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Evaluation of a regenerated natural meadow in a semi-arid area of Algeria[1]

K. Abbas*, T. Madani, M. M'hammedi Bouzina***, M. Laouar*, A. Abdelguerfi**** and N. Tedjari****
*INRA Algeria – e-mail: abbaskhal@yahoo.fr
**Université Sétif, Algeria
***Université de Chle, Algeria
****INA Alger, Algeria

SUMMARY – A fodder mixture was tested to regenerate a permanent meadow (PR) in the semi arid-area of Sétif (Algeria), on one hectare and was compared to a natural meadow (PN). The PR dry biomass is 1.3 t/ha on average on the year of installation (2005/2006) and 8.22 t/ha the following year. For PN it was 7.0 t/ha the first year and 8.36 t/ha the second year. Then, PR biomass increased strongly the second year to approach that of PN. A comparison between PR and PN regarding floristic composition gives 76% against 46% for grasses, 19% against 26% for legumes and 5% against 28% for the other species, on the first year; and 62% against 84% for grasses, 30% against 11% for legumes and 8% against 5% for the other species, the following year. The floristic composition of the regenerated meadow was clearly improved.

Keywords: Meadow regeneration, multi-species grazing pasture, semi-arid areas, Algeria.

RESUME – *"Evaluation d'une prairie naturelle régénérée naturelle dans une zone semi-aride d'Algérie". Un mélange fourrager est testé pour régénérer une prairie permanente (PR) dans la région semi-aride de Sétif (Algérie), sur 1 ha et comparé à une prairie naturelle (PN). La biomasse sèche de PR est en moyenne de 1,3 t ha^{-1} lors de l'année d'installation et de 8,22 t ha^{-1} l'année suivante. Elle a été respectivement de 7,0 t ha^{-1} et 8,36 t ha^{-1} pour PN. La biomasse de PR a fortement augmenté donc pour se rapprocher de celle de PN. La composition floristique entre PR et PN, donne 76% contre 46% pour les graminées, 19% contre 26% pour les légumineuses et 5% contre 28 % pour les autres espèces, la première année et 62% contre 84% pour les graminées, 30% contre 11% pour les légumineuses et 8% contre 5% pour les autres espèces, l'année suivante. La composition floristique de la prairie régénérée s'est ainsi nettement améliorée.*

Mots-clés : *Régénération de prairie, pâturage multi-espèces, région semi-aride, Algérie.*

Introduction

In recent work on the subject (Abbas *et al* 2005a and Abbas *et al*. and 2005b), it appeared that the natural meadows underwent a strong degradation in the semi arid zones of Algeria. The constraints are the pressure of the cultivation of cereals, the climate and the bad management of the herbs. The role of these spaces from an environmental point of view and of support for the activities of the husbandry could be of a great contribution to the agriculture durability. The objective of this work is to define technologies of low cost sowing and preserving of the environment with optimizing the introduction and the establishment of perennial cultivars lately developed in various rain agricultural systems. The question is the composition of the species and the mixtures of cultivars adapted to semi arid cereal Algerian zone. The introduction of mixtures (multiannual including) into the farming systems is studied with the attention to optimize management (fertilization, pasture, mowing), in comparison with not-modified systems (traditional). Advantages will be measured on the nutrition of cattle. It is supposed that the mixtures of the species or the cultivars are adapted to achieve certain goals (pasture and fodder, conservation of fertility of the ground…) that pure varieties.

Materials and methods

Delimitation of the parcels: In autumn 2005, two parcels of 1 ha each, one on the side of the other. The ground is a natural meadow from which a part (to be sown) is degraded.

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Seed: 28.33 Kg/ha of of a mixture of annual and perennial grasses and legumes from *Fertiprado* (Table 1) were used to sow. TThe mixture includes 73% legumes of which 41 % are perennial. The perennial grasses make the remainder of the seed.

Table 1. "Fertiprado" seed mixture components for Task2

Component	Weight (kg/ha)	%
Medicago sativa cv. Genesis	2	6.67
Onobrychis viciifolia	2	6.67
Trifolium pratens cv. Atlaswede-	2	6.67
Trifolium fragiferum cv. Palestinel-	2	6.67
Lotus corniculatus cv. San Gabriel, L. Glaber cv. Estero	1	3.33
Lotus subbiflorus cv. Mediterraneo-	1	3.33
Trifolium michelianum cv. Frontier, Pradana	3	10.00
Trifolium resupinatum cvs. Prolific,Nitro Plus-	4	13.33
Medicago polymorpha cvs. Santiago, Scimitar-	3	10.00
Medicago truncatula cvs. Parabinga, Jester-	2	6.67
Lolium perenne cvs. Victorian, Vitoca-	2	6.67
Dactylis glomerata cv. Currie-	2	6.67
Phalaris aquatica cv. Atlas Landmaster-	2	6.67
Festuca arundinacea cv. Demeter	2	6.67
Total	30	100

Ploughings: At the establishment year, 2005, the ploughings were carried out using plough disc harrow. Several passages were made until obtaining a fine seed bed.

Sowing: Sowing was carried out with a cereal grains seedier which gutters were withdrawn beforehand in order to ensure itself a low depth of sowing (less than 1 cm).

Rolling: A smooth-wheeled roller was used to reinforce the contact of the ground to the seed.

Fertilization: 200 kg/ha super phosphate (0.46 P2O5) were spread per ha. This corresponds to 92 kg P_2O_5/ha.

Sampling: 8 cages were placed on the two fields – 4 in the sown parcel and 4 in the natural pasture. Eight samples of 1 m^2 were mown to estimate the biomass and its composition. The operation was carried out in the cages.

Mow: in 2006 and 2007 the mowing was carried out using manual sickles and using an experimental mower of 1m of cut bar. They were carried out 4 cm above the ground. Mow has been carried out in spring at the at the beginning flowering stage of legumes as well as in test surface and in control.

Drying fodder: Drying was carried out in a drying oven of mark "*memmert*".

Meteorological trend: Fig. 1 resumes temperature and precipitation registered in last 2006 and 2007 first six months.

Irrigation: Flush irrigation is done and follows what is done on the exploited natural meadow (Abbas *et al.,* 2005).

Recognition of the species: It was made using photographs of individual plants in pots.

Results and discussion

Climate conditions: Fig. 1 summarizes the temperatures and average monthly rainfall curves recorded on the test site during 2007. The climate in the Sétif region was characterized in 2006-2007 by average rainfall (Table 1). Nevertheless, it was very badly distributed: 16% in autumn, 26% in

winter and 55% in spring. The low winter rainfall was offset by heavy rain in the spring accompanied by a drop in temperature. These conditions disrupted the occurrence of physiological stages, which were shifted and mostly ruined any possibility of grazing during that period.

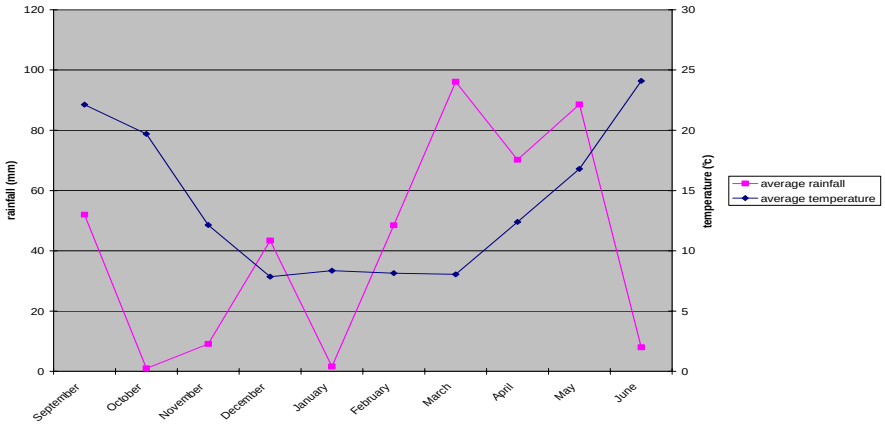

Fig. 1. 2006-2007 climate trends.

Fresh and dry biomass: Productivity in fresh biomass is significantly greater in the regenerated meadow (Table 2, Fig. 2). Because of the lower dry matter rate in the regenerated meadow, the dry biomass produced by the regenerated meadow is comparable to that of the control (8.22 t/ha^{-1} versus 8.37 t/ha^{-1}). The physiological earliness of the indigenous species of the control meadow (adaptation), especially the grasses may have caused this phenomenon. The comparison of these findings with those in the first year shows that the regenerated meadow may have reached its normal rate. Thus, the dry biomass rose from 1.4 t/ha-1 to 8.22 t / ha^{-1}. The productivity of the control meadow also increased because of better weather conditions. It rose from 8.37 t/ha^{-1} to 9.4 t/ha^{-1}.

Table 2. Comparison of the productivity parameters of seeded meadow with the control

	Green weight t/ha^{-1}		% DM		Dry weight t/ha^{-1}	
	Control	Sown meadow	Control	Sown meadow	Control	Sown meadow
Average	35.47	43.90	0.24	0.19	8.37	8.22
Std. deviation	10.48	12.50	0.02	0.03	2.14	1.78
Var. coef. (%)	29.54	28.46	9.39	14.22	25.60	21.67
Significance	a	b	a	b	a	a

a, b: different letters = significant difference (0.05) between the two types of meadow.

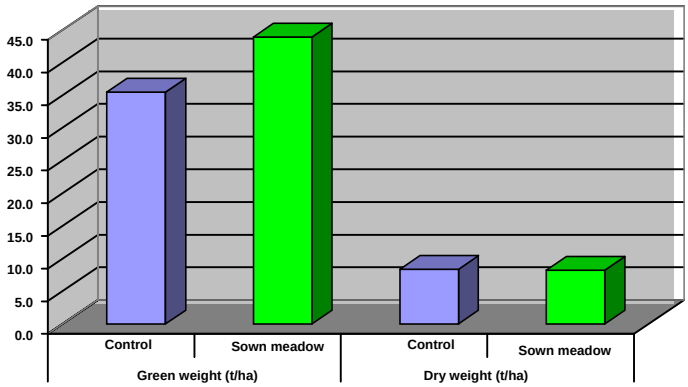

Fig. 2. Productivity average.

Botanical composition: Compared to the control meadow, the biomass produced by the

regenerated meadow is much more balanced because it is richer in legumes and poorer in grasses and weeds (Table 3, Fig. 3). The grasses make up 66.7% *vs* 83%, legumes 31.1% *vs* 12% and other species 2.2% *vs* 4.5%. In the previous year, the comparison gave: 61.86 *vs* 26.4% for grasses, 19.70 *vs* 41.93% for legumes and 4.7% *vs* 26.51% for other species. The regenerated meadow evolved then towards a greater presence of legumes at the expense of the grasses. The heterogeneity of the control meadow does not allow establishing its fodder composition and evolution.

Table 3. Comparison of the fodder composition between sown and control meadow (weight relating to 200 g of green matter of collected biomass)

	Dry weight grasses		Dry weight legumes		Dry weight other species	
	Sown meadow	Control	Sown meadow	Control	Sown meadow	Control
Average	41.3	55.6	19.3	8.5	1.3	3.0
% of total	66.7	82.9	31.1	12.7	2.2	4.5
Significance	a	b	a	b	a	b

a, b: different letters = significant difference (0.05) between the two types of meadow.

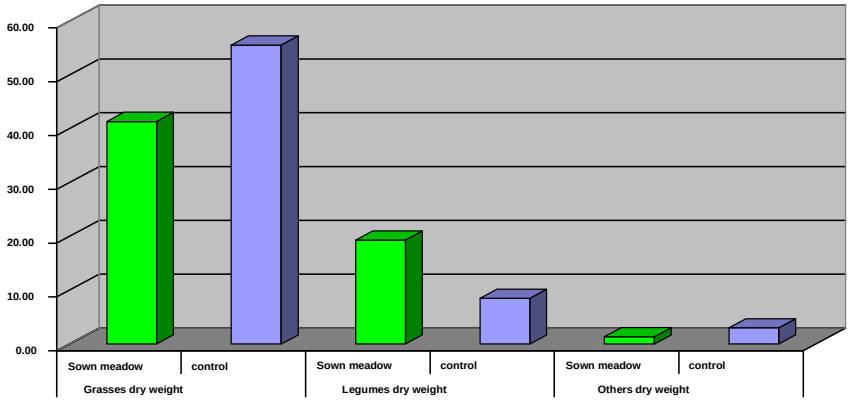

Fig. 3. Botanical composition.

However, it appears that only 53.3% of the sown species were found in the samples collected from the regenerated meadow (Fig. 4, Table 4). This could be due either to the inadaptation of some introduced species or to the non-representativeness of the samples probably because of the difficulty of sowing (inadaptation of the seeder).

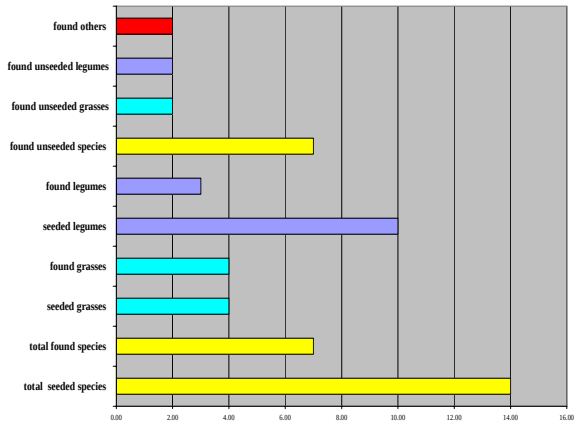

Fig. 4. Species persistence and botanical diversity.

All the species that were sown but not found were legumes (7 not found out of 10 sown, i.e. 70%). This is a huge rate, but it should be considered with caution because of the heterogeneity factors of

Table 4. Botanical composition of regenerated meadow

Seeded species	Seed weight in kg	In % of total	Forage dry weight average	In % of total	Not seeded species	Forage dry weight average	In % of total
Medicago sativa cv. Genesis	2	6.67	0	0	*Festuca pratensis*	8.5	1.67
Onobrychis viciifolia	2	6.67	0	0	*Lolium multiflorum*	60.77	11.95
Trifolium pratens cv. Atlaswede-	2	6.67	0	0	*Hordeum vulgaris*	36.39	7.16
Trifolium fragiferum cv. Palestinel-	2	6.67	0	0	*Lotus corniculatus*	9.25	1.82
Lotus corniculatus cv. San Gabriel, L Glaber cv. Estero	1	3.33	9.25	1.81	*Trifolium subterraneum*	5.1	1
Lotus subbiflorus cv. Mediterraneo-	1	3.33	0	0	*Trifolium*	30.65	6.03
Trifolium michelianum cv. Frontier, Pradana	3	10	74.9	14.66	*Ranunculus officinalis*	4.04	0.79
Trifolium resupinatum cvs. Prolific, Nitro More	4	13.33	34.39	6.73	*Ranaculus indica*	7.43	1.45
Medicago polymorpha cvs. Santiago, Scimitar-	3	10	0	0			
Medicago truncatula cvs. Parabinga, Jester-	2	6.67	0	0			
Lolium perenne cvs. Victorian, Vitoca-	2	6.67	59.55	11.66			
Dactylis glomerata cv. Currie-	2	6.67	125.38	24.55			
Canary grass aquatica cv. Landmaster- Atlas	2	6.67	17.07	3.34			
Festuca arundinacea cv. Demeter	2	6.67	37.33	7.31			
Total	30	100	357.87	70.07		162.13	31.88

the samples above mentioned. Among the legumes, we noted the absence of sown *Medics*, the failure to recognize a clover counted as indigenous, and the emergence of an indigenous *Medic*. It was also noted that 2 grasses species, 2 legume species, and 2 other species, all of them not sown, were found. These species were indigenous. To the problem of inadaptation of the seeder, we should add the method of irrigation by flooding with flood waters which may have brought indigenous seeds and put them directly in competition with the sown species. The control meadow is botanically richer, especially with grasses (Table 5, Fig. 5).

Table 5. Control meadow botanical composition

Species	Average dry weight	Dry weight in %
Festuca pratensis	218.96	42.4
Festuca elatior	38.6	7.5
Dactylis	91.5	17.7
Lolium perenne	32.6	6.3
Canary grass	19.4	3.8
Avena sativa	1.1	0.2
Hordeum vulgaris	40.81	7.9
Trifolium dubium	1.1	0.2
Trifolium	20.9	4.0
Médicago indica	6.5	1.3
Médicago officinalis	28.58	5.5
Carex divided	5.81	1.1
Teraxacum officinalis	1.37	0.3
Merendera pyrenaica	0.13	0.0
Ranuculus repens	5.96	1.2
Plantago lanceolata	3.12	0.6
Arthematherum elatins	5.59	1.1
Total	521.96	100.0

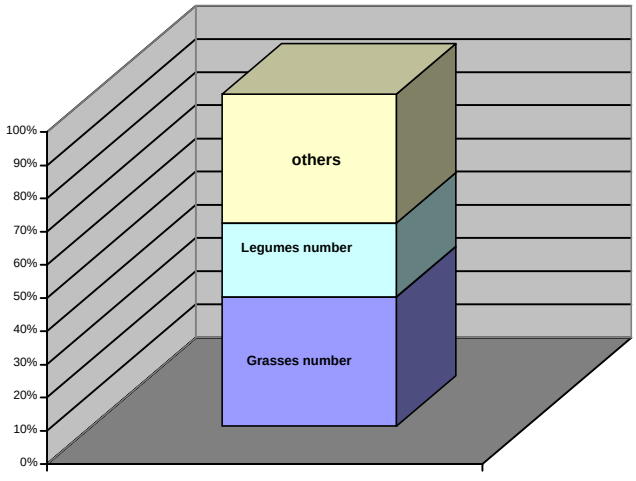

Fig. 5. Control botanical composition.

Conclusion

First results of this work show that it is possible to regenerate meadows in semi arid area of Algeria. However, some modifications of the research plan seem necessary to evaluate with more precision performances and durability of these species.

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