

# Can We Produce Seed of Indigenous Pasture Species in Hot Humid Gulf Climate to Re-vegetate Our Degraded Rangelands?

- A Success Story -



**Association of Agricultural Research Institutions  
in the Near East and North Africa  
ICARDA West Asia Regional Program, P. O. Box 950764  
Amman - Jordan**

**Can We Produce Seed of Indigenous  
Pasture Species in Hot Humid Gulf  
Climate to Re-vegetate Our  
Degraded Rangelands?**

**- A Success Story -**

**BY**

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# ***FOREWORD***

The Executive Committee of the Association of Agricultural Research Institutions in the Near East & North Africa (AARINENA) has recently decided to publish success stories from member institutions in the Region. Disseminating this information will benefit member countries through adoption of agricultural research technologies in our region.

The present publication is the first in these series. The aim of this study is to demonstrate that the seed of indigenous pasture species could be produced in the Gulf climate throughout the year to re-vegetate degraded rangelands. The study indicated that the seed of the species *Cenchrus ciliaris* could be harvested within couple of weeks to obtain optimum quantity of high quality seed under the climatic conditions of Oman.

**Executive Secretary,  
AARINENA**

# *I. Introduction*

The Sultanate of Oman, situated at the eastern end of the Arabian Peninsula, facing the Arabian Sea and Gulf of Oman, is the third largest country in the Peninsula occupying 309, 500m<sup>2</sup> it has a variety of topographical features consisting of plains, wadis and mountains. The most important area for agriculture is the coastal plain, which represents 3% of the total area. The mountain ranges occupy about 15% and the remaining area that occupies 82% of the country is mainly sand and gravel desert (MI, 1999). The climate- that essentially consists of warm, sunny winters and very hot summers- varies from region to region, with the coastal areas more humid than the Interior and high altitude areas. In the South, Dhofar region has a moderate climate. With the exception of Dhofar region in the South where monsoon rains occur between May and September, rainfall throughout most of the country is generally light and irregular < 50 to 100 mm annually). Ground water is the main source for irrigation and domestic use.

Oman has a large area of rangelands in the Arabian Peninsula. For instance, in Dhofar region itself, it has rangeland area of about (500) thousand hectares. Of late, these rangelands are slowly degraded due to prolonged spell of drought since early 1990s and rise in ground water salinity all along the coastal regions. Indiscriminate heavy grazing is yet another factor for reduced availability of good quality forage species in the rangelands. The result of degradation of rangelands has been endangerment or even loss of indigenous plant species, accompanied by low rangeland productivity. Rangelands assessment of the Dhofar Jabal areas had identified a great trend in decreasing productivity and quality (Zaroug, 1983 and 1991; Yassin and Al-Shanfari, 1985; UNDP/FAO Project, 1990; MAF, 1990; GRM, 1989 and RFD, 1995, 1996, 1997). Decline in range quality reflected in the increased abundance of herbs of poorer quality species at the cost of good quality forages that are in the stage of extinction due to over grazing.

Decline in productivity on the other hand, is evidenced by lower forage yields and increased dependence on concentrates and baled hay to maintain local herds. The loss of vegetation also results in soil erosion and loss of wildlife habitat and food resources.

The indigenous pasture plants viz. herbs, shrubs, tree and grass species represent valuable genetic and economic resources that are in danger of being lost. Some species that currently have ecological and biodiversity values may also have great economic value in the future. It could be used as a source of adaptation to environmental stresses of heat, drought and salinity. Oman recognizes the threat to its native pasture plant species.

More than 100 germplasm accessions of indigenous pasture species have been collected from the rangelands under ICARDA- APRP Phase I during 1998 and Phase II during 2002, which are part of genetic diversity.

In order to re-vegetate these degraded rangelands, seed of indigenous pasture species should be multiplied. Multiplication of seed of prioritized pasture species has been one of the main objectives of rangeland component' of ICARDA-APRP Phase-II. In the present investigation, series of experiments were conducted to streamline seed production

procedures in two indigenous pasture species viz. *Cenchrus ciliaris* (UAE Accession No. MAF-120) and *Coelachyrum piercei* (UAE Accession No. MAF-116).

## ***II. Objectives***

- i. Multiplication of seeds of prioritized pasture species from initial very low quantities (mg).
- ii. Determination of the appropriate inter-row and inter-plant spacing for maximizing seed yield of pasture species,
- iii. Determine the appropriate irrigation system for seed multiplication of pasture species.
- iv. Find the appropriate time of maturity for harvesting maximum high quality seed in pasture species.
- v. Re-vegetation of degraded rangelands of northern Oman with 50 to 100 mm rainfall.

## ***III. Methods used***

In the beginning, bulk seed multiplication of two pasture species was taken up at Sohar Research Station under drips in an area of 250 m<sup>2</sup>. following appropriate crop husbandry practices under drips during summer 2000 (**Plates 1 to 2**).

Subsequently during 2001-02, this task was extended at Livestock Research Center Rumais in an area of about 350 m<sup>2</sup>. to multiply seed of *Cenchrus ciliaris*.

Simultaneously several experiments were conducted from 2001 to 2003. under drips and sprinklers in modified Factorial Randomized complete Block Design to study the effect of inter-row (50 and 100 cm) and interplant (25, 50 and 100 cm) spacing on seed yield of grass species (**Plates 3 to 5**).

The effect of maturity stage on seed weight per se and seed quality of grass species was studied in the same experiment by sampling the inflorescences at physiological maturity (PM) and 1, 2, and 3 weeks after PM and statistically analyzing seed weight/inflorescence and germination (**Plate 6**).

Ultimately, seed of *Cenchrus ciliaris* was used for re-seeding an area of 2000 m<sup>2</sup> at unprotected site in one of the wadis immediately after first showers during December 2002 to study the prospect of re-vegetation and extend the same in as many as 20 sites in the Interior Oman during winter 2004.



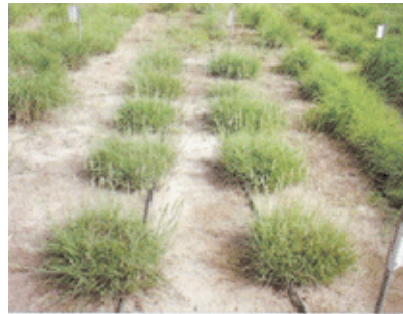
**Plate 1.** General view of the seed multiplication plot of *Cenchrus ciliaris* L. at Agriculture Research Station, Sohar.



**Plate 2.** Collection of matured panicles in the seed multiplication plot of *Cenchrus ciliaris* L. at Agriculture Research Station, Sohar.



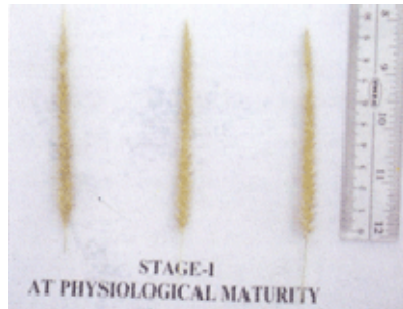
**Plate 3.** General view of an experiment on investigation of the effect of inter-row and inter-plant spacing on seed yield of indigenous rangeland grass species at Livestock Research Center, Rumais.



**Plate 4.** Plant stand of indigenous *Cenchrus ciliaris* in 1m X 1m spacing after IV the harvest at Livestock Research Center, Rumais.



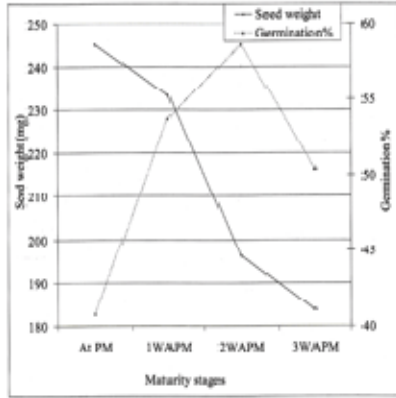
**Plate 5.** Collection of panicles for studying the effect of maturity stage on seed weight per se and seed quality in indigenous rangeland grass species.



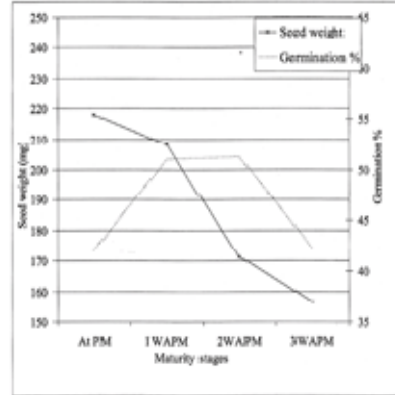
**Plate 6.** Panicles of *Cenchrus ciliaris* L. harvested at physiological maturity stage.

## ***IV. Results achieved***

- i. We were able to collect to about 13.6 kg seed (with husk) of *Cenchrus ciliaris* (with 34.37 % germination) from initial 6 g and 12.6 kg seed of *CoeZachyrum piercei* (with 37.62 % germination) from initial 8 g from eight harvests from the plots of 250 m<sup>2</sup>. laid at) sohar Research Station. About 37.50-kg seed of *Cenchrus ciliaris* was harvested so far from Livestock Research Center, Rumais. The seed material is under utilization in our task of re-vegetation and other experiments. Non-synchronous formation of inflorescences and early shattering of seeds were the problems faced during seed multiplication and harvesting the two pasture species (Nadaf *et al.* 2004).
- ii. The grass species produced higher mean seed yield (with husk) under wider rows (100 cm) than under narrow rows (50 cm) in both the irrigation systems during each harvest. Under drips, *Cenchrus ciliaris* produced significantly higher mean seed yield of 356.20 kg/ha at 100 cm than at 50-cm row spacing (306.42 kg/ha). Similarly, *coelachyrum piercei* also produced higher seed yield of 291.91 s/ha at 100 cm than at 50-cm row-spacing (264.87). Under sprinklers, *Cenchrus ciliaris* produced higher seed yield of 270.60 kg/ha at 100 cm than at 50-cm row spacing (245.36 kg/ha). Similarly, *coelachyrum piercei* produced higher seed yield of 229.96 kg/ha at 100 cm than at 50-cm row-spacing (197.93 kg/ha). Higher seed yield as also obtained under wider inter-plant spacing in both the pasture species. The two grasses showed very low germination % when tested immediately (1-2 weeks) after harvest not only for bulk seed (0 to 1.5%) but also for selected seed (0.8% to 2.8%). Mean germination % of grass species recorded after 12 months of harvests was significantly greater (52.62%) than that recorded after 5 months (33.67%) of harvests. *Cenchrus ciliaris* recorded significantly ( $p < 0.01$ ) highest germination % (49.68 %) as compared to *CoeZachyrum piercei* (38.71%). Selected seed had significantly ( $p < 0.01$ ) higher germination % (53.21%) than bulk seed (33.08%) (Nadaf *et al.*, 2004a).
- iii. Drips irrigation system was found to be more appropriate for seed multiplication of pasture species as seed yield levels under sprinklers were lower than those obtained under drips due to shattering of seeds by the frequent hits of sprinkler drops (Nadaf *et al.*, 2004 a).
- iv. Seed of indigenous pasture species studied viz. *Cenchrus ciliaris* could be harvested just about a week (**Fig 1 and 2**) after the crop attains physiological maturity to obtain optimum quantity of high quality seed (with germination % of 51.24 to 58.57). Good quality seed could be harvested in winter than in summer during which deterioration of seed was faster (Nadaf *et al.*, 2004b).
- v. The average regenerated plant density ranged from 2.79/m<sup>2</sup> to 6.78/m<sup>2</sup> recorded, respectively, three and nine months after the task of seeding of *Cenchrus ciliaris* during December 2002 at a site in the wadi Sharadi (**7 to 8**).



**Fig. 1.** Effect of maturity stages (PM (Physiological Maturity), 1, 2, and 3 Weeks After Physiological Maturity (WAPM) on seed weight / inflorescence and germination % of *Cenchrus ciliaris* at LRC (Rumais).



**Fig. 2.** Effect of maturity stages (PM (Physiological Maturity), 1, 2, and 3 Weeks After Physiological Maturity (WAPM) on seed weight/inflorescence and germination % of *Cenchrus ciliaris* at IRS (Interior).



**Plate 7.** Closer view of germinated plants of indigenous *Cenchrus ciliaris* 1. in a wadi area after three months of re-seeding.



**Plate 8.** Closer view of browsed plants of indigenous *Cenchrus ciliaris* in a wadi area.

About 47.66 % of the plants were found grazed at the time of flowering by local goats and sheep. This site formed primary source of these plants for further spread of their seed through either wind at maturity or run-off water in the wadi after subsequent rains. The preliminary inspection after first showers made during second week of January 2004 has indicated that the seeds have spread over 2 km all along the wadi where germinated seedlings of *Cenchrus ciliaris* have been noticed. Re-seeding of local *Cenchrus ciliaris* was extended in 20 sites during March- April 2004 in the Interior Oman immediately after late winter rains. The encouraging results have been obtained from these sites.

## ***V. Conclusions***

Our studies clearly demonstrated that seed of indigenous pasture species like *Cenchrus ciliaris* and *Coelachyrum piercei* could be produced in the Gulf climate throughout the year to re-vegetate degraded rangelands of Oman. The seed yield (with husk) of *Cenchrus ciliaris* could be obtained to the extent of 306.42 to 356.20 kg/ha under drips and 245.36 to 270.60 kg/ha under sprinklers during each harvest. These seed yield (with husk) levels of *Cenchrus ciliaris* are comparable with the seed yield levels reported elsewhere (10-60 kg/ha (Skerman and Rivorose, 1989) and 100-200 kg/ha (Chatterjee and Das, 1989)). Our studies have demonstrated for the first time that seed of indigenous pasture species viz. *Cenchrus ciliaris* could be harvested just within couple of weeks after the crop attains physiological maturity to obtain optimum quantity of high quality seed through out the year under the climatic conditions of Oman.

## ***VI. Acknowledgements***

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