shows that the amount of regrowth was low during September to November. These facts suggest that more increase in productivity during April to July results in more increase in annual yield. We recommend frequent cutting, more water irrigated and high top-dressing during this period.

We had cut alfalfa 12 times per year in CUTTING plots to obtain the data on seasonal productivity. We recommend to conduct the trial to examine the annual yield under more frequent cutting regimes, 14-15 times per year.

The results of micro-meteorogical trial showed that twice irrigation per day results in higher yield than once irrigation on condition that both plots had the same amount of water irrigated per day. We recommend more frequent irrigation throughout the year, especially in April to July.

The annual yield was 2800-3000kg/10a in dry weight in CUTTING plots. Leaf area was high in May, June and July, but low in other months (Fig. 2). Generally, it has been reported that well-developing canopy has LAI of 4-8 in alfalfa, so leaf area should be increased in other months. We recommend to conduct several trials to

examine the characters affecting leaf area index, leaf weight and stem number per unit area, the number of nodes on stem and vertical distribution of leaves, under the irrigation and fertilizer treatments.

We observed many small-sized bare grounds in alfalfa fields. We recommend that irrigation and fertilizer are applied more regularly in space, and large amount of compost are applied as possible to obtain sufficient number of alfalfa plants and vigorus seedlings with large and deep root system.

(ii) Growth analysis of Wheat

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In 1987/1988 winter cropping, two levels of fertilizer treatment, CONTROL and FREQUENT, were set up with three replications. CONTROL plot was applied at 100kg/ha urea in levelling but PREQUENT plot was applied at each 50kg/ha urea in both levelling and 9 February. Seeds of wheat (cv. MEXIPAK) were row-seeded at the rate of 150kg/ha on 18 November 1987, with the interrow space of 42kg N/ha, 110kg P₂0₃/ha, 96kg K₂0/ha and 20tons/ha of Al Ain compost.

Wheat plants were sampled at seven times from 8 December to 5 March. Morphological variables were measured.

In analyzing the yield components, while grain number per ear and 100 grainb weight were high, ear number was considerably low, 215.2-219.6 ears per m² (Table 1). Therefore, it is important for the improvement of yield to increase the ear number per unit area. It may be accompanied with the increase in plant number. Plant density, however, was low and a large spatial variation in that was also observed in the study field. We recommend that both irrigation and fertilizer are applied more regularly in space, and a large amount of compost is applied as possible to obtain the sufficient number of wheat plants. Especially, irrigation should be payed more attention in early phase of wheat plant for the development of root system more deeply and strongly.

Although the period between heading and grain-filling was long enough to mature, that between the seeding and heading was short. We suggest that there is some possibility to increase the yield by extending the vegetative growth period. We recommend to conduct some experiments on the effects of the seeding date on productive process and yield components.

Grain yield in this study, 4475kg/ha, was much higher than that in the 1986/1987 crop, 2766kg/ha. In comparing the yield components of both experiments, large differences were found in ear number, kernel number per ear and 100 kernel weight. 1987/1988 experiment had more kernel number per ear and heavier 100 kernel weight than 1986/1987 experiment, although it had fewer ear number. These differences seemed to be partially due to the difference in the seeding date, 1987/1988 experiment started on 27 November. The differences in the seeding date may affect the yield components. The growth data also suggest that the difference in LAI (leaf area index) of the late phase (mid-January to late-February) was partially responsible for the difference in grain yield (Table 2). LAI was high, 3.15-3.26, in this study but low, 2.18, in 1986-1987 experiment. It should be maintained to be high in the late phase of growth. The irrigation and top-dressing in this phase should be payed attention.

Table 1. Yield components of wheat.

	No. ears No	o grains 100 gra	iin Yleld	Culm	Bar
	(no./m²)	per ear weigi	ht(g) (g/m²) 🐭	length ()	length
1986 Control	277.3	30.6	276,6	50.4cm	8.6m 2.400 2.444
1987 Control	219.6	54.7	. 445.7	60.2cm	10.2cm
1987 Treatment	215.2	60.1 3.90	504.4	60.6cm	10.7cm

Table 2. Leaf area index and dry matter weight (g/m²)

Con	t-1986/19	987		Cont-1987/19	88	Tr	eat.+1987/19	88
Date	LAI	DW	Date	LAI	DW	Date	LAI	DW
			8 Dec.	0.27	39.8	8 Dec.	0.20	32.7
24 Dec.	2,56	154.3	24 Dec.	1.98	250.4	24 Dec.	1.78	245.5
16 Jan.	5.19	784.7	10 Jan.	4.00	800.4	10 Jan.,	3.90	770.2
30 Jan.	3.00	994.7	21 Jan.	4.68	932,3	21 Jan.	5.05	1063.9
13 Feb.	1.52	1491.7	6 Peb.	2.00	1062.7	6 Peb.	1.96	1091.3
27 Peb.	0.94	1338.8	22 Feb.	1.47	1394.7	22 Feb.	1.69	1498.5
13 Mar.	0.03	1211.3	5 Mar.		1759.2	5 Mar.		1530.1

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(3) STUDIES ON MICROMETEOROLOGY

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(i) Effect of irrigation frequency and irrigation amount on soil temperature

This study was conducted in September and December 1986. Diurnal changes in soil temperature and some micrometeorological variables were measured in the desert near Al Ain city.

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September, an extremely hot and dry month, had a high daily maximum temperature of 41.9°C, and exhibited large diurnal changes in air temperature. Evaporation was high during the day (10.59mm/12 hours), and diurnal pattern of evaporation corresponded well with diurnal changes in air temperature. Maximum temperature at 5cm depth in bare soil with no irrigation was 49.7°C. High irrigation frequency and plant cover reduced soil temperature at 5 cm depth, while irrigation amount had no effect.

December had a low daily maximum temperature of 23.0°C. Evaporation was low during the day (2,34mm/ 11 hours) and exhibited large diurnal changes in soil temperature at 5cm depth, which corresponded with changes in air temperature, but little changes were found at 30cm depth. Both irrigation frequency and irrigation amount had no effect on soil temperature. On the other hand, plant cover reduced soil temperature at 5cm depth (Fig. 1 and 2).

(ii) Effects of different kinds of mulches on soil temperature, soil moisture and plant growth

Plastic mulches are frequently used to conserve soil moisture, increase soil temperature, and control weeds. Increasing soil temperature is especially beneficial when warm-season crops are grown in winter. On the other hand, conserving soil moisture is very important in UAB, specially in summer, because evaporation is considerably high.

Three field experiments were conducted under drip irrigation system to evaluate the effects of mulches on soil temperature, soil moisture and plant growth.

(a) 1st experiment: Okra seeds were sown on 27 December 1987. The following mulch treatments were tested: 1) bare soil (control); 2)paper mulch; 3)clear plastic mulch; 4) black plastic mulch. Soil temperatures were increased by plastic mulches, which resulted in faster germination and better plant growth in the plastic mulch plots. The experiment was terminated in the middle of February 1988 due to heavy damage to the plant by strong wind. This result suggested the necessity of proper windbreak around the experimental plot (Fig. 3).

- (b) 2nd experiment: Treatments included bare ground, white plastic mulch, and black plastic mulch, each with two levels of irrigation amount (3 litres/plant/day and 6 litres/plant/day). Soil temperatures and soil moistures were increased by plastic mulches. Irrigation amounts did not influence both soil temperatures and soil moistures. It is suggested that a very durable mulch is required under the severe weather condition in UAB, because the tested plastic mulches were destroyed within two months after the experiment started (Fig. 4 and 5).
- (c) 3rd experiment: Cauliflower was seeded in the middle of October 1988, and transplanted to the field on 10 December 1988. The treatments were as follows: 1) bare soil (control); 2) clear plastic mulch; 3) black plastic mulch; 4) chemical mulch (KURI-COAT). Soil temperatures were increased by plastic mulches. Chemical mulch, however, had little effect on soil temperature. Soil moistures were not influenced by mulches. Clear plastic mulch increased curd yield by 5%, however, the difference was not significant (Fig. 6 and 7).

(iii) Effect of irrigation frequency on transpiration rate, leaf temperature and yield of alfalfa

UAE belongs to extremely arid area and its annual rainfall is approximately 100mm, which fluctuates from 0mm to more than 200mm. Consequently agriculture in UAE mainly depends on ground water supply. Since recharging the ground water by rainfall is very limited in UAB, too much water use may result in shortage or exhaustion of water resource. It is very important to clarify water movement for appropriate agricultural management. Several basic studies on water economy were conducted in alfalfa field.

(a) The amount evaporation from water surface and soil surface

The evaporation amount from water surface (Ew), soil surface with everyday irrigation (Ee), and soil surface with every two days irrigation (Et) were measured in August 1988. Ew was 12-14mm/day and Ee was 11-13mm/day. Et of irrigated day was similar to Ee, but that of no-irrigated day was much less than Ee (i.e. 2-3mm/day). It was obvious that once soil surface was dried, evaporation from soil surface was reduced remarkably (Fig. 8).

(b) Diurnal change in transpiration rate and leaf temperature of alfalfa

Diurnal change in transpiration rate and leaf temperature of alfalfa was measured by porometer (LI-1600: LI-COR Co.) with two levels of irrigation frequency. The measurements were done in April, June, August, November 1988 and January 1989. Leaf temperature was lower than air temperature in April, June and August. Leaf temperature was, however, almost same as air temperature in November, and was higher than air temperature in January. Frequent irrigation was effective to keep

higher transpiration rate during midday, which resulted lowered leaf temperature especially in hot season (Fig. 9).

(c) Effect of irrigation frequency on the yield of alfalfa

Fresh weight, dry weight and plant height of alfalfa were measured monthly from March 1988 to Pebruary 1989 with two levels of irrigation frequency. Fresh weight of alfalfa was significantly increased by frequent irrigation (Fig. 10). In general, the yield of alfalfa was high in winter and spring, but low in summer. The ratio of dry weight to fresh weight was the largest in May, followed by gradual decrease up to January.

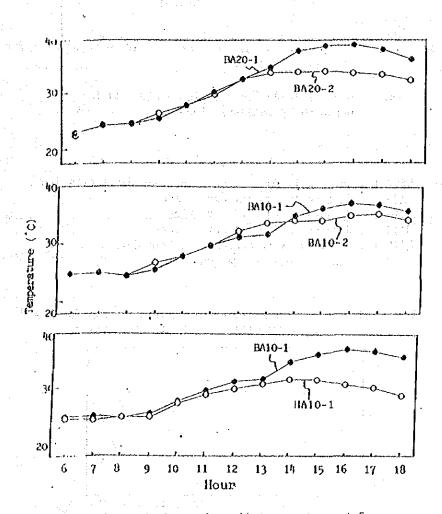
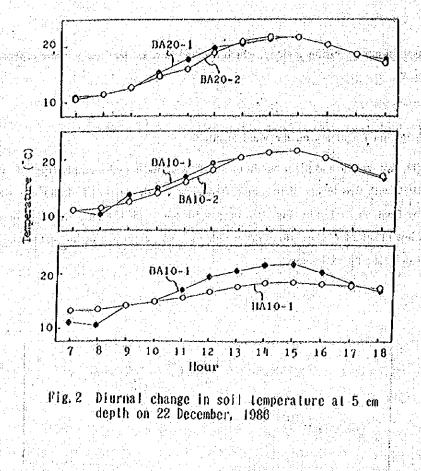
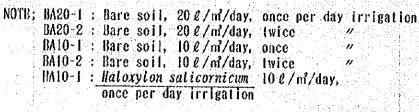
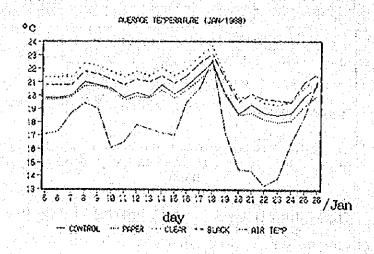


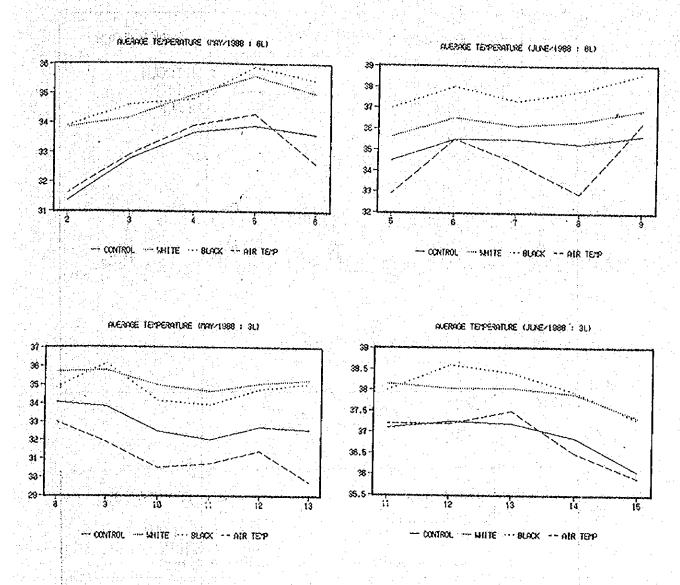
Fig. 1 Diurnal change in soil temperature at 5 cm depth on 14 September, 1986







Pig. 3 Change in average soll temperature at 10cm depth and average air temperature (Okra 1/ winter)



Pig. 4 Change in average soil temperature at 10cm depth and average air temperature (Okra 2/ summer)

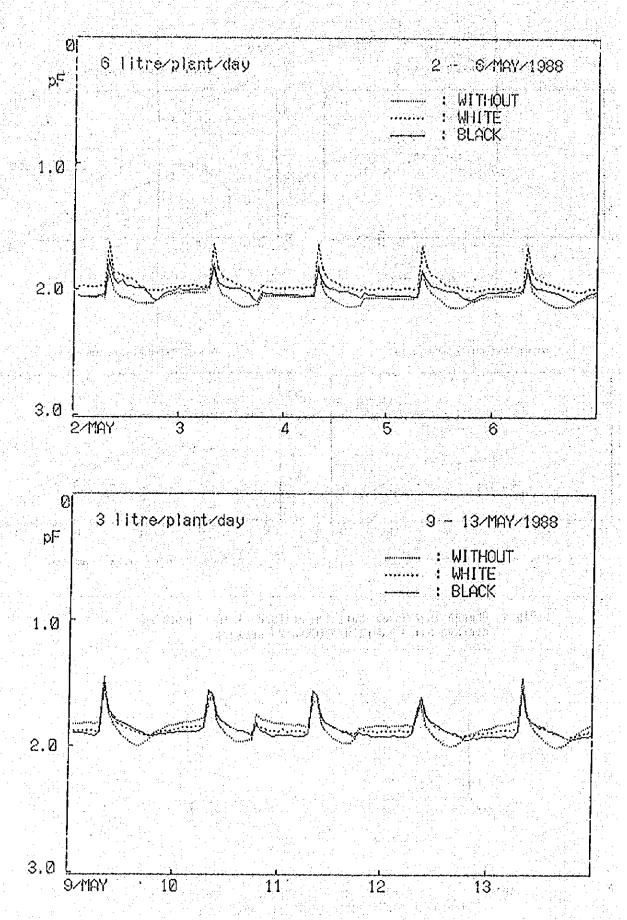
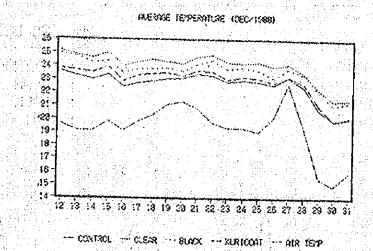


Fig. 5 Diurnal change in soil moisture at 10cm depth (Okra 2/ summer)



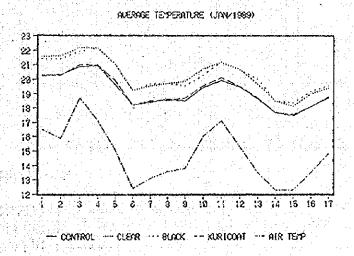


Fig. 6 Change in soil temperature at 10cm depth and average air temperature (Cauliflower)

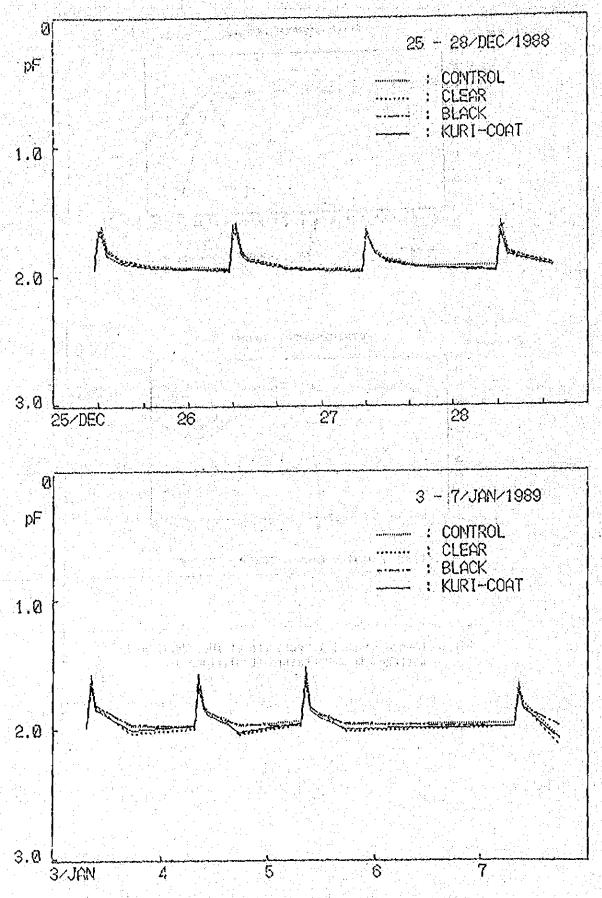
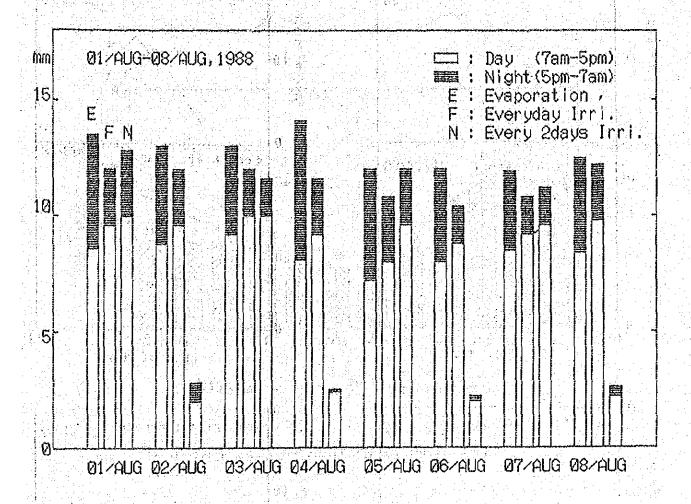
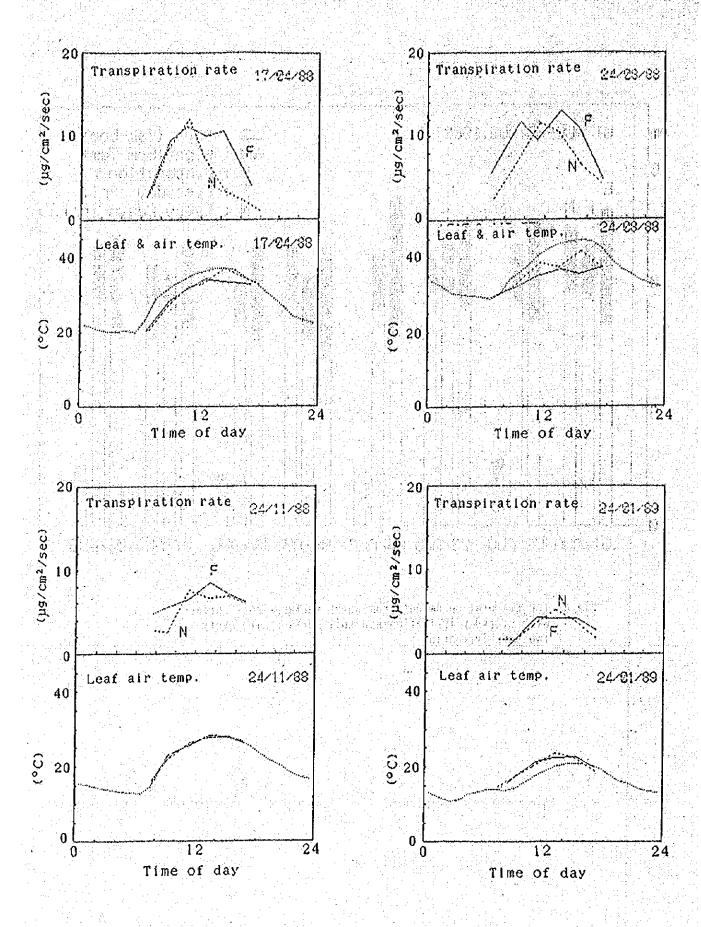


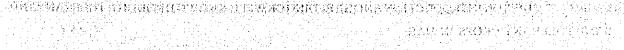
Fig. 7 Diurnal change in soll moisture at 10cm depth (Cauliflower)

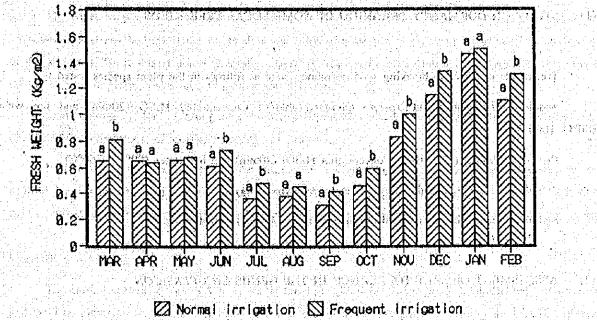


Pig. 8 The evaporation amount from water surface, soil surface with everyday irrigation and soil surface with every two days irrigation



Pig. 9 Diurnal and seasonal trends of transpiration rate, leaf temperature and air temperature.





Normal irrigation S Frequent irrigation

Fig. 10 Forage fresh weight for the normal and the frequent alfalfa.

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- 3. Theme C: STUDIES ON INTRODUCTION AND BRBEDING OF WELL-KNOWN DROUGHT-TOLERANTAND SALT-TOLERANT CROPS IN UAE
 - (1) STUDY ON DORMANCY BREAKING OF SOME LOCAL TREE SEEDS

Treatments effective in breaking seed dormancy were as follows in the plant species jested:

Acacla forillis (Samar) and Prosopis spicigera (ghaff): Concentrated H2SO4 (20min) and hot water (80°C, 10min)

Prospois juliflora (Ghwaif): Concentrated H2SO4 (20min) and hot water (80°C or 60°C)

Zizyphus sping-christ (Sidar): Soaking in water for 3 days

Acaçia arabica (Garaat): No difference were found among treatments.

(2) ASSESSMENT OF SALT TOLERANCE IN THE GENUS LYCOPERSICON

Salinity problem is one of the main obstruction to arid land agriculture. There are two major strategies for this problem. One is improvement of cultural practice including soil reclamation or establishment of drainage system. And another is introducing salt tolerant crops. Since engineering and management costs are high, to develop higher salt tolerant crops has increased tremendously. This study was conducted to establish the procedure of assessment of salt tolerance in the genus *Lycopersicon* and to select the salt tolerant accessions according to the procedure.

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- 1. Preliminary experiment was conducted to establish the procedure of screening test. The procedures are as follows:
 - (a) Use 15mS/cm of saline water for 4 weeks after 2 weeks of sweet water irrigation in artificial weather chamber (BIOTRON LH-200-RDCD).
 - (b) Transfer survived seedlings of selected accessions to nursery and irrigate with saline water (15mS/cm) for 15 days more, then irrigate with sweet water for 2 or 3 weeks.
 - (c) Transplant all surviced plants in the field to extract seeds from the remaining accessions for further studies.
- Three screening tests were conducted according to the procedure using both commercial and wild accessions.
 The wild accessions were kindly provided by United States Department of Agriculture (USDA) and University of California. 10 accessions were survived, and transplanted in the field.

(3) INVESTIGATION OF PROPAGATING METHODS OF ADAPTIVE WOODY PLANTS IN ARID LAND

The water supply is one of the most important factors for covering and land with rich-green. However, we should also stress the importance of breeding and cultivating the plants which are adaptive to the environment of the arid land. These desert plants generally depend on the seed propagation although some of them depend on the vegetative propagation such as cutting and division.

Leafy cutting and leafy grafting are extremely difficult to succeed in rooting and uniting because of severe environmental conditions, especially humidity conditions.

In this experiment, we tried to root the cuttings by covering them with polyethylene film so that we used as little water as possible and investigated the possibility of the rooting by leafy cutting of adaptive woody plants in UAE. We also investigated the application for acclimating process of plantlets after proliferation by tissue culture.

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Materials and Method

The current season shoots of Samar(Acacia tortilis), Siddir (Zizyphus jujuba), Ghaff(Prosopis spicigera) and Wild jasmine(Clerodendron inerme) which were grown in the experimental farm of the U.A.B. University were collected for use. The subterminal cuttings which was cut back weakish shoot tip (about 5cm) was immediately adjusted to 10cm long. The cuttings of Wild jasmine had four leaves and other species were adjusted to cuttings with same amount of leaves in same species because it was difficult to adjust the numbers of leaves and attaching of branches.

The cuttings were immersed in the water for about 3 hours to protect from wilting.

Before inserting the cuttings to the rooting media, the base of cuttings was dipped in Oxyberon (IBA 4000ppm) for 5 seconds or covered with Oxyberon powder (containing 0.4% IBA). Sand and Sand + peatmoss (1:1 v/v) were used as the rooting media. These treatment sections were respectively set up with and without polyethylene film cover. Those sections were given the short name of PC and CONT respectively.

Irrigation was carried out every day to CONT and once a month to PC. The percentage of rooted cuttings, number of root per cutting and total dry weight per section were counted after three months of planting. The light intensity, temperature and relative humidity during planting period were recorded in CONT and PC.

1. Experiment of leafy cutting in March

Twenty five to 41 sub-terminal cuttings were inserted to the rooting media on 21 March and the aspects of rooting were compared with CONT and PC on 20 July.

2. Experiment of leafy cutting in October

On 15 October 1988, 20 sub-terminal cuttings were used for experiment and were counted on 17 January 1989. The aspects of rooting were contrasted to polyethylene film covered cutting (PC) and polyethylene film scaled cutting (PS) except for CONT.

Results

1. Experiment of leafy cutting in March

Changes of the light intensity, temperature and relative humidity in planting period were shown in Fig.

The ratio of light intensity under cheese cloth in contrast to direct sunlight stayed at 6-8% in CONT. In PC, the ratio of light intensity in PC was 0.5-1.0% less than that in CONT as shown in Fig. 1 (upper).

The air temperature at 1.0m high from the ground at noon ranged from 35-47°C except for rainy day. On the other hand, the temperature (on the soil surface) under cheese cloth maintained 25-31°C and the temperature in PC was 6-7°C higher than that in CONT as shown in Fig. 1 (middle).

The relative humidity in PC was kept at a uniform rate about 100% through planting periods but the relative humidity in CONT showed a great differentials between 4:00 AM and 14:00 PM. The differentials came to about 70%/day in the widest range as shown in Fig. 1 (lower).

In CONT, all cuttings of Samar, Siddir and Ghaff died after 30th to 40th day from inserting but a few cuttings of Wild jasmine survived up to 3 months. In PC, both of the survival and root formation of Samar, Siddir and Ghaff were very difficult but the cuttings of Siddir and Ghaff formed a small amount of roots. On the other hand, Wild jasmine obtained rooting percentage of over 90% at all sections.

The effects of rooting media and treatment of Oxyberon on root formation were not significant but yet the highest total dry weight of root was obtained in the cuttings that treated with Oxyberon powder in the sand as shown in Table 1.

2. Experiment of leafy cutting in October

Root formation of four species in PS showed as same tendency as in PC. Percentage of survival of cuttings was higher than those of Siddir, Ghaff and Wild jasmine in March and this cuttings also failed to root in October as shown in table 2.

Conclusion

Leafy cuttings of Samar, Siddir, Ghaff and Wild jasmine were unable to endure the severe changes of humidity between day and night in Al Ain. However, the cuttings in PC and PS could be put a high survival percentage with two times of irrigations during three months.

These apparatus are considered to be useful as a brief system in relation to the propagation of leafy cutting, easy to root, and the acclimation of plantlet by tissue culture in arid land.



The seasonal changes of relative light intensity, temperature and relative humidity in polyethylene film covered(P C) or Uncovered(Cont) cutting in March 1988

Fig. 1

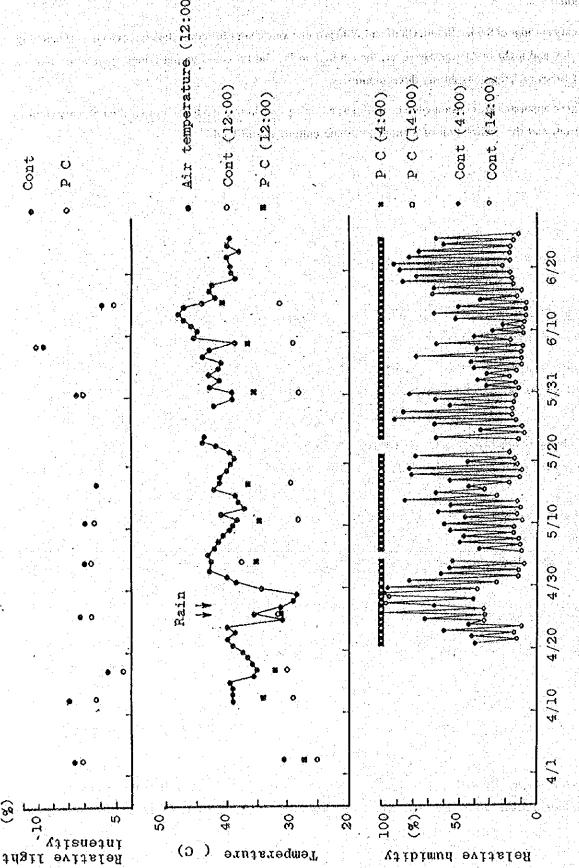


Table 1 Effects of the polyetlylene film covered cutting on root formation of the four plants in U.A.E.

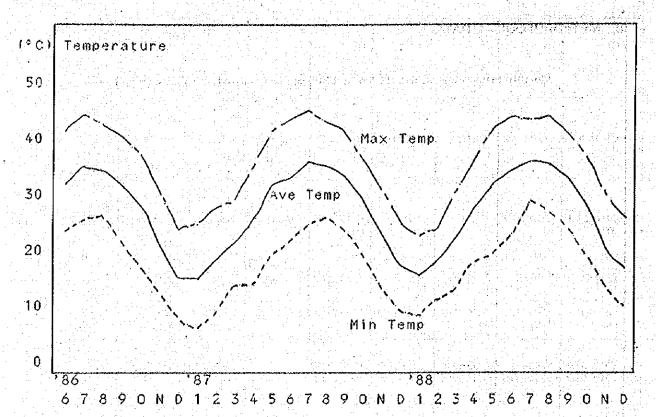
			(Cont)				coverd cutting (PC)		The Pe
Rooting media	sand			sand 4 peat moss	pures			peat moss	sriod of
18A treatment	19pmod	4 0 0 0 ppm 5sec. dipping	rapwod	4000pm 5sec. dipping	r e p w o a	4000pm 5sec. dipping	rep.w.od	4000pm 5sec. dipping	propagati
species	Samar Siddir Ghaff Wild jasmine	Samar Siddir Gnaff Wild-jasmine	Samar Siddir Ghaff Wild-jasmine	Samar Siddir Ghaff Wild jasmine	Samar Siddir Ghaff Wild jasmine	Samer Siddir Ghaff Wild jesmine	Samar Siddir Ghaff Wild jasmine	Samar Siddir Chaff Wild jasmine	T SEM UO
NO, of cuttings	2 9 4 0 2 7	8428 1510	დეგე ტიტტ	ພດ40 ⊶ເບ⊷∞	ພለພພ ጣኮኒክክ	വയയപ നഗഗന	യവംപം വവാധ	യഗ്വധയ പയപ്പാ	rom Mar
NO, of survival (%)	0 0 13.7%) 1 (3.7%)	0000	0000	1-00	0 0 29 (82. 9%)	28 (80. £%)	2 (7.4%) 8 5 (100%)	0 (3.6%)	сћ 21
% of rooted cutting	7 · L	0000	000	0004 8	1.00	0004 0004 w	92.70 7.94 7.94	9 10.00 4.4	to Jun
NO, of roots per cutting	0 0 1.2.5	0000	0 0 4.	000m	000%	3 2000 2000	140 40.2	0400 8	e20, 1
D.W. of roots per cutting	0 0 0-0-1	0 0	0	0 000	8 ic 000is	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	2.28	0 2.05	888

Table 2 Effects of the polyetlylene film covered or seald cutting on root formation of the four plants in U.A.B.

D,W.of roots per cutting	0.26 0.26 3.95	0 0 2 0 3	6 0000		0 0 1.36	0000	0.02 0.55	0000
NO, of roots per cutting	1 0808	8 0204	0004	ဝင္ဝဏ္	0 7 0 4 7	00 6 4 4	0 0 2.1	- - - -
% of rooted cutting	1 0 0 1 0 0	9 H 9 ONO	ဝဝဝ ဖဲ့ ၈	000m	2 0 2 5 1 0 0	0 0 0 0 1	1 0 1 0 1 0 0	බටවට ගි
NO, of survival (%)	0 (45%) 1 (5%) 2 0 (100%)	1 5 (25%) 2 0 (100%)	0 1 5%) 1 9 (100%)	0 3 (15%) 1 (5%) 1 9 (95%)	0 5 (25%) 6 (30%) 2 0 (100%)	0 0 2 0 (10%) 2 0 (100%)	. 0 3 (15%) 1 5%) 1 9 (95%)	0 22 (10%) 1 9 (95%)
NO, of cuttings	8888 0000	2000 0000	2007 2007	0000 0000	0000 0000	2000 0000	2 2 2 0 0 0 0	0000
species	Samar Siddir Ghaff Wild jasmine	Samer Siddir Ghaff Wild jasmine	Samar Siddîr Ghaff Wild jasmine	Samar Siddir Ghaff Wild jasmine				
IBA treatmant	powder	4 0 0 0 ppm 5sec. dipping	powder	4 0 0 0 ppm 5sec. dipping	rebwog	4 0 0 0 pom 5sec. dipping	powder	4 0 0 oppm 5sec. dipping
Rooting media		Serio		Sand 7 peat moss		Duess		peat moss
			coverd cutting (PC)				seald cutting (PS)	

III. METEOROLOGICAL DATA

Monthly meteorological data (1986 to 1988) are summarized as follows (Fig. $1 \sim 5$).



Pig. 1 Change in maximum, average and minimum air temperature.

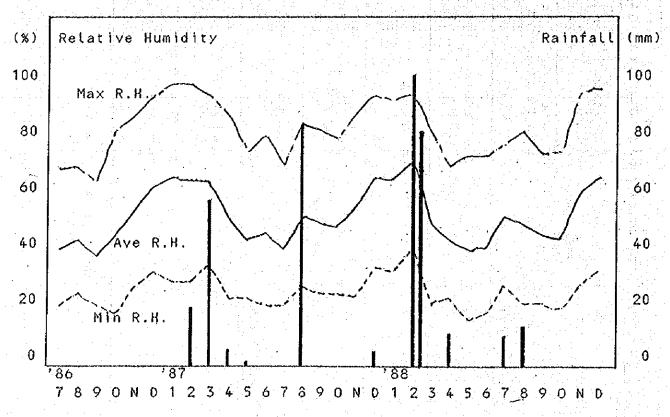
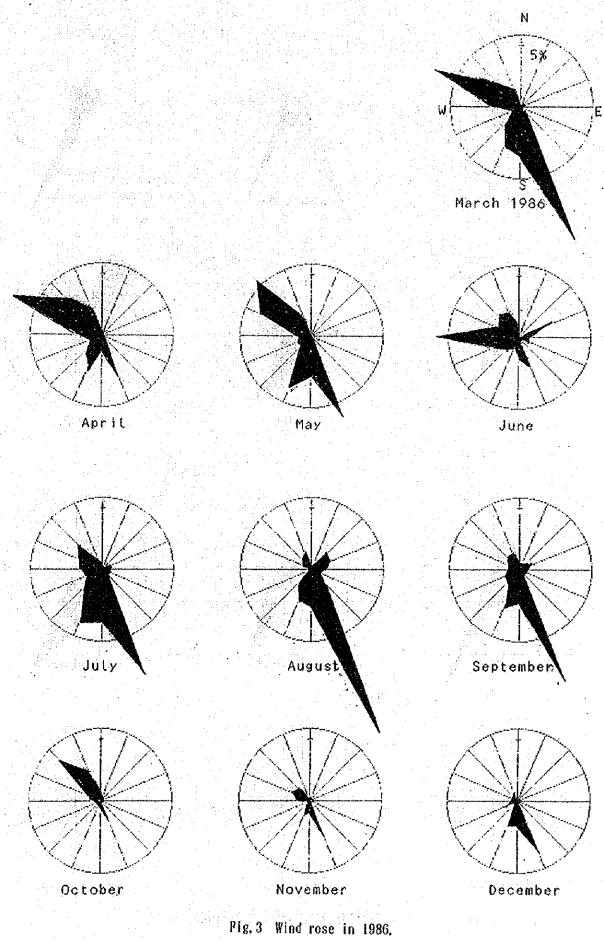
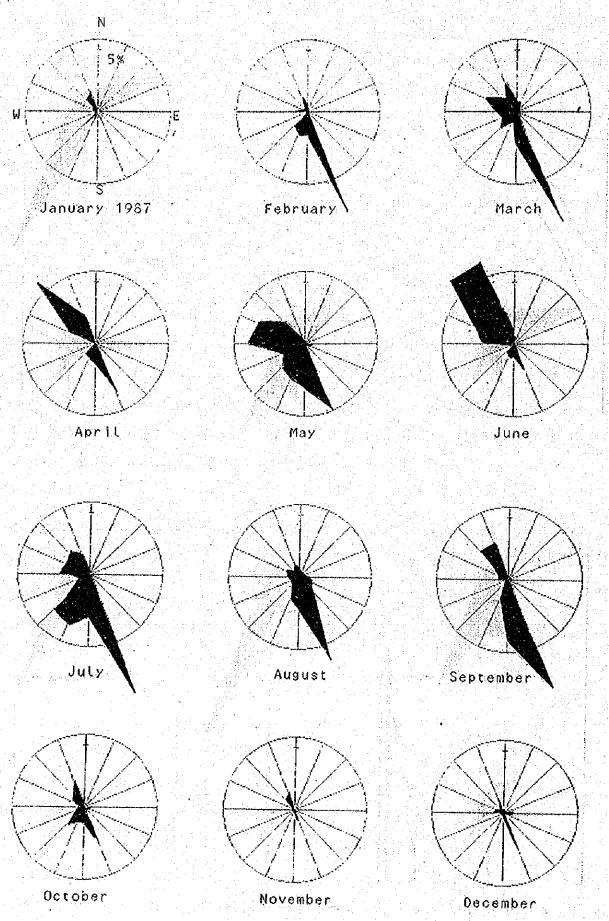


Fig. 2 Change in maximum, average and minimum relative humidity with monthly rainfall data.





Pig. 4 Wind rose in 1987.

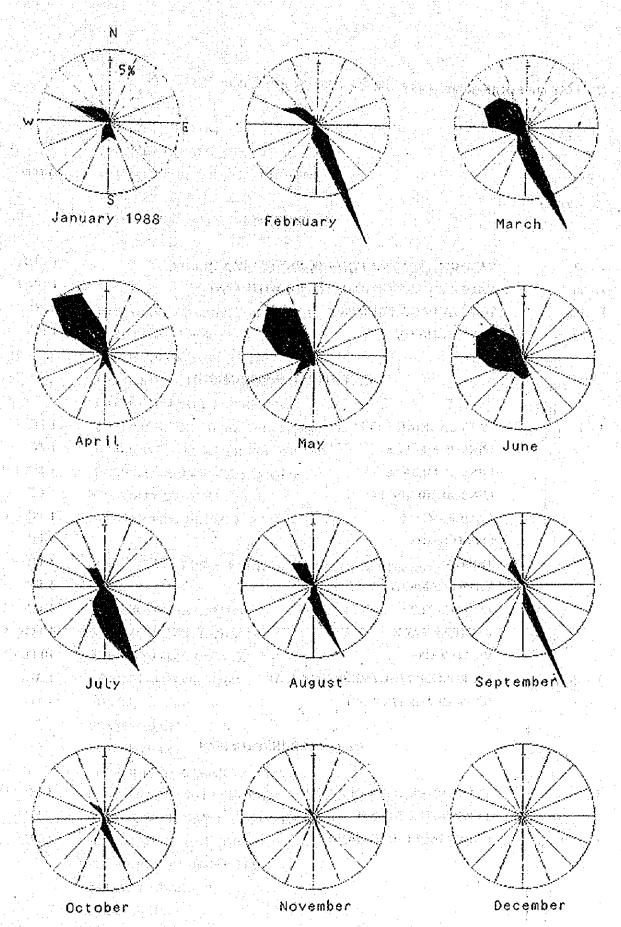


Fig. 5 Wind rose in 1988.

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No.	() Equipment		Amou
	I. VEHICLE	ġġ.	
J - 52	YAMMER TRACTOR (YKA 400 S) WITH	PARTS	i uni
J • 56	YAMMER CARRIGE (CAD 120 SH) WITI	I TENT	i Uni
J - 128	TOYOTA LAND CRUISER		i PC
J - 29	TOYOTA HILUX		l PC
	II. OPTICAL INSTI	RUMENT	
	CAMERA (NIKON FE2)		1 PC
	LENS 35 MM F2.8		1 PC
	LBNS 55 MM F2.8		1 PC
	LENS 70-210 MM F4 CAMBRA CASE		1 PC
	SPBED LIGHT		1 PC
	TRIPOD		1 PC
J - 2	VIDEO CAMERA		1 PC
	AC ADAPTER		1 PC
	BATTERY PACK		5 PCS
	VIDEO TAPB		10 PCS
J - 40	MICROSCOPE (OLYMPUS VMZ-4SA)		1 SET
J - 76	BINOCULARS (7X50 IF)		l PC
	왕 () 보고 보고 있다고 있다. 역시 보고 있는데 생각 되고 있다. 강 () 보고 있는데 15대 15일 () 보고 있는데 15일 () 15일 (
	III. OFFICE INSTRI	JMENT	
J-9	TYPEWRITER (CANON AP200)		l PC
	TYPEWRITER STAND		1 PC
J - 130	COPY MACHINE (CANON)		1-PC
	그 사람들은 이번 시간에 불으로 받는 사람은 하루를 하였다.	교기를 하는 이번 모든 것은 존재를 다	

	경기 경기를 받았다. 경기 기업을 하고 있다. 그 기업을 보고 있다. 그는 사람들은 사람들이 되었다. 그런	
	IV. FIELD EQUIPMENT I (SPRAYER)	
J - 28	SPRAYER (HOTTA)	l SE
J - 61	SPRAYER (SMALL TYPE)	
J - 85	NOZZLES POR SPRAYER	3 PC
J - 88	SPRAYER (MARUYAMA)	1 SE
J - 102	NOZZLB FOR MARUYAMA SPRAYER	5 PC
	V. FIELD EQUIPMENT II (PLANT PHYSIOLOGY)	
		X-180
J - 43	PRESSURE CHAMBER (DIK - 7000)	1 SE1
J - 44	COMPRESSOR FOR J. 43	1 SET
J - 97	SUPER POLOMETER (LI-1600)	1 SE 1
J - 117	LIGHT INTENSITY METER (NS-2)	2 SE1
J - 122	LIGHT INTENSITY METER (NS-2)	1 SET
J -146	RAM PACK FOR SUPER PLOMETER	1 PC
	RAM CARD FOR SUPER POLOMETER	5 PCS
J -162	HUMIDITY RECORDER (SS-100P)	1 Set
	HUMIDITY SENSER	3 PCS
J - 10	ASSMAN PSYCHROMETER	1 PC
	VI. FIELD EQUIPMENT III (THERMOMETER)	
- 12	THERMOMETER (L-TUBE)	2 SET
-24	THERMOMETER (L-TUBE)	2 SET
-26	THERMOMETER (ER-186)	2 SET
	CHART PAPER (ER-186)	12 RO
	SENSER 10 CM	16 PC:
	SENSER 30 CM	6 PCS
	SENSER 50 CM	2 PCS
- 63	THERMOMETER (MAX AND MIN)	2 PCS
- 112	DATA COMPUTING RECORDER FOR SOIL TEMPERATURE	1 SET
	IPC 1112 WITH HAND HELD COMPUTER	1 SET
	SENSER WITH 30 M CORD	8 PCS
	STEP DOWN TRANSFORMER	1 PC
the state of the state of	BATTERY CHARGER	

vit. Field equipment IV (soil moisture)

J - 106	MEMORY SENSER (MES 801)	t set
	BATTERY PACK	1 Open
	AC ADAPTER	i opri
	SOLAR BATTERY	1 0000
	FITTING BASE	1 000
	CASE FOR OUT DOOR	1 SET
	CABLE (MES 892)	1 PC
	PROGRAM (FLOPPY DISK)	1 PC
J - 107	SOIL MOISTURE SENSER	8 PCS Tit
J - 108	HAND HELD COMPUTER (HC-20)	1 SET
J - 109	TRANSFORMER (YSA-500)	1 PC
J - 182	MEMORY SENSER (MES 801)	1 SET
	BATTERY PACK (MES 823)	1 SET
	PLUG IN ADAPTER (MES 822)	i șet
	SOLAR BATTERY (MES 826)	1 SET
	FITTING PLATE (MES 826)	1 SET con
The state of the s	OUTDOOR CASE	1 SET
	SOIL MOISTURE SENSER	6 PCS
	SOIL TEMPERATURE SENSER	2 SET
	MICRO CASSETE TAPE	30 PCS
	ROLL PAPER FOR HC-20	10 PCS
	CASSETTE RIBON FOR HC-20	5 PCS
	CABLE	1 PC

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	VII. FIELD EQUIPME	NT IV (SOIL MOISTURE)	
J 14			
J - 34	TENSIOMETER (DIK-3006)		1 SET
J - 35	TENSIOMETER (DIK-3006)		3 SET
J - 77	TENSIOMETER (DIK-3100)		20 PCS
J - 123	TENSIOMETER SENSOR	建筑建设设施,	3 PCS
J - 133	TENSIOMETER (DIK-3120)		12 PCS
J - 134	TENSIOMETER (DIK-3100)	50 CM	8 PCS
J-174	TENSIOMBTER (DIK-3100)	100 CM	8 PSC
	TENSIOMETER (DIK-3100)	10CM	20 PCS
	마시 () 도통하는 경험에 가능을 하는 계속을 모임해 되는 기술을 통하는 기술을 하는 것이다.	30 CM	50 PCS
		50 CM	20 PCS
I 175		100 CM	10 PCS
J - 175	CABLE FOR TENSIOMETER (DIK		10 PCS
J -187	SENSER FOR TENSIOMETER (DI		8 PCS
J - 188		30CM	8 PCS
1 100		50CM	8 PCS
J - 189	ARRESTER (MA-200) FOR TENSION	DMETER (DIK-3006)	5 PCS
	AITT PIETO EGOTUMENT	(GEOGRAPHICAL SURVEY)	
7 8 A			
J - 4	PLASTIC PILB		100 PCS
J - 5	AUTO LEVEL (TOPCON AT-F2)		1 SET
	WITH TRIPOD		
J - 6	ALIMINUM STAFF		3 PCS
J - 7	ESLON PLB		10 PCS
J - 8	MEASURING TAPE		1 PC
J - 11	COMPASS (S-27)		1 PC
J + 19	STEEL MEASURE	The second of the second secon	150 PCS
J - 60	LARGE MALLET	en en 15. Mei 15. Mei 16. Mei 15. Mei	2 PCS
J - 64	INCREMENT BORES	The second of th	1 PC
J - 65	MEASURING TAPE	on to the property of the property of the second se	2 PCS
J - 75	STAINLESS SCALE (IM LENGTH)		100 PCS
J - 152	MEASURING POLE		1 PC

	IX. FIELD EQUIPM	ent yı (soil sürvey)	
- 16	BORING SHOVEL (DIK-1670)		I SET)
- 17	SOIL SAMPLING BOTTLE	Area terraing that the	10 SET
- 18	SOIL SAMPLER (DIK-1800)	(and how activities it	ı şet
- 46	BORING STICK (DIK-1640)		1 ŠET
- 47	POST HOLB AUGER (DIK-1700)		i set
- 67	CYLINDRICAL SAMPLER		1 PC
- 68	CYLINDER FOR GATERING SOI		l2'PCS
- 69	CARRIAGE FOR J ¹ 68		2 PCS
- 70	DRILL LOD FÖR HAND AUGER		2 PCS
- 137	SOIL PENETRATION TESTER (H	-100)	i set
	네 등이 분들 등이 가는 이번 바로 바로 바다를 하시네다.	nt vii (wind survey)	
			A OTEM
- 3	ANEMOMETER		2 SET 6 SET
- 21	ANEMOETER		o sei 2 set
- 104	ANEMOMETER (KC101)		2 SB1 -
- 111	ANEMOMETER (MX865)		1 PC
	WIND VANE SENSER		ı re
	CAB LE (L7S-100)		5 PCS 1
	CABLE (LAS-100)		5 PAIR
	STAND ANEMOGRAPH SENSER		5 PCS
- 150	AMPLIFER FOR MX865		2 PCS
- 150	CABLE FOR MX865		2 PCS (
- 173	ANEMOMETER (MX865)		l PC
raine Saige is s	WIND SENSER (VF216)		1 PC
	WIND SENSER (AF860)		5 PCS
ale de la	EXTENSION CABLE		1 PC
	EXTENSION CABLE		5 PCS
	POLE FOR SENSER		5 PCS
		등을 되는 말을 맞을 봤다는 것을	

	등로 있는 경기를 가는 하는 것을 받는 것이 되었다. 그들은 그들은 그들은 그들은 그들은 것이 되었다. 그렇게 되었다. 그런 것이 되었다. 	
() 등 보다(전, 경기가 () 사람이 () - () :	수는 교육 전 경험을 통해 가는 경험을 하고 있다면 수 있다. 그는 것이 되는 것이 되었다는 것이 되었다. 사용하는 경험 하는 경험적 하게 되었다. 그렇게 하는 것이 되었다는 것이 없는 것이 되었다.	
	XI. FIELD EQUIPMENT VIII (SAND CATCH SYSTEM)	
J - 23	SAND CATCH SYSTEM	l set
J - 62	METAL BOX FOR SHIFTING SAND	50 PCS
J - 90	STOPPER FOR SAND CATCH SYSTEM	75 PCS
J ½ 92	SAND CATCH APPARATUS	24 SET
J - 93	SPARE BAG FOR SAND CATCH SYSTEM	100 PCS
J - 127	SAND CATCH SYSTEM	10 SET
J - 131	SAND CATCH SYSTEM WITH MESH	32 SEŤ
J - 151	SAND CATCH SYSTEM WITH POLE AND BAG	20 SET
	XII. FIELD EQUIPMENT IX (UNDER GROUND WATER SURVE	Y)
J • 25	AUTOMATIC WATER LEVEL METER (NR-110)	1 SET
J - 115	EARTH RESISTANCE TESTER (3244 00)	1 SET
J - 145	PORTABLE WATER LEVEL METER	1 PC
J - 149	WIRE FOR WATER LEVEL METER	1 PC
	PULLY FOR WATER LEVEL METER	1 PC
J - 159	WATER LEVEL METER 50 M	1 PC
J - 160	WATER LEVEL METER 100 M	1 PC
J -197	SENSER FOR WATER LEVEL METER (NR-110)	1 SET
	WITH 45 M CORD	
ARMAN EL		
	- 보고 1986년 1일 1일 등 전 1일 전 1일 등 등 1일 일 2 등 1일 등 1일 등 1일 등 1일 등 1일	
	그리는 유럽 소리를 맞고 있는데 이번에 하는데 보고 있는데 이번에 보는데 그는 그들이 되지 않고 있을 것이다. 소리 아내리 그는 생산들은 아이지는 그들은 그들은 이 동안이다. 그를 만든 것이 나를 가득 수를 보고 있다.	
	보이는 발문한 것은 말씀하는 이 사람이 모든 말을 받는 것이 살아가 되는 것 같아. 그런 하게 하고 싶어 마음을 했다. 사용하는 사용 사용 본 사용들은 사람이 되는 것으로 가장 수 없을 기록 수 없는 것이 모른 상품을 받을 하는 것이다.	
	그림의 문제한 4. 그림의 하고 있는 그를 하면 있는 경험하여 한 분석 사람이 있는 것도 일하는 소리는 소리를 한 것은 사람들이 하는 명화를 보고 통해를 보고 되는 것을 다.	

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	도로 들 었다. 본 시간 전에 가는 것을 다 하고 말하는 것이 되었다. 그는 것이 되었다면 되었다. 그는 것이 되었다. 그는 것이 되었다면 되었다. 그는 것이 되었다면 되었다면 되었다면 되었다. 그는 것이 되었다면 되었다면 되었다면 되었다면 되었다면 되었다면 되었다면 되었다면	
	하다. 현재 보다는 경기 전 사람들이 하는데 하는데 하는데 그 보다는 것이다고 않는데 함께 들었습니다. 하는데 아니를 하는데	
	고 그는 전에 한 소리하는 그는 것도 하는 것을 하는 것이 하는 것은 말로 하는 물로 프로그램을 보았다. 하는 것은	
	XIII. LABORATORY EQUIPMENT I (SOIL PHYSICS)	
	그리는 그는 그렇게 화가를 하고 있다. 그리고 있는 중에서 그리는 경우를 하면 되었다.	
J - 20	THREE PHASE METER (DIK-1100)	1 set
J - 41		I SET
J - 45	A ALTERNATION AND A COMMAND AN	1 SET.
J - 48	그 그리 집에 살아보고 하고 있다면 하는 사람이 되었다. 그리고 하는 사람들은 사람들이 되었다. 그리고 있다면 하는데 살아보다는 것이다. 그리고 있다면 하는데	i Set
I - 51		1 SET
J - 59	PERMABILITY METER (DIK-40000	1 set
1 - 91	EVAPORATION BOTTLE	50 PCS
J - 202	SHAKER FOR SIEVE WITH 150mm ADAPTER	1 SET
	AND TRANSFORMER	
J - 203	SIEVE 45 MICRON	l PC
	63 MICRON	1 PC
	75 MICRON	1 PC
	150 MICRON	1 PC
	300 MICRON	1 PC
	500 MICRON	1 PC
	CUP AND PLATE FOR SIEVE	1 SBT
6-4 8 -1	XIV. LABORATORY EQUIPMENT II (METEOROLOGY)	
J - 36	IPC SYSTEM	1 SET
	COMPUTER SYSTEM (PC-8801)	1 SET
	ANBMOETER (S-SAI)	1 SET
	AIR TEMPERATURE (S-PT)	1 SBT
	SOIL TEMPERATURE (S-PT)	3 SET
	DEW POINT (S-DW-1)	1 SET
	SOLAR RADIATION (S-SR-1)	1 SET
	LEAF WETNESS (S-DW-C)	1 SET
	EVAPORATION (S-EV)	1 SBT
	CORD (100M0	1 SBT
	POLB (PM-6)	1 SET
	INSTRUMENT SHELTER (IUS-2)	1 SET
	BATTERY POWER SUPPLY	1 SET
	OBSERVATION HOUSE	1 SET
J - 183	IPC COLOR DISPLAY (PC-KD854)	1 SET
J - 125	RAIN GAUGB	1 PC
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	경영 보는 사람들이 이 기를 보고 있다. 이 기계 등 등 경영 등 위치를 가장하지 않는 것이다. [일일] 12 : 12 : 12 : 12 : 12 : 12 : 12 : 12	
J - 126	RECORDER FOR J - 123	
J - 153	CARTRIDGE PEN FOR RAIN GAUGE	
J - 189	ARRESTER FOR IPC SYSTEM	
	SK- I FOR POWER SOURCE	
	SK- 2 FOR SENSER	
	POLE 3 M	
	XV. LABORATORY EQUIPMENT III (COMPUTER SYSTEM)	
J - 37	PERSONAL COMPUTER SYSTEM (PC8001)	
	COLOR DISPLAY	
	PRINTER	
	REGURATOR	
	MANUAL	
J - 144	PERSONAL COMPUTER SYSTEM (PC9801 VM)	1
	COLOR DISPLAY (KD-853)	ı
	PRINTER (PC-PR201 H2)	1
	REGURATOR (SVC-1010-A)	1
	MANUAL	ì
J - 196	BACK-UP POWER SUPPLY (BU502)	1
J - 147	SOFTWARE LIBRARY (MS-DOS)	1
J - 158	SOFTWARE STATISTICS	1
J - 164	SOFTWARE FORTRAN 77	1
	SOFTWARE PLINK 86	1
	SOFTWARE COREGRAPH	1
J • 165	RAN BOARD FOR PC 9801VM	1
J - 184	DATA PROCESSOR	1
	수 있는 것이 하는 것들이는 그들은 것이 되었다. 그래면 되었다. 그래면 되었다. 그래면 되었다. 장면 사람들은 사람들이 하는 것이 하는 것이 되었다. 그는 사람들은 사람들은 사람들은 사람들이 되었다.	
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	성 - 그렇게 하면 하면 등 보고 있는데 가장 하는데 하면 되었다. 그런데 하는데 하는데 하는데 하는데 하는데 하는데 하는데 하는데 하는데 하는	
	그렇게 되었다. 생생 그리고 되어 가지 않아 하는데 되는데 말을 하다. 이 생활이 되었다. 그는 것이다. 그 사람들은 사람들이 나는 것이 되었다. 생생들은 그 보고 사용을 하는 것이 되었다. 그 사람들이 되었다.	
	문 하고 그 말이 하고 한 것이 되는 그는 그렇게 되었다. 현지 전 사는 전하다 보는 것이 한 한 가능한다. 하고 하는 것은 사는 그를 지는 사람들은 사람들은 사람들이 하고 한 한 화를 하고 한 화를 활동하고 있다.	
	교육 시민은 사이 되는 것을 통해 가게 되었다면 하는 것이 되었다. 시합 중에게 제한 경기 위한 일반 때문에 공단 교회 기본 전에 보고 한 경기 등이 되었다면 하는 것들은 기술을 가통하고 있다면 하는 것이다.	·
	가 보고하는 보고 있는 이 전환 경기를 보고 있는 것이 되었다. 그는 사람이 되었다는 그런 사람들이 되었다면 하는 것이 되었다. 그런 그런 그런 것이 되는 것이 되었다. 그는 그는 그는 그는 그는 그런	٠

	[1] 문문 바람이 아니는 하는 하는 그는 그를 보는 것 같아. 이 얼마가 아니라 하는 것 같아.	
	XVI. LABORATORY EQUIPMENT IV (LAND SAT DATA	9
J - 142	NEGATIVE FILM FOR LAND SAT NO. 1, 2, 3	4 PCS
	POSITIVE FILM FOR LAND SAT NO. 1, 2, 3	i PC
	MAGNETIC TAPE FOR LAND SAT NO. 1, 2, 3	1 PC
	NEGATIVE FILM FOR LAND SAT NO. 4, 5	4 PCS
	POSITIVE FILM FOR LAND SAT NO. 4, 5	1 PC
	MAGNETIC TAPE FOR LAND SAT NO. 4, 5	1 PC
	XVII. LABORATORY EQUIPMENT V (TISSUE CULTURI	3)
J + 38	CLEAN BENCH (HITACHI)	1 SET
J -3 9	AUTO CLÁVE (RKI KT-23)	i set
J - 42	REFRIGERATOR (HITACHI)	1 SET
J - 120	CLEAN BENCH (HITACHI)	1 SET
	그 사는 사용을 하는 것이 되었다. 그들은 경기 등에 가장하는 것은 것은 것으로 가장 사용을 받았다. 지금 가장 사용을 통해 없다.	化二氢化二乙甲基醛丁醛
J - 121	NK SYSTEM BIOTRON	1 SET
	NK SYSTEM BIOTRON	ıset
J - 121		
	NK SYSTEM BIOTRON XVIII. LABORATORY EQUIPMENT VI (CHEMICAL ANAL)	
		'SIS)
	XVIII. LABORATORY EQUIPMENT VI (CHEMICAL ANAL) SPECTROPHOTOMETER (UV-120) GLASS CELL	'SIS)
	XVIII. LABORATORY EQUIPMENT VI (CHEMICAL ANAL) SPECTROPHOTOMETER (UV-120) GLASS CELL TUNGSTEN LAMP	'SIS)
	XVIII. LABORATORY EQUIPMENT VI (CHEMICAL ANAL) SPECTROPHOTOMETER (UV-120) GLASS CELL TUNGSTEN LAMP FUSE	'SIS) 1 SET 4 PCS 4 PCS
	XVIII. LABORATORY EQUIPMENT VI (CHEMICAL ANAL) SPECTROPHOTOMETER (UV-120) GLASS CELL TUNGSTEN LAMP FUSE HANDY ASDIBATER (WD-25)	'SIS) 1 SET 4 PCS 4 PCS 5 PCS
J - 27	XVIII. LABORATORY EQUIPMENT VI (CHEMICAL ANAL) SPECTROPHOTOMETER (UV-120) GLASS CELL TUNGSTEN LAMP FUSE HANDY ASPIRATER (WP-25) AUTO STILL (WS-22)	'SIS) 1 SET 4 PCS 4 PCS 5 PCS 2 SET
У - 27	XVIII. LABORATORY EQUIPMENT VI (CHEMICAL ANAL) SPECTROPHOTOMETER (UV-120) GLASS CELL TUNGSTEN LAMP FUSE HANDY ASPIRATER (WP-25) AUTO STILL (WS-22) EUNNEL FOR ARSORPTION	'SIS) 1 SET 4 PCS 4 PCS 5 PCS 2 SET 1 SET
J - 27 J - 50 J - 49	XVIII. LABORATORY EQUIPMENT VI (CHEMICAL ANAL) SPECTROPHOTOMETER (UV-120) GLASS CELL TUNGSTEN LAMP FUSE HANDY ASPIRATER (WP-25) AUTO STILL (WS-22) FUNNEL FOR ABSORPTION GLASS BOTTLE FOR ABSORPTION	'SIS) 1 SET 4 PCS 4 PCS 5 PCS 2 SET
J - 27 J - 50 J - 49	XVIII. LABORATORY EQUIPMENT VI (CHEMICAL ANAL) SPECTROPHOTOMETER (UV-120) GLASS CELL TUNGSTEN LAMP FUSE HANDY ASPIRATER (WP-25) AUTO STILL (WS-22) FUNNEL FOR ABSORPTION	'SIS) 1 SET 4 PCS 4 PCS 5 PCS 2 SET 1 SET 10 PCS 10 PCS
J - 27 J - 50 J - 49 J - 71	XVIII. LABORATORY EQUIPMENT VI (CHEMICAL ANAL) SPECTROPHOTOMETER (UV-120) GLASS CELL TUNGSTEN LAMP FUSE HANDY ASPIRATER (WP-25) AUTO STILL (WS-22) FUNNEL FOR ABSORPTION GLASS BOTTLE FOR ABSORPTION MUFFLE FURNACE (OPM-40)	'SIS) 1 SET 4 PCS 4 PCS 5 PCS 2 SET 1 SET 10 PCS 10 PCS 1 SET
J - 27 J - 50 J - 49 J - 71 J - 96	XVIII. LABORATORY EQUIPMENT VI (CHEMICAL ANAL) SPECTROPHOTOMETER (UV-120) GLASS CELL TUNGSTEN LAMP FUSE HANDY ASPIRATER (WP-25) AUTO STILL (WS-22) FUNNEL FOR ABSORPTION GLASS BOTTLE FOR ABSORPTION	'SIS) 1 SET 4 PCS 4 PCS 5 PCS 2 SET 1 SET 10 PCS 10 PCS 1 SET 1 SET
J - 27 J - 49 J - 71 J - 96 J - 101	XVIII. LABORATORY EQUIPMENT VI (CHEMICAL ANAL) SPECTROPHOTOMETER (UV-120) GLASS CELL TUNGSTEN LAMP FUSE HANDY ASPIRATER (WP-25) AUTO STILL (WS-22) FUNNEL FOR ABSORPTION GLASS BOTTLE FOR ABSORPTION MUFFLE FURNACE (OPM-40) CRASHER (SK-M-10)	'SIS) 1 SET 4 PCS 4 PCS 5 PCS 2 SET 1 SET 10 PCS 10 PCS 1 SET
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J - 135	KIJELDHAL DIJESTORS	2 SBT
J - 116	OVEN (WFO 1000D)	1 PC
J'- 13	CONDUCTIVITY METER (CM-117)	1 PC
1 - 57	pH METER (HORIBA M-8)	i set
J - 138	ph meter (nph-30)	2 set
J - 139	BC METER (U-7 COND.)	2 SBT
	XIX. LABORATORY EQUIPMENT Y (BALANCE)	
J438	BALANCE (METTLER PE3600)	1 PC
J - 78	BALANCE (EK-1200 A)	1 SET
J - 95	BALANCE (AB 166)	1 SET
J - 98	BALANCB (FA2000)	1 SET
J - 99	SHIBLD FOR J-98	1 PC
J - 100	WEIGHT (AD-1600-2K) FOR 1-90	1 PC
J - 136	BALANCE (DP-6000) WITH TRANSFORMER	1 SET
POMPS ?		
	XX. LABORATORY EQUIPMENT VI (AREA METER)	
J - 15	LEAF PUNCHER (NO. 162)	I PC
J • 94	LEAR PUNCHER	1 PC
J • 110	AREA METER (AAM-8)	1 SET
N. A.	BROKEN	
J - 186	AREA METER (AAM-8)	1 SET

7387	XXI. NURSERY MATERIALS	WI I
	deri and private and the control of	
J - 83	SEEDLING REAR POT	30 PCS
J 7 118	JIPPY POT (NO. 517)	5 BOXES
j - 119	PLASTIC TRAY	100; PC\$
J - 166	PLASTIC TRAY	50 PCS
J - 168	LABEL 15X1.9 CM	1000 PCS
	LABEL IOXS,4 CM	1000 PCS
J - 169	POLY POT	2000 PCS
	PAPER POT	1 BOX
J - 176	WAGNER POT	50 PCS
J - 140	CHAIN SAW (B-346-14)	1 SET
J - 141	BIRD NET	12 PCS
	XXII. CHEMICAL EMULSION AND POWDER	
	genga coloni Piroco in 1900 de la C	
J - 53	ASPHALT BMULSION	5 PACKS
J - 73	ASPHALT EMULSION	25 DRUMS
J - 179	ASPHALT EMULSION	2000 LITTER
J - 54	SYNTHETIC RESIN EMULSION (KURICOAT)	6 PACSK
J - 74	SYNTHETIC RESIN EMULSION (KURICOAT)	78 CANS
J - 180	SYNTHETIC RESIN EMULSION (KURICOAT)	1008 KG
J - 87	SYNTHETIC RESIN POWDER (G-20)	30 KG
J - 180	SYNTHETIC RESIN POWDER (G-20)	50 KĠ
J • 87	SOFT CERAMICS (FG-3)	60 KG
J - 178	SOFT CERAMICS (FG-3)15KG/PC	14 PCS
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	보고 있다. 그런 경기 전에 발표하는데 이번 경기 전투에 발표하는데 보고 함께 되었다. 	
	- 아이트의 이 경기는 경험을 가는 것으로 하는 것으로 함께서는 한국을 하시다. 함께 함께 사이를 받는다. 	
	보는 사람들이 한 경기 전혀 가장 보면 수 있습니다. 그는 그런 보고 있는 것이 되는 것이 되었다. 그는 것이 되었다. 	
	. 이 사람들이 전혀 하면 이 경험에 들어 전혀에 들어 보다는 것은 것이 되었다. 그는 것 같아 있다. 사람들이 다른 것이다. 	
	. 하는 사용, 보통 이 전문 기계 기계 기계 기계 보는 것이 되었다. 그는 것이 되었다. 그는 것이 되었다. 	
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	[하는 하다 이 얼마는 몸으로 다니면 다른 하는 말을 하다고 했다.	
	하는 방법에 말한 눈말을 보지 뭐 물로 불로 보는 이 호환 없었다.	
	· 보기 의 기술에 있는데 보는 지역 하고 있는 나는 항상 등을 되었다.	
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XXIII. OTHERS

J - 29	INSECTICIDE AND PESTICIDE	120 PCS
J - 84	INSECTICIDE (ORTHORAN)	50 BAGS
J - 30	FERTILIZER (14;14:14)	30 PCS
J - 31	COMPOST (BARK 20KG/BAG)	10 BAGS
J - 55	COMPOST (BARK 20KG/PACK)	500 PACKS
J - 181	COMPOST (BARK 20KG/BAG)	200 BAGS
J - 33	IRRIGATION TUBE (EVAFLOW)	10 PCS
J - 172	IRRIGATION TUBE (EVAFLOW)	2 PCS
J - 163	INDOLE BUTYLIC ACID EMULSION (OXYBELON)	10 PCS
	INDOLE BUTYLIC ACID POWDER (OXYBELON)	2 BOXES
	HYPONEX	10 PCS

J - 72	B (ooks			r Majakk Kat Katang Pe				10 VOLS
J - 89	B (OOKS		455			andi Pagada		1 LOT
J - 105	BO	ooks	erio de la Gasta ant	1 / 1 Y					2 VOLS
J - 143	ВС	OOKS							i lot
J 158	B(OOK							1 PC
J - 161		OKS							5 VOLS
J.4.171	ВС	OKS							25 VOLS
		AVAS (L							
			9(-);						
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V. DISPATCH OF EXPERTS

V. DISPATCH OF EXPERTS				
Experts mentioned below	v vere dispa	atched by	IICA to co	nduct the Joint
Study Project in the perio	od of 1985	to 1988.		
			Bakuli (Alla	
Short-term Experts		(18 15 Desk 21/2)	eng translations	
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COLUMN TABLE			
Short-te	31 JU 123	perts	
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Short-term Experts		
Name	Speciality	Duration of Dispatch
Dr,Keiichiro Matsuda		(1) 12-29 Sep., 1985
	Soil Science and	(2) 15-28 Dec 7 1985
	Plant Nutrition	(3) 2-20 Sep. 1986
		(4) 17-30 Nov. 1986
	이 1.5 시간에 한 경험 1.4 시간 전략 (1.4 시간) 1.4 시간 전략 2.5 시간 시간 시간 시간 시간 시간 1.4 시간 1.4 시간	(5) 3-16 Apr. 1987
		(6) 17-31 Dec. 1987
		(7) 16-30 Sep. 1988
		(8) 16-31 Dec., 1988
Dr.Miroshi Murai	Forest Hydrology	(1) 12-29 Sep. 1985
		(2) 15-26 Jun. 1986
		(3) 2-20 Sep. 1986
		(4) 18-31 Dec. 1986
		(5) 3-16 Apr. 1987
		(6) 17-31 Dec. 1987
		(7) 16-26 Sep. 1988
Dr.Mamoru Nagai	Crop Science	(1) 12-29 Sep. 1985
		(2) 15-28 Dec. 1985
Mr.Yasuo Yuasa	Silviculture	(1) 15-28 Sep. 1985

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Branch and the control of the contro
    Dr.Hitoshi Sawada
                                                                                     Crop Science
                                                                                                                                                         (1) 2-20 Sep. 1986
    ban no 18 magain and angus an 1987 angus (2) 22 Jun. 5 Jul. 1987
    (3) 15-26 Mar. 1988
   Dr.Atsushi Ooishi
                                                                                Horticultural Plant (1) 15-26 Mar.
                                                                                                                                                                                                                    -1988
                             Propagation
  Dr. Yoshitaka Kakubari Silviculture (1) 10-21 Apr. 1988
                                                                   DADYAUT) - Son Feb. America. I. Libbar.
  Mr.Satoru Tsuchiya Porest Hydrology (1) 10-21 Apr. 1988
                                                                              Alteration of the territorial and the
  Long-term Experts
                                                                              Cherto Cressiana de distribución de
                                           Criminitation area in a real property of the
  Mr. Hiromi Yokota Plant Nutrition 20 Aug. 1985-19 Aug. 1987
                     foliación e cost oxide da cela folial diagrafación
  Mr. Akira Koto
                                                                        Soil Science and 20 Aug.
                                                                                                                                                                                                             1985-7 Apr.
                                  Soil Conservation
                                                                                                                       Mr.Shinji Yoshizaki Silviculture 11 Apr. 1987-9 Apr. 1989
                                                                   Mr.Hiroyasu Onuma
                                                                    Plant Nutrition 1 Aug. 1987-5 Apr. 1989
                                                     CONTROL OF BURNEY, MARKET VILLEY OF THE SERVICE
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V1. OBSERVATION AND RESEARCH WORKS BY COUNTERPARTS

THE MARKET Tangas kan mengalik sebawaa tangat Hord

Counterparts mentioned below were invited to Japan for observation and research works on the arid land agriculture in the period of 1986 to 1989.

The latter thank as an CD and the Least below the

Dr. Ababahi Motent

Name

Period of visit/Institutions visited

Dr. Abdur-Rhaman Saghir 14 Jan. 1987-27 Jun. 1987

JICA Headquarters (TOKYO)

Shizuoka University (SHIZUOKA)

Kyoto University (KYOTO)

Tokyo University (TOKYO)

Ministry of Agriculture (TSUKUBA)

-Tropical Agriculture Research Center

-National Institute of Agro-Environmental

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-National Institute of Agrobiological

Resources

Dr. Mahmoud A. Al'Afifi

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28 Oct. 1986-8 Nov. 1986

JICA Headquarters (TOKYO)

Shizuoka University (SHIZUOKA)

Tottori University (TOTTORI)

Tsukuba University (TSUKUBA)

Ministry of Agriculture (TSUKUBA)

-Tropical Agriculture Research Center

-National Institute of Agro-Environmental

Sciences

-National Institute of Agrobiological

Resources

in Francisco

Mr.Suhayl A. Itani

Saahii kantif

位加特别特 医环酸症

24 May 1987-21 Aug. 1987 JICA Headquarters (TOKYO) Shizuoka University (SHIZUOKA) Kyoto University (KYOTO) Tokyo University (TOKYO) Tottori University (TOTTORI) Ministry of Agriculture (TSUKUBA) Tropical Agriculture Research Center -National Institute of Agro-Environmental Sciences

-National Institute of Agrobiological. Resources

Forestry and Forest Products Research Institute

Dr.A. Almasoum

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1 Júl. 1988-28 Jul. 1988 JICA Headquarters (TOKYO) International Meeting on Remote Sensing (KYOTO)

Shizuoka University (SHIZUOKA) Tottori University (TOTTORI) Tsukuba University (TSUKUBA) Ministry of Agriculture (TSUKUBA) -Tropical Agriculture Research Conter -National Institute of Agrobiological Resouces

-Forestry and Forest Products Research Institute

Dr.A.S. Ibrahim

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JICA Headquarters (TOKYO)

Shizuoka University (SHIZUOKA)

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Ministry of Agriculture (TSUKUBA)

-Tropical Agriculture Research Center

-National Institute of Agrobiological

Resouces

-Forestry and Forest Products Research Institute

Dr.I. Haffar

JICA Headquarters (TOKYO)

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Tottori University (TOTTORI)

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-Tropical Agriculture Research Center

-National Institute of Agrobiological

Resouces

-Forestry and Forest Products Research Institute

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वस्त्र हो कर्षे । यो का ने स्टाइस्ट्री कर केरो सम्बोधिक है है है कि विश्वीत है

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VII. ACKNOWLEDGEMENT

The Joint Study Project Team between UAE University and Shizuoka University is indebted to His Hiness Shaikh Nahyan bin Mubarak Al Nahyan, President of UAE University and Dr. Abdul-Hafez M. Elkordy, Acting Vice Chancellor of UAE University, and staff members of the Faculty of Agricultural Sciences, UAE University during implementation of the Project.

We wish to express our appreciation to staff members of Al Ain Agriculture Department, Al Ain Forestry Department, and Central Laboratory of Ministry of Agriculture and Fisheries for their kind arrangements during our studies.

We also would like to appreciate staff members of the Embassy of Japan in Abu Dhabi, Japan International Cooperation Agency (JICA) and the Faculty of Agriculture, Shizuoka University for their counsel and advice during the implementation of the Project.

