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FORAGE DEVELOPMENT IN SEMI-ARID AND IRRIGATED
LANDS OF LEBANON

I - A study on the introduction of drought resistant forage
species to the semi-arid areas of Baalbeck-Lebanon

by

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A STUDY ON THE INTRODUCTION OF DROUGHT RESISTANT
FORAGE SPECIES TO THE SEMI-ARID AREAS OF BAALBEK-LEBANON

INTRODUCTION

Lebanon is greatly dependant on import of animal products to feed its population. The scarcity of pastures and the limited availability of good forage during the whole year, constitute the major factors which limit the expansion of milk and meat industry in Lebanon.

As a result, one of the basic policy objectives of the Government is the development of pasture and fodder production to raise enough livestock to supply the country with its needs of milk and meat products.

Recently, great attention has been directed to the abandoned agricultural lands for the expansion of forage cultivation. Sears (1965) estimated the total, area of these lands to about 150,000 hectares. A recent study by the writer (1968) mentioned a bigger area to cover about 175,000 hectares. The abandoned land in Bekaa Province constitute 45% of the area (79,400 hectares). In this province, most of these lands are located in Baalbek and Hermel; 39,000 and 21,000 hectares respectively. The remainder (about 19,000) are found in Rashya, Zahleh, and Western Bekaa. All of these uncultivated areas in the Bekaa are semi-arid lands. Naturally grown dry-land vegetation is scattered in communities all over the area. Its poor quality herbage is overgrazed by goats and sheep.

Intensive researches and trials have to be carried out to find out the most suitable forages which can survive the severe climatic factors occuring in these semi-arid areas during summer time. Ahlgern (1965) mentioned that for successful cropping in resembling areas, grasses must be resistant to heat, strong winds, and severe aridity. They must withstand

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droughts through dormancy or prompt maturity and reseeding. Ability of seeding grasses to establish in spite of heat and drought is a much desired characteristic.

He also mentioned that adapted grasses must take full use of limited moisture supplies by producing new tillers, rhizomes or stolons, or by renewing old growth.

The present study was carried out in the semi-arid area, North of Baalbek to test the establishment and growth of some introduced dry-land forage species and to recommend the most suitable forages which can be successfully cultivated in this area.

MATERIALS AND METHODS

The present investigation was conducted at the Demonstration Farm of the Ministry of Agriculture at Shaat, 25 Kilometers north of Baalbek. The experimental area was divided into 29 plots; each measuring 40 square meters. Seeds of 29 drought resistant forage species, used in this study, were introduced from Desert Seeds Company, California, U.S.A. and the seed arrived in Lebanon on the first of March, 1969. The species of imported seeds are recorded in Table (1).

Seeding was done on the 5th of March 1969. Quantity of seeds per plot for each species was determined according to the list of seeding rates mentioned by Huges et al. (1953).

To evaluate the success of the introduced species in establishment and growth, the percentage of ground surface covered by the species was estimated. For such evaluation, a frame 1 square meter subdivided into 100 squares by means of wires stretched across the frame, was used. An estimate was made by eye of the proportion of ground cover by the species. When brought to a percentage the total vegetal cover plus bare ground should make up 100 (BROWN, 1954).

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Table 1: Introduced forage species used in the present investigation.

Common name	Scientific name
Crested wheatgrass	<u>Agropyron cristatum</u>
Western wheatgrass	<u>Agropyron smithii</u>
Slender wheatgrass	<u>Agropyron trachycaulum</u>
Bluebunch wheatgrass	<u>Agropyron spicatum</u>
Stiffhair wheatgrass	<u>Agropyron trichophorum</u>
Intermediate wheatgrass	<u>Agropyron intermedium</u>
Tall wheatgrass	<u>Agropyron elongatum</u>
Turkistan bluestem	<u>Andropogon ischaemun</u>
Caucasian bluestem	<u>Andropogon intermedius</u> var. <u>Caucasius</u>
Big bluestem	<u>Andropogon gerardi</u>
Little bluestem	<u>Andropogon scoparius</u>
Sand bluestem	<u>Andropogon hallii</u>
Bluegrama grass	<u>Bouteloua gracilis</u>
Side-oats grama	<u>Bouteloua curtipendula</u>
Black grama	<u>Bouteloua eripoda</u>
Rothrock grama	<u>Bouteloua rothrockii</u>
Slender grama	<u>Bouteloua filiformis</u>
Smooth brome grass	<u>Bromus inermis</u>
Buffalograss	<u>Buchloe dactyloides</u>
Bahiagrass	<u>Paspalum notatum</u>
Sand lovegrass	<u>Eragrostis trichodes</u>
Weeping lovegrass	<u>Eragrostis curvula</u>
Boer lovegrass	<u>Eragrostis chloromelas</u>
Lehman lovegrass	<u>Eragrostis Lehmaniana</u>
Yellow Indiangrass	<u>Sorghastum nutans</u>
Dropseed	<u>Sporobolus cryptandus</u>
Cocksfoot	<u>Dactylis glomerata</u>
Harding grass	<u>Phalaris tuberosa</u> var. <u>stenoptra</u>
Russian wildrye	<u>Elymus junceus</u>

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The following degrees of cover attributed to Braun-Blanquet (1932) were applied in this study and are shown in Table 2.

Table 2: Degrees of cover based on percentage of ground surface cover by species (after Braun-Blanquet, 1932)

Degrees of Cover	Percentage of ground surface covered by species
	%
1	0 - 5
2	5 - 25
3	25 - 50
4	50 - 75
5	75 - 100

Estimation of percentage cover was done in the middle of November 1969 after about five months of severe semi-arid climatic factors.

RESULT AND DISCUSSION

Average precipitation in the area under study is irregular and ranges from 10 to 15 inches annually.

High temperatures and severe periodic droughts occur in summer time. Days are bright and clear during much of the growing season with frequent hot, dry winds, followed by cool nights.

Soil is gravely with different sizes of rocks scattered on the soil surface and found in the subsoil. After rains, soil texture becomes very hard and forms a large, hard, irregular mass very difficult to till. This phenomenon is one of the main characteristics of the semi-arid soils due to salt accumulation as a result of shortage in rainfall.

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Visual observation done in June 1969 indicated the success of fifteen species out of the 29 introduced forage species used in this experiment.

In November 1969, percentage of ground surface covered by each of the successful species was secured by means of the frame mentioned in the part concerning the Materials and Methods. From the data obtained "Degrees of Cover" adopted by Braun-Blanquet was determined and are shown in Table 3.

Table 3: Degrees of cover of the successful introduced forage species based on percentage of ground surface covered.

Introduced Species	Degrees of Cover	Percentage of ground surface covered
Tall wheatgrass	5	75 - 100
Smooth brome grass	5	
Harding grass	5	
Crested wheatgrass	4	50 - 75
Russian wildrye	4	
Western wheatgrass	3	25 - 50
Slender wheatgrass	3	
Stiffhair wheatgrass	3	
Cocksfoot	3	
Big bluestem	3	
Bluebunch wheatgrass	2	5 - 25
Intermediate wheatgrass	2	
Caucasian bluestem	2	
Little bluestem	2	
Sand bluestem	2	

Data in Table 3. indicate that Tall wheatgrass, Harding grass, and Smooth brome grass were the most successful dry-land forage species used in the present investigation. These three species might be of great importance in any future project planned for the development of forage production in the semi-arid areas north of Baalbek.

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Other successful species by order of importance are crested wheatgrass, Russian wildrye, western, slender, and stiffhair wheatgrasses, cocksfoot, and big bluestem. The last five species covered only an area ranging from 25 to 50% of the total area.

The other species covering from 5 to 25% of the total area were Bluebunch and intermediate wheatgrasses, and Caucasian, little and Sand bluestems. Although these species did not show great success in establishment and growth, they may prove their worthiness when reseeded at the proper time in future experiments.

The failure of the other 14 forage species might be attributed to either unfavourable environment conditions or to the unsuitable seeding date which was carried out in March 1969. It is of great importance to note that for successful establishment, drought resistant species should maintain their characteristic deep root systems before the beginning of the dry, hot season which starts from June till the end of September. This may explain the failure of some of these species in their establishment. Reseeding in November might indicate those species which definitely cannot be adapted to the environmental conditions of the region.

A new trial was started in the middle of November 1969 in the same area to test the growth and establishment of the 14 failure species. In the new trial, forage species which have already shown great promise were planted in bigger areas in order to obtain data on the yield and quality of their herbage.

It thus appears from the present investigation that some valuable drought resistant forage species can be introduced to the semi-arid areas of Bekaa Province. The most successful forage species are Tall wheatgrass, Harding grass, Brome grass, crested wheatgrass, and Russian wildrye. Further studies should be carried out to determine the nutritive value of the herbage and the livestock carrying capacity per hectare for each of the newly introduced forage species.

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SUMMARY

An experimental study was carried out in the semi-arid areas of Baalbek - Lebanon to test the growth of 29 introduced drought resistant forage species. Seeding was done on March 1969 in plots, each measuring 40 squares meters. Introduced species used in this experiment belong to wheatgrasses, bluestems, gramagrasses, bromegrasses, buffalograss, bahia-grass, wildryes, lovegrasses, yellow Indiangrass, harding grass, and cocksfoot.

Fifteen out of the 29 species were successful in their establishment and growth. These species have been arranged in a descending order according to their relative degree of success as follows:

Tall wheatgrass (Agropyron elongatum), Smooth bromegrass(Bromus inermis), Harding grass (Phalaris tuberosa var. stenoptra), Crested wheatgrass (Agropyron cristatum), Russian wildrye (Elymus junceus), Western wheatgrass (Agropyron smithii), Slender wheatgrass (Agropyron trachycaulum), Stiffhair wheatgrass (Agropyron trichophorum), Cocksfoot (Dactylis glomerata), Big bluestem (Andropogon gerardi), Bluebunch wheatgrass (Agropyron spicatum), Intermediate wheatgrass (Agropyron intermedium), Caucasian bluestem (Andropogon intermidius var. Caucasius), Little bluestem (Andropogon scoparius), Sand bluestem (Andropogon hallii).

The failure of the other 14 species might be attributed to either unfavourable environment conditions or to the unsuitable seeding date. It is beleived that these species did not have enough rains for the full development and establishment of their characteristic deep root systems to resist the hot and dry summer prevailing in the area from May till the end of September.

A new trial was started in the middle of November 1969 in the same area to test the growth and establishment of the 14 failure species. In the new trial, forage species which have already shown great promise were planted in bigger areas in order to obtain data on the yield and quality of their herbage. Results obtained might help the project now being planned by the Government to use the semi-arid areas in Lebanon for fodder production.

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