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in

Acar Z. (ed.), López-Francos A. (ed.), Porqueddu C. (ed.).  
New approaches for grassland research in a context of climate and socio-economic changes

Zaragoza : CIHEAM

Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 102

2012

pages 319-322

Article available on line / Article disponible en ligne à l'adresse :

<http://om.ciheam.org/article.php?IDPDF=6935>

To cite this article / Pour citer cet article

Abdelguerfi A., Laouar M., Abbas K., M'Hammedi Bouzina M., Madani T. **Development of agro forestry areas in Northern Algeria to improve pastoral production.** In : Acar Z. (ed.), López-Francos A. (ed.), Porqueddu C. (ed.). *New approaches for grassland research in a context of climate and socio-economic changes*. Zaragoza : CIHEAM, 2012. p. 319-322 (Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 102)



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# Development of agro forestry areas in Northern Algeria to improve pastoral production

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**Abstract.** In Algeria, the exploitation for livestock breeding of grazing land sloping, gaps in the forests, and some marginal lands, can be of substantial interest. Indeed, these spaces, including catchment areas of dams extending over 3 million hectares, can improve feed production. Currently, forage productivity of scrubs and forest rangelands varies from one region to another depending on environmental conditions (rainfall, exposure, soil, etc.), animal pressure and botanical composition of vegetation. Considering the chronic deficit of forage, and to improve pastoral production, we propose the development of some agro-forestry areas in northern Algeria with natural re-seeding of legumes, such as annual *Medicago*, some *Trifolium*, *Hedysarum*, *Onobrychis*, and *Scorpiurus* species. The choice of species and mixtures of species should take into account the ecological conditions and the adaptation of plant species. In this context, a list of suitable plant species is proposed according to soil and climatic conditions.

**Keywords.** Development – Agroforestry – Reseeding – Legumes – Algeria.

## ***Aménagement des espaces agro-forestiers d'Algérie du nord pour l'amélioration de la production pastorale***

**Résumé.** En Algérie, l'exploitation par l'élevage de terres en pente, des vides en forêt et de certaines terres marginales, peut représenter un intérêt très important. En effet, ces espaces, dont les bassins versants des barrages ont une superficie d'environ 3 millions d'hectares, peuvent rendre un service énorme à notre élevage. Actuellement, la productivité fourragère des maquis et des parcours forestiers est très variable d'une région à l'autre en fonction des conditions du milieu (pluviosité, exposition, sol...), de la charge animale et de la composition botanique des formations végétales. Compte tenu du déficit fourrager chronique et afin d'améliorer la production pastorale, des aménagements de certains espaces agro-forestiers du Nord de l'Algérie sont proposés par l'utilisation des légumineuses à ressemis naturel, tels les *Medicago annuels*, certains *Trifolium*, les *Hedysarum*, les *Onobrychis* et les *Scorpiurus*. Le choix des espèces et des mélanges d'espèces doivent tenir compte des conditions écologiques et de l'adaptation des espèces végétales. Dans ce cadre, une liste d'espèces végétales adaptées est proposée selon les conditions édaphiques et climatiques.

**Mots clés.** Aménagement – Sous-bois – Agroforesterie – Résemis – Légumineuses – Algérie.

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## **I – Introduction**

The small agricultural area of Algeria, with 8.5 million ha, of which only 4% is irrigable and 75% receives less than 400 mm/year of rain, for 36 million inhabitants, makes it difficult to establish an agriculture capable of ensuring maximum food safety. Indeed, to promote optimal use of agricultural land, the valuation of fallow (3.5 million ha) is imperative. Moreover, the exploitation for breeding purposes of sloping land, empty tillable areas in forests and some lands classified as non-agricultural areas, may be very important. Indeed, these spaces, including catchment areas of dams with an area of nearly 3.6 million hectares, can be valuable for our agriculture.

Based on this observation, we propose to conduct an innovative approach to increase food and pastoral resources of areas classified as non- agricultural ones, including sloping land, some dam catchment areas, empty arable areas of forestlands and some degraded scrubs. We consider that large forest areas, especially in eastern Algeria, can provide considerable extra fodder units. In this respect, we propose the development of undergrowth, some forest areas, forest enclaves, and sloping grounds. Through research findings, proposals are made in favor of better preservation and enhancement of natural resources (soil, water) and biological resources with a view to improving animal production and sustainable development.

## II – Materials and methods

The mountain is commonly defined as an area that includes all lands above 12% slope, i.e. 43% of the Tell region (Khelil, 2000). In Algeria, mountain areas cover a total area of 7.56 million hectares. Distribution by slope class is as follows (Table 1).

**Table 1. Distribution of mountain areas depending on the slope**

Slope	Name	Area (ha)	% Total area
<12%	Lower piedmont	615,000	8
12.5 to 25%	Higher piedmont	5,078,000	67
>25%	Mountain	1,872,000	25
Total	–	7,565,000	100

Source: Bureau National d'Études sur le Développement Rural in Khelil (2000).

Forage productivity of scrublands and forest rangelands is highly variable from one region to another depending on environmental conditions (rainfall, exposure, soil, etc.), the stocking rate and botanical composition of plant communities.

Pastoral production in mountainous sloping areas, scrubland and some forest areas is very low. It is essential to improve the management of these environments and/or vegetation. In this perspective, we will address opportunities for improvement of pastoral and/or forage production in: sloping land in mountainous areas, enclaves, clearings and firebreak strips, oleaster (wild olive tree) and mastic; scrubs and forests.

## III – Results and discussion

### 1. Soils on slopes in mountainous areas

The steep sloping soils of many catchment areas are affected each year, usually toward the slope. The phenomenon has increased in recent years with access to land ownership and the sharing of land among heirs (Abdelguerfi and Laouar, 1997; Laouar and Abdelguerfi, 1997). Cultivation of these soils not only causes strong degradation of the soil but also the siltation of dams downstream, which reduces the possibilities of irrigation and intensification in the lowlands. Already, in 2000, according to Khelil (2000), the total area of catchment areas of dams in operation was estimated at 2.56 million hectares, i.e. 34% of the total area of mountain areas. It is essential to use these soil types differently, while preserving the land and avoiding the siltation of dams. The use of forage and/or pastoral species with natural reseeding is one of the few solutions for the development and preservation of these soils. The annual herbaceous and/or perennial species of legumes and/or grasses, as well as trees and shrubs of forage interest should be enhanced in this type of situation. Given the usual practice around the world, it is possible to use woody species (forage and/or fruit) in strips following level curves and to

seed inter-strips in annual and/or perennial herbaceous species crops (legumes and/or grasses). In this context, we can mention, for example, the following species:

- Annual species: *Hedysarum coronarium*, *H. flexuosum*, *H. aculeolatum*, *H. glomeratum*, *Medicago polymorpha*, *M. truncatula*, *M. orbicularis*, *M. aculeata*, *Trifolium pallidum*, *T. lappaceum*, *T. glomeratum*, *T. isthmocarpum*, *T. subterraneum*, *Onobrychis caput-galli*, *Scorpiurus muricatus* (the two taxa) and *S. vermiculatus*.

- Perennial species: *H. naudinianum*, *H. pallidum*, *M. sativa* subsp. *tunetana*, *O. argentea*, *O. alba*, *T. fragiferum*, *T. pratense* and *T. repens*.

The choice of species and species mixtures should take into account environmental conditions and adaptation of plant material.

## 2. Enclaves, clearings and firebreak strips

Forest enclaves, clearings and firebreak strips should be seeded with species of pastoral and/or forage interest. The use of natural re-seeding legumes, such as annual *Medicago*, some *Trifolium*, *Hedysarums*, *Onobrychis* and *Scorpiurus*, is widely recommended (Abdelguerfi, 1993; Abdelguerfi and Laouar 1999a,b; Abbas *et al.*, 2006). Bätke (1994) obtained yields of about 5 to 7 t DM/ha in favorable years with subterranean clover in the Middle Atlas region (cold winter) in Morocco.

## 3. Oleaster and mastic

These plants are quite widespread in northern Algeria and their pastoral production is quite low. As part of the National Program of Agricultural Development and to reduce unemployment and create jobs, the grafting of oleaster is strongly encouraged. Given the alternating production of the olive tree and its effect on beneficiaries' income, it is essential to diversify sources of income. In this perspective, the introduction of local breeds of livestock (goats, sheep, and cattle) will develop available feed units. Besides the use of grass production, livestock will also add value to all byproducts of the olive tree (branches, grounds, etc.). The installation of some trees and forage shrubs such as ash, elm, white poplar, shrubby alfalfa and carob shrub will allow the establishment of balanced agro-silvopastoral systems.

## 4. Scrubs and forests

Flat and/or low slope terrain of scrubs and forests of northern Algeria should be developed to allow the increase of pastoral production while reducing grazing pressure on the remaining forests. These agro-silvopastoral and/or silvopastoral developments may be part of land development and access to land ownership. The use of annual species with natural reseeding and perennial herbaceous species should be strongly encouraged. The introduction of *Hedysarum* throughout the north central (from Chlef to Kabylia) and northeastern (from Skikda to Souk-Ahras) part of the country is necessary. Moreover, the use of ash, shrubby alfalfa, the carob tree, the spineless cactus and other species (for their leaves and/or fruit), is indispensable for tough times (off-season, inter-year).

The forests of evergreen oak (*Quercus ilex*) are often subjected to significant pressure of use (wood, grazing, etc.). Intensive exploitation has generally transformed these forests into low grade forest stands where the presence of sub-shrubby and bushy strata is remarkable. The clearing of bushes and possibly the sub-shrubby strata on flat and/or low sloping terrain will facilitate the development of an herbaceous layer of pastoral interest.

Algeria is one of seven Mediterranean countries with forests of cork oak (*Quercus suber*). Oak trees cover 450,000 ha, but true cork forests spread over only 150,000 ha. The flat and low slope terrain of the Algerian cork forests should be developed. Cork oak stands should be preserved and the undergrowth should be seeded with subterranean clover (*T. subterraneum*)

in particular. The establishment of *dehesas*-type vegetation allows the increase of the production of cork oak while providing significant animal production. The *dehesas* is a silvopastoral feature of west-central Spain. This technique is also practiced in some regions of Portugal. In Spain, the management of *dehesas* is eco-friendly: its natural components (soil, grass, tree, herbivores, and predators) can be preserved while achieving maximum economic benefit (Gómez-Gutiérrez and Pérez-Fernández, 1996).

In forest clearings of cedar, the species most common are clover and certain grasses. Different cedar groves should be given special attention and rigorous development that should enable both the regeneration of tree species and provide some pastoral production for livestock in neighboring communities. At a clearing in the cedar forest of Teniet El Had, we found more than a dozen species of *Trifolium* and four species of *Medicago*.

The forests of Aleppo pine should also be developed. Several species of the genus *Hedysarum* grow mainly in open forests of Aleppo pine and during the various surveys; we repeatedly found *H. naudinianum* and *H. glomeratum* under Aleppo pine; *H. boveanum* (*H. humile*) and some *Onobrychis* reported in these vegetations. It is therefore possible to improve pastoral production under Aleppo pine by overseeding of certain species of *Hedysarum* and *Onobrychis*.

## IV – Conclusion

Currently, the lack of a significant program of development and management of pastures (broadly defined) causes their degradation and clearance. It is essential to properly manage these areas, not only to preserve biodiversity but also to better take advantage of them. Moreover, given the limited agricultural area, it is essential to reclaim pastoral lands in mountainous areas, scrubland, and forests through adequate development.

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