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Plantation of fodder shrubs in arid and semi-arid zones of Iran

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SUMMARY - Iran's rangelands occur in the steppe, substeppe and xerophilous zones occupying 90 million hectares of the country. Topography is varied from 22 m below sea level up to 5670 m elevation. Precipitation ranges from 25 mm (central desert) to 1600 mm (forest) per annum. Rangelands of the country have been in a poor condition for many years. Its current production provides only 20-25% of the total feed requirements of existing herds and flocks which amount to 115 million sheep equivalents. Fodder shrub species such as: *Atriplex spp, Artemisia herba-alba,* and *Erotia ceratoides* are used for revegetating degraded rangelands.

Key words: Rangeland, *Atriplex canescence, Atriplex lentiformis, Atriplex halimus, Artemisia herba-alba, Erotia ceratoides.*

RESUME *- "Plantation d'arbustes fourragers dans des zones arides et semi-arides en Iran". En Iran, les pâturages se trouvent dans la steppe, la substeppe et les zones xérophylles répartis sur 90 millions d'hectares dans le pays. La topographie varie entre 22m. au-dessous niveau de la mer et 5670 m. d'élévation. La précipitation varie entre 25mm. (désert central) et 1600 mm. (forêt) par an. Les parcours du pays ont été dans de mauvaises conditions pendant beaucoup d'années. Leur production courante fournit seulement 20-25% des besoins alimentaires totaux des troupeaux existants qui représentent environ 115 millions d'équivalents moutons. Les espèces arbustives fourragères telles que* Atriplex *spp.,* Artemisia herba-alba, *et* Erotia ceratoides *sont utilisées pour reformer la végétation des parcours dégradés.*

Mots-clés *: Parcours,* Atriplex canescence, Atriplex lentiformis, Atriplex halimus, Artemisia herba-alba, Erotia ceratoides.

Introduction

The rangelands in Iran have been in an extremely degraded condition requiring urgent and drastic action to return the nation's soil resources and livestock industry.

A massive effort has been required to deal with the problem on a national scale. Therefore, to overcome the situation, the Range Department, as a Governmental agent, has started to draw up and conduct integrated plans for the application of suitable range rehabilitation techniques that will lead to an overall improvement in vegetation cover, increase the availability of forage for livestock and alleviate the grazing pressure on exhausted range sites of the country.

Materials and methods

In order to aim at conducting a sound range management policy, various range improvement and rehabilitation projects and techniques were and are being applied. In this paper, due to limited time and space, only shrub planting on arid and semi-arid rangelands will be discussed briefly. Information presented here are either observational or the results gained from works during the past 26 years of experience in the field.

For most areas it is essential to establish shrubs by sowing seeds in the field (direct seeding). Shrub establishment by direct seeding into degraded rangelands receiving less than 300 mm precipitation per annum faced many hazards. Hence, use of seedlings raised in plastic bags or trays were favoured.

Most shrub plantings on degraded rangelands of Iran have been and are from nursery-raised seedlings rather than direct seeding. The most common species used were: *Atriplex canescens, Atriplex lentiformis, Atriplex halimus, Artemisia herba-alba, Eurotia ceratoides*. Raising and establishment of the two latter species were difficult and unsatisfactory, consequently we had to use the three former species for the time being.

Atriplex canescence and *Atriplex lentiformis* are introduced and *Atriplex halimus* is a native species.

Raising seedlings

Three to four months before the opening rains nurseries of shrub species were prepared at sites close to the transplanting sites, preferably where water was available for irrigation of the seedlings. The size of plastic bags was 10 cm diameter and 20 cm high (currently 7 cm x 18 cm, and for use of trays 5 x 14 cm).

Plastic bags were filled to within 3 cm of the top with a soil mixture 35% by volume of clay loam, 30% manure and 35% sand.

For assurance and increasing germination rates the clean and healthy seeds were soaked in water for 24 hours. Then, two to four seeds were placed on the mixed soil surface in each bag and then covered by about 1 cm of fine sand.

Transplanting

Three month old seedlings (10-20 cm high) raised at the nurseries were then transplanted, by hand, (currently by mechanical planters) into prepared contour furrows or diggings with the depth in accordance with the length of pots.

The contour furrows were (in general) 4 m apart and the distance between the plants was 3 m. The seedlings were irrigated at the time of transplanting. In waterlogged areas *Atriplex spp.* were planted in mounds to overcome the waterlogging effects on growth.

Results and discussion

Transplanting of *Atriplex spp.* gave good results specially when the plantations were combined with suitable water conservation practices and protected from grazing for 12-18 months.

Application of 2-4 litres of water for each single seedling once after transplanting assured establishment of plants.

Within four years, under protection, growth of transplanted seedlings, on average, reached 1-1.5 m high covering an area of 1.5-2 m^2 each single plant. During this period of time forage production of the rehabilitated sites increased from 130 kg dm ha^{-1} to 1200 kg dm ha^{-1}.

Their tolerance to grazing from mid autumn till late winter was good, but after that grazing left harmful effects on the bushes.

Under controlled grazing management, annual growth of bushes showed better results when the sites were grazed by combination of sheep, goats, and camels, because sheep and goats graze lower parts of plants and camels browse the higher parts. Consequently most parts of bushes, virtually, were stimulated evenly.

Atriplex canescens was more drought and cold (-10ºC to -15ºC) tolerant than the *Atriplex halimus* and *Atriplex lentiformis*. Volunteering ability of *Atriplex canescence* was lesser than *Atriplex lentiformis* and *Atriplex halimus*.

In some cases, at planting time the seedlings (probably due to too much irrigation in the nursery) appeared to be very soft. Hardened plants may handle better and be less likely to require watering.

Established stands which were protected from grazing for more than 4-5 years started to dry up from tips.

Establishment by direct seeding especially with the seeds of *Artemisia herba-alba* and *Erotia ceratoides* did not succeed on the areas receiving less than 250 mm precipitation per annum.

Conclusion

Observations made and experiences gained since late 1960's with the implementation of various techniques for improvement and rehabilitation of rangelands showed that establishment of nursery raised seedlings of bushes in arid and semi-arid zones of the country was more reliable than direct seeding.

Establishment of bushes and rehabilitation of degraded rangelands in large scales require adoption of low cost methodology. Hence, efforts should be continued for achievement of success in establishing fodder shrubs by using direct seeding methods.

Recommendations arising from experience

Socio-economic context

Solving the problems of communal use of common rangelands must precede the application of technological solutions.

There should be close consultation with graziers and land users, prior to planting programmes, concerning forage requirements and plans for utilization.

Current beneficiary participation in planting programmes should be increased, and reliance on rangeland for fuel should be reduced. In this regard, the Government should endeavour to facilitate the distribution of fuel oils (kerosene) and gas for cooking. In addition, plantations for firewood need to be established on suitable soils.

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