Combining Pasture Improvement and Carob Production in Cyprus

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The concept of improved grazing land composed of grasses and legumes, well managed and highly productive without irrigation, is relatively new in Cyprus and in most of the Mediterranean area. The newness of pasture improvement in a country with 14 to 23 inches of rainfall may seem surprising. However, rainfall occurs only in winter and the dry period extends from May to December with maximum temperatures of 108° F. Add to this the exploitation and despoliation of perhaps thirty centuries and a picture of the problem will begin to emerge.

Not only are there the technical difficulties of how to seed and establish better grazing, but also those of trying to evolve systems of management with shepherds whose ancestors have grazed when and where they liked for a hundred generations. Such graziers frequently own no land but guard jealously their ancient rights to use, as they will, the stubbles, fallows, ranges and pastures of the village community.

Little thought has been given to forage conservation in the past. Indeed, there was little to preserve, so that flock husbandry was and is at a very low ebb. Flocks of sheep and goats have adequate feeding only in spring and early summer. In late summer, fall and winter, the sheep become scavengers, growing thinner as the season progresses. Lambing occurs in early winter when the ewes are at a low nutritional level. Changes are taking place slowly with the development of hand-feeding, increased production of arable forage and its conservation and the present emphasis on improvement of grazing land.

Establishment of carob trees (*Ceratonia siliqua*) is affected by the same livestock management systems. Techniques of growing these trees are well known but the problems of their preservation in regions with hungry goats are considerable.

FIGURE 1. Typical Maquis scrub with *Pistacia lentiscus* and *Juniperus* in the foreground.

Dual Crops: Carob and Pasture

The natural vegetation of the carob-producing areas of the coastal plain consists of scrub species such as: lentisk (*Pistacia lentiscus*), *Genista sphacelata,* thorny broom (*Calycotome villosa*), buckthorn (*Rhamnus oleoides*), juniper (*Juniperus phoenicea*), myrtle (*Myrtus communis*), rockrose (*Cistus* spp.), prickly burnet (*Poterium spinosa*), thyme (*Thymus capitata*), olive (*Olea europea*), and carob (Holmboe, 1914). The cover of browse, grass and forbs is relatively poor in grazing value (Fig. 1).

Carobs are often grown with other crops, usually cereals in a cereal-fallow rotation, so the idea of dual cropping with carobs is not new. The trees are normally grown in a scattered haphazard fashion which suggests that they are remnants of an original scrub or Maquis flora and grafted at the time of clearing.

The idea of combining carobs with improved grazing is new, however. Since the areas under consideration are extensive, low in production and generally unsuited for normal cultivation, their reclamation can mean much to the economy of Cyprus.

The need for such dual cropping may be queried on the grounds that pasture establishment alone would be worthwhile. But Cyprus has a peasant farming community dependent all too frequently on mono-cultural systems, and multiplicity of cropping can help to avoid the recurrent crises inherent in such systems. Again, the idea

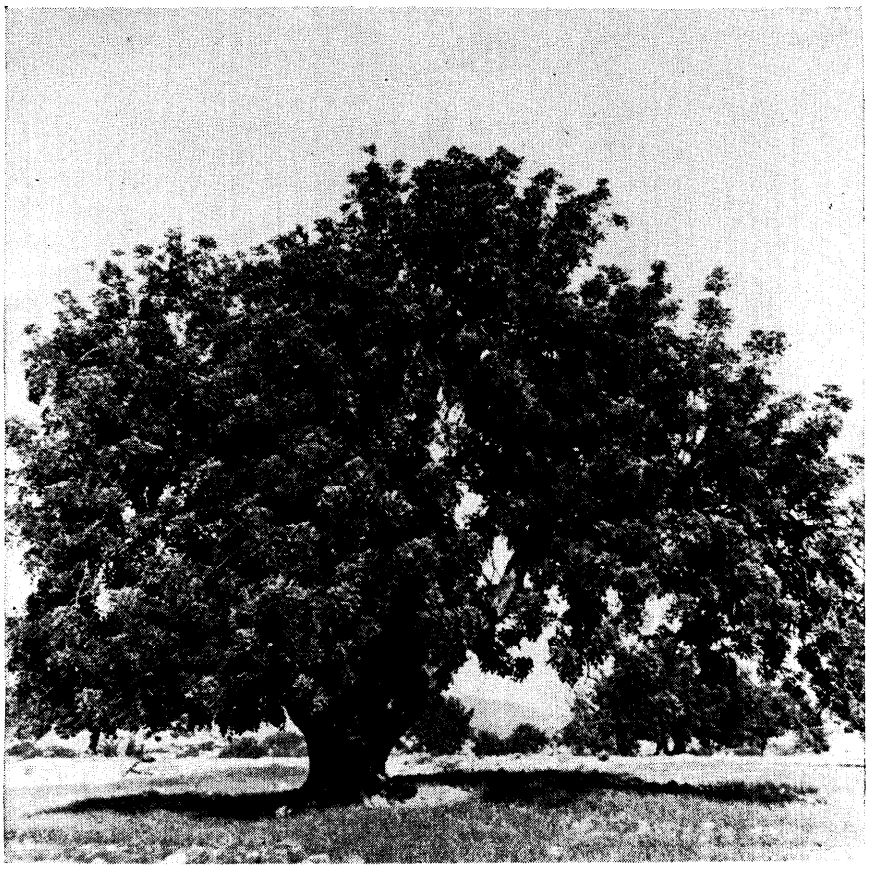

FIGURE 2. A mature carob tree, capable of producing 200 pounds of beans.

of growing improved pasture is new and linking it with a well known practice may assist in making it popular. Competition for moisture between the trees and pasture plants is not considered important. When the trees are planted in rocky outcrops, this could be completely discounted.

The Carob

Syria is regarded as the place of origin of the carob but its cultivation is perhaps most highly developed in Cyprus. This leguminous tree, when grafted, produced thick, fleshy pods up to one foot in length. It is found on Mediterranean coastal areas as a common constituent of the Maquis or scrub forest as a native tree or low-growing, grazed bush (Fig. 2). Commercial stands may be established by grafting wild trees with improved varieties or by establishing seedling trees and grafting subsequently (Jones, 1953).

The pods are widely used for cattle feeding and are becoming more popular for human food (Fig. 3). A gum in the seeds is used widely in confectionery and industry. However, the whole pod has too much carbohydrate to give a balanced animal diet (Watson and More, 1937). Fairly productive trees can be grown on very rocky and poor sites provided root penetration is possible and drainage is free. All soils in Cyprus are alkaline, so the reaction of carob to acid soils is not known. It can tolerate a few degrees of frost but normally does not grow well above 1,500 feet.

The Pastures

The major pasture species are: corn brome (*Bromus squarrosus* var. *villosus*), Madrid brome (*B. madritensis*), ovate goatface grass (*Triticum ovatum*), big quaking grass (*Briza maxima*), Spanish orchardgrass (*Dactylis glomeratus* ssp. *hispanica*), bulbous bluegrass (*Poa bulbosa* var. *vivipara*), smilo (*Oryzopsis miliacea*), asphodel (*Asphodelus ramosus*), star clover (*Trifolium stellatum*), hop clover

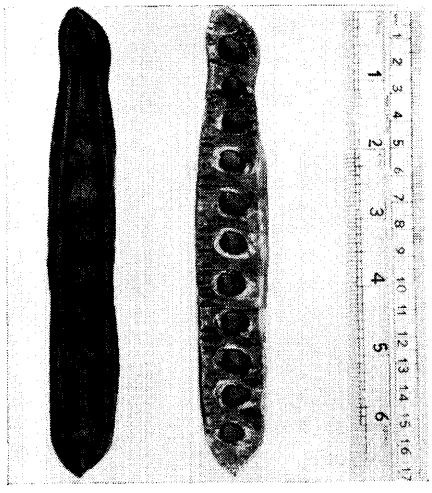

FIGURE 3. Pods of carob are flat, indehiscent and contain up to 15 seeds.

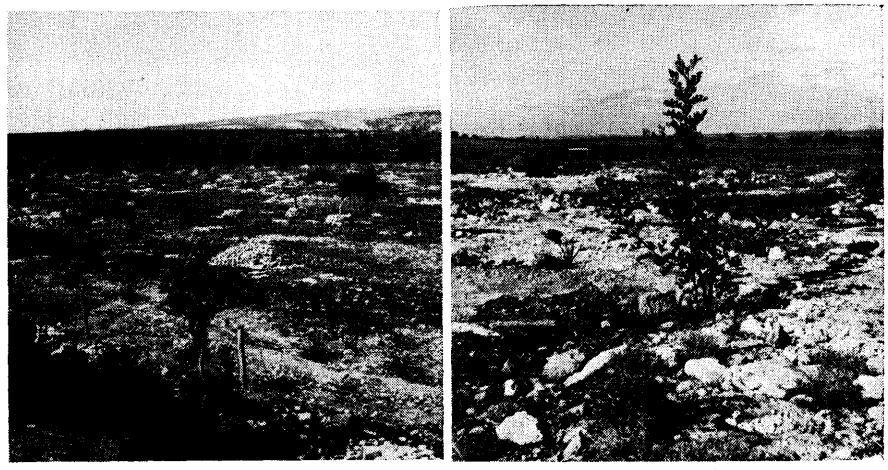

FIGURE 4. *Left.* Area with underlying hard limestone cap cleared for reseeding; scattered trees are carobs. *Right.* 1-year-old transplanted carob in limestone with hard cap overlying soft rock.

(*T. procumbens*), purple clover (*T. purpureum*), cockscomb (*Onobrychis Crista-galli*), milkvetches (*Astragalus* spp.) and various vetches (*Vicia* spp.) and vetchlings (*Lathyrus* spp.).

Production is low and fluctuates so widely with season and management that actual productivity is difficult to assess. Moreover, actual grazing capacities of areas used for grazing are difficult to estimate, since they are utilized in conjunction with stubbles and fallows. The production obtained from clearing and reseeding is so markedly superior to the existing cover that yield comparisons of before and after treatment are hardly necessary to demonstrate the need for improvement.

Many of the areas available for reseeding are characterized by Terra Rossa soils. These areas often have a discontinuous surface of hard limestone of varying thickness over the soft, chalky parent material. The thin soils occur as patches interspersed with and overlying the hard cap (Fig. 4).

Establishment of the Carob

Techniques for establishing carobs are well known and have been detailed by Jones, 1953. Year-old seedlings are planted in 2 x 2 x 2 foot holes or wild trees are grafted in place. In areas with the lime hardpan, blasting may be necessary (Fig. 4, *rt.*). During the first summer, seedlings should be irrigated and mulching is advisable.

Establishment of Pastures

Improved management alone is not sufficient to promote forage recovery, as the climax vegetation of the area is forest. Deferment permits increased tree and shrub growth so that brush control is a primary consideration. Burning programs may be restricted by the presence of wild carobs needed for grafting. These trees may be protected by clearing 10-foot areas around the trees prior to burning.

Establishment of seeded pastures requires proper methods of seedbed preparation. Reseeding in the ash following burning has not been successful. Cultivation is essential as a method of weed control and as a method of covering the seed to avoid losses from harvester ants. Cultivation implements range from the biblical wooden plow to the D-6 Caterpillar with a ripper attachment. A light covering of the seed may be achieved with the primitive harrow of the Near East, a flat board, to which brushwood is attached.

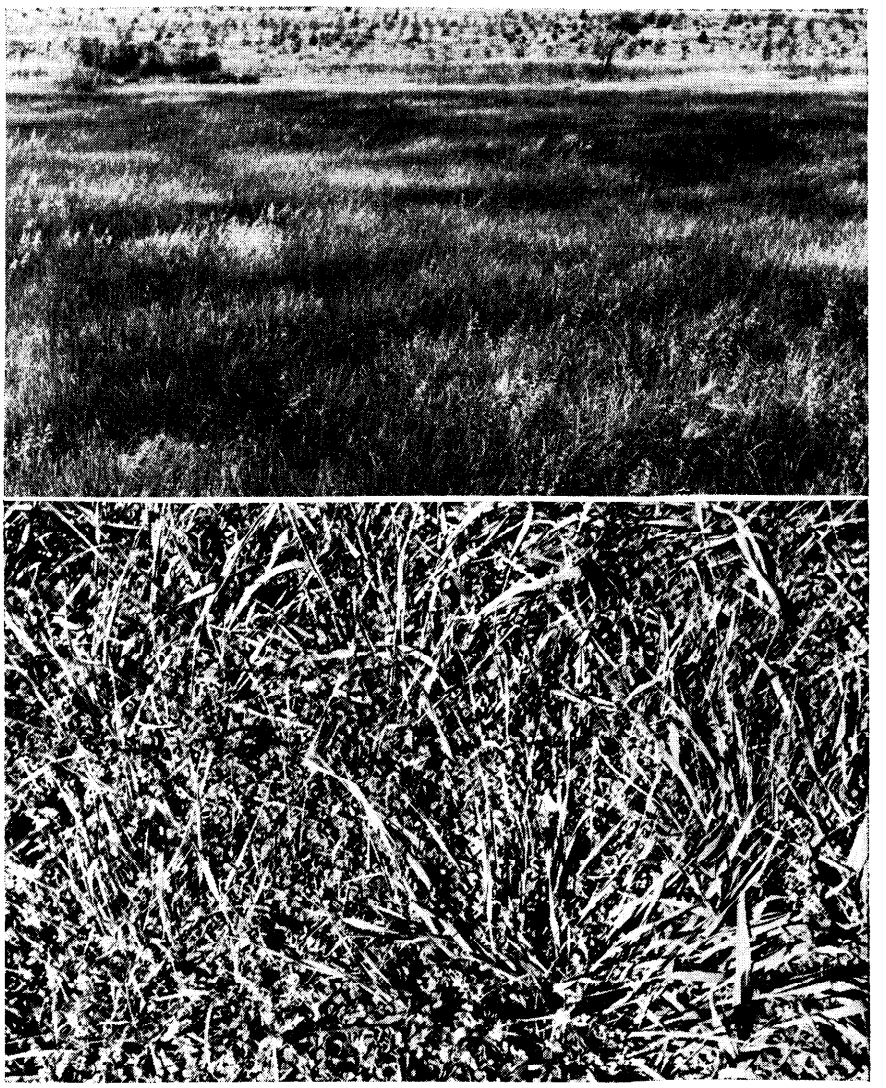

FIGURE 5. *Upper.* A good stand of Wimmera ryegrass *(Lolium rigidum)* with occasional plants of wild oats. *Lower.* Harding grass and barrel medick form a good cover under dryland conditions.

Date of planting is important. Ideally, seeding should be done in early December, following the first rains of mid-November on August burns. Weeds which germinate following the initial rains are plowed in and clean stands are obtained. Seeding prior to rains has not been successful because of weed competition with the sown species. Delayed sowing limits the growth made before the minimum temperatures of February. Date of seeding is particularly important for species of slow germination and poor seedling vigor such as smilo (Jones, 1954).

Species for Improved Pastures

Rainfall is marginal for perennials in many areas under the Mediterranean climatic conditions and the use of annuals is often advocated. Research on suitable species has been in progress for four years. The more promising species have been under test in

field grazing trials. Mixtures of a single grass and legume have been tried, as well as mixtures containing several species. The most successful mixture has been barrel medick (*Medicago tribuloides*) and Wimmera ryegrass (*Lolium rigidum*) (Fig. 5, *upper*). Establishment is not difficult and both are naturally aggressive in re-establishment from seed under proper management.

Perennials such as Harding grass (*Phalaris tuberosa*), smilo, orchardgrass, veld grass (*Ehrharta calycina* and *E. longiflora*) and bulbous barley (*Hordeum bulbosum*) are very definite possibilities (Fig. 5, *lower*). Successful stands, totalling some fifty acres of the first two species, have been made. No suitable perennial legume has been found. Alfalfa grows without irrigation, but production is poor; sanfoin (*Onobrychis sativa*) looks good in small plots but its field behavior has not been evaluated.

Utilization

Light grazing can be obtained on areas seeded to annuals, but the growth of perennial species is slow and grazing is not advisable during the first year. Seeding of annual legumes at the same time as perennial grasses may require modification as the legumes may offer strong competition with the slow-growing perennials. Seeding the legume during the second year is being tested, using the almost indestructible pods of barrel medick rather than the threshed seed. This legume can be seeded in summer as the pods are too large for harvster ants to remove and soil cover is unnecessary. The high cost of seed may be a limiting factor as only one or two seeds per pod germinate.

The carob produces fruit five years after grafting but maximum yield is reached at 20 years. Obviously, introduction of grazing animals in young carob plantations is a risk but injury may be minimized by the provision of a guard of thorny brush or stakes around young seedlings. Grafting may be done at a height out of reach of sheep and goats. In Cyprus, harvesting is carried out by knocking the pods from the trees; if left to fall to the ground, they can provide feed for livestock.

Costs and Returns

On favorable sites, the cost of planting carob seedlings is about $50 per acre; where blasting holes is necessary, costs may be somewhat higher. Grafting established wild stocks may cost only a few cents. The present overall cost of establishing pasture, including burning, cultivating and seeding, amounts to $18 per acre but this may be reduced with more experience and on larger areas.

Maximum production, reached in about 20 years, would provide returns of $41 per acre per year, based on an average yield of 56 pounds of beans per tree, stands of 27 trees per acre, and a purchase price of $61 per ton of beans.

Returns from reseeded pastures are somewhat variable as shown in the early pilot tests. In the 1955 grazing season, a typical area reseeded with Wimmera ryegrass and barrel medick gave a gross return of $61 per acre based on production of wool, meat and milk and maintenance of sheep at prevailing market prices. In terms of sheep grazing, this represents 384 days per acre.

It is obvious to even the casual observer that present production from large areas of Cyprus is very low and that reseeding may bring phenomenal increases. However, it must be emphasized that the scrub flora may regenerate readily with incorrect management (Naveh, 1954). Large scale projects must be approached with caution until further experience is gained.

Summary

Increasing production in typical Maquis scrub of the Eastern Mediterranean through combining carob growing with improved pastures is described.

Methods of establishing carobs and reseeding are outlined. Grasses and legumes suitable for reseeding cleared scrub land are listed.

Dual cropping of carobs with cereals in a cereal-fallow rotation is commonly practiced in the area. An extension of this practice to scrub areas, in which improved pasture replaces arable crops, is advocated.

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Make plans now to attend the Ninth Annual Meeting of the American Society of Range Management to be held January 23-27, 1956, in Denver, Colorado.