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El Nahrawy M., Mikhiel G.

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Effect of protection on plant species and growth of natural vegetation in the Western North Coast in Egypt

M. El-Nahrawy and G. Mikhiel
ARC, National Forage Crops Research Program, 9 Gamma St., Giza, Egypt

RESUME –*"Effet de la mise en défens sur la composition et la croissance de la végétation naturelle sur la côte nord-ouest de l'Egypte". L'impact de la mise en défens sur la biodiversité, sur la production fourragère et sur le coût de gestion a été mesuré pendant 3 ans sur un gradient est-ouest dans 5 sites. La mise en défens a permis de récupérer 13 espèces annuelles ou pérennes qui avaient disparu des parcours. La production fourragère a augmenté en moyenne de 300 kg/ha ce qui correspond à 140 UF.*

Mots-clès : *Gestion des parcours, mise en défens, végétation naturelle, biodiversité.*

Introduction

Matrouh Resource Management Project, (MRMP) has aimed at realizing sustainable resource management and alleviating poverty in its mandated area, extending over 320 km along the North West Coast of Egypt with 60 km in-land on average. The area has a semi-desert environment, moderated by maritime influence and a fragile resource base, with a low and highly erratic rainfall averaged at about 150 mm on the coast and up to 20 km in-land, but drastically declines thereafter. Project area was administratively divided into five sub-regions. A Sub-Regional Support Center (SRSC) was established in each of the five sub-regions. These are from east to west, Ras El-Hekma, Marsa Matrouh, El-Negila, East Barrani and West Barrani. Different range rehabilitation approaches were adopted. Reseeding annuals and perennials in the open, transplanting fodder shrub seedlings on small areas mainly on rangelands within small landholdings, and a range-improvement package is currently under test on Selected Range Management Areas (SRMAs) within relatively large landholdings. This paper presents the technical, biological and economic impact of fencing on vegetation cover.

Materials and methods

Twenty of the 68 SRMAs planted in 1997-98 were selected. Four from each of the five SRSCs distributed agro-climatically as one in the first strip (some 5 km from seashore), one in the second strip (5-15 km from the sea), and two in the third strip (beyond 15 km). All SRMAs were planted with shrubs during November 1997 to February 1998. Data were collected before fencing and after three years about the fenced area of 10 ha to facilitate assessment of biodiversity enhancement. Families, species and range plants cover inside and outside the fence were surveyed. They were identified and classified by family and species (frequency, and cover). The cover of each species was calculated as a percentage of the total vegetation cover. Green and dry yields of the aerial biomass were determined (12-25 March 2001) inside and outside the protected area. From each SRMA, the green yield of the vegetative cover was measured on 10 samples of 1 m² each, randomly selected. Random samples (2 kg) were taken and dehydrated at 70-80℃ in an air-hot oven for 24 hours to determine the moisture content and dry matter yield. A preliminary economic assessment of the fenced plantations was carried out. Experiments for monitoring and evaluation were carried out in a randomized complete block design with four replicates and analyzed accordingly.

Results

Fencing plus a 3-year protection from grazing yielded a substantial good impact on biodiversity and on fodder production from the natural vegetation cover (Tables 1 and 2).

Table 1. Average green and dry forage yields of the vegetation cover by SRSCs inside and outside the fenced area over all strips

SRSC	Inside fenced area		Outside fenced area	
	Green yield (kg/ha)	DM (kg/ha)	Green yield (kg/ha)	DM (kg/ha)
Ras El- Hekma	815 b	482	358	218
Marsa Matrouh	808 b	503	400	244
El- Negila	1408 ab	644	445	202
E Sidi Barrani	2248 a	914	1215	541
W Sidi Barrani	969 b	537	566	321

Means followed by the same letter were not significantly different at 0.05 level according to L.S.D. test.

Table 2. Average green and dry forage yields from the vegetation cover by strip inside and outside the fenced area over all SRSCs

Strips	Inside fenced area		Outside fenced area	
	Green yield (t/25 fed)	Dry forage yield (t/25 fed)	Green yield (t/25 fed)	Dry forage yield (t/25 fed)
1	20.666a	9.695 a	7.554	3.639
2	15.453 ab	8.031 ab	11.416	5.951
3	6.453 c	3.499 b	2.552	1.402
3	7.412 bc	3.415 b	2.345	1.219

Means followed by the same letter were not significantly different at 0.05 level according to L.S.D. test.

The average plant richness was increased by 40% for plant families (from 5 to 7 families), and by 66% for species (from 6 to 10 species). Fencing has revived some 13 species, seemed as being extinct (7 annuals, and 6 perennials), rising total species over all sites from 38 to 51 species. The revived annual species are *Pisum sativum; Chrysanthemum coronarium; Matricarria recutita; Avena sp; Lolium multiflorum; Setaria viridis*; and *Ocimum menthaefolium*; and the perennial species are *Onopordum alexandrimum; Jasonia candicans; Convolvulus hystrix; Marrubium vulgare; Thymus capitatus;* and *Allium desertorum*. A significant variability was traced between and within SRSCs in terms of the families and species inside and outside the fence (Tables 1-4). Generally, the highest number of families and species (before and after fencing) was for West and East Barrani, followed by Hekma and Matrouh, and the lowest was for Negila.

A significant variability between and within SRSCs was also found in the impact of fencing on the overall vegetation. The natural vegetation cover over all strips was increased by 81% (from 32% to 58% before and after fencing, respectively). Fencing has enhanced vegetation cover from 25% to over 52% in Hekma; from 27% to 55% in Matrouh and Negil; from 35% to 70% in East Barrani; and from 46% to over 56% in West Barrani.

After fencing, the highest impact was observed on *Haloxylon scoparium*, observed in 16 of the 20 monitored sites with a total cover of 180% over all sites. A good recover was also observed on *Deverra tortusa*, 12 sites with an overall coverage of 41%; *Anacyclus alexandrinum*, 12 sites with an overall coverage 34%; *Thymelaea hirsuta*, 9 sites with an overall coverage score of 61%; *Chrysanthemum coronarium*, 8 sites with a total score of 84%; and *Eruca sativa* with a total coverage score of 87%, but on only 5 sites. However, it should be noted that, 14 species (27% of total species after fencing) were observed in only one site and at a very low coverage of 2-6%; and 34 species (66% of the total species) were observed in less than 5 sites. Nevertheless, it is most likely that both characteristics would be enhanced by time if suitable management practices would be adopted.

The impact of protection by fencing increased forage yield (Tables 1 and 2) by over 100% (from 6.0 to 12.5 t/10 ha for green fodder, and from 3.1 to 6.0 t/10 ha for dry fodder). Results of the analysis of variance (Table 3) showed that the difference was highly significantly between fenced and unfenced areas and significant between the agro climatic strips while differences between SRSCs were not

significant. The relative impact of fencing varied according to the SRSCs (Table 1): it increased the green yield by about 215% in Negila, 125% in Hekma, 100% in Matrouh, 85% in East Barrani, and 70% in West Barrani. However, the highest yields were obtained at East Barrani. Similar trends, but at a smaller magnitude were found for dry matter inside the fence, and for both green and dry matter outside the fence (Table 1). The relative impact of fencing also varied considerably among agroclimatic strips (Table 2). It was pronounced on strips 1 and 3 (170 to 180%) but reached only 36% in the second strip. This relatively low impact might require further investigations. The overall averages of green and dry forage yields per SRMA (10 ha) by the different agro climatic strips over all SRSCs are given in Table 4. No significant differences were found between the first and the second strips, while it became significant between these two strips and the third strip.

Table 3. Analysis of variance of green and dry forage yields of vegetation cover by strips, SRSCs, and inside or outside the fenced area

Source Of variation	d. f.	Mean square	
		Green forage	Dry forage
Strips	4	275.78*	66.07
Main treat. (SRSCs) A	4	178.52	18.66
Error (a)	12	63.65	22.27
(Inside & outside) B	1	426.02	96.35**
BxA	4	20.09	1.74
Error (b)	15	14.61	3.05

* Significant; ** highly significant.

Table 4. Average green and dry forage yields of vegetation cover per SRMA by strips over all SRSCs and inside or outside the fenced area

Strips	Green forage yield (t/10 ha)	Dry forage yield (t/10 ha)
1	14.112 a	6.667
2	13.434 a	6.991
3	4.503 b	2.451
3	4.883 b	2.317

Means followed by the same letter were not significantly different at 0.05 level according to L.S.D. test.

Global data (Table 5) show a highly significant impact of fencing on both green and dry yield. The green yield inside the fenced doubled the yield outside and a similar impact was depicted for the dry yield. The economics of fencing was evaluated in terms of the cost recovery period (i. e. the time needed to recover the cost of the fenced plantations). The annual yield of the fenced area was transformed into feed units (FU=1 kg of barley) and priced to produce the total annual benefits in currency units (LE). On the basis of a total cost of 6885 LE for fencing 10 ha, the benefit gained on forage production in the fenced area permitted to limit the cost recovery period from 14 to 8 years in Negila, from 14 to 10 years in Hekma, and from 9 to 7 years in Matrouh. Such impact was less evident in the SRSCs of high shrubs' output as in West and East Barrani.

Table 5. Average green and dry forage yields of vegetation cover per SRMA inside and outside the fenced area over all SRSCs and strips

Location	Green forage yield (t/10 ha)	Dry forage yield (t/10 ha)
Inside fenced area	12.496	6.160
Outside fenced area	5.969	3.053
L.S.D. test	**	**

Table 6. Annual output and benefits from natural vegetation inside the fenced area

SRSC	Incr. eased dry vegetation		Total benefits
	(kg)	(FU)	(LE)
Hekma	2640	1190	714
Matrouh	2590	1170	702
Negila	4420	1990	1194
East Barrani	3730	1680	1008
West Barrani	2170	980	588
Over all mean	3110	1400	841

Conclusions

Satisfactory success in terms of shrub survival, fodder production and economics has been achieved after three years of protection. Moreover, great potential for improvement seems feasible due to the extreme variability existing among SRSCs in all assessment criteria used. Due to the dry conditions that prevailed during the three years of establishment, the real impact could be higher. It is visible from the data to complete implementation of the other developmental components of SARM (overseeding of annuals and improved management of the natural rangeland area) would facilitate assessment of the overall SRMA approach. However, some design and arrangement modifications should be contemplated for cheaper technologies and more equity in distributing the benefits.