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Can Harmel (*Peganum harmala* L.) Influence Sheep Reproduction in the Dry Areas?

Farmers exposing ewes to harmel smoke to bring more ewes in estrus. In appreciation of indigenous knowledge, the Mashreq-Maghreb team in Iraq and ICARDA designed a study to investigate any relationship between harmel smoking and sheep production (see page 4). Photo: Azhr H. Al-Haboby.

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EDITORIAL

People participation and implementation of the United Nations Convention on Combating Desertification

The vast areas of rangelands represent an important economic resource which significantly contributes to national income and provide livelihood for pastoral people of the countries of the Near East region. Nationalization of rangelands has decreased the control of local communities over land resources and enhanced overexploitation and agricultural encroachment resulting in wide degradation and desertification. Earlier attempts to reduce range degradation relied mainly on technical interventions without due attention to the prevailing socio-economic conditions affecting the targeted communities. Past experience gained from such interventions indicated their failure to achieve the expected objectives, mainly because development did not address the real causes behind land degradation. Also, it did not address increased poverty resulting from inequitable access to resources, and the inability to motivate the local communities to patronize development activities.

Consequently, there is currently a growing trend to devolve the responsibility for range rehabilitation and desertification control to the pastoral communities and direct development assistance to enhance their capabilities for participatory development. An initial condition for the success of this new approach is the restoration of pastoral people's control over land resources by reviving traditional management institutions that were effective in conserving the resource in the past, or by creating modern forms of similar function. This requires frameworks of policies to address lack of people's participation and create a suitable framework for an effective partnership with development agencies and Non-Governmental Organizations (NGO).

FAO, as stipulated by the World Food Summit, the United Nation Convention on Combating Desertification (UNCCD) and the United Nations Conference on Environment and Development, is giving the highest priority to support Food Security within a framework of sustainable agricultural and rural development, and with a greater emphasis on desertification problems. A large number of FAO field projects aimed primarily at promoting Food Security, but with elements of dry lands management and combating desertification.

The FAO Regional Office for the Near East is playing an important role in fostering people's participation through the provision of technical assistance to countries in the Region to develop methods and improve modalities of action and in exploring new avenues for financial support for participatory dryland development.

There is a need to better rationalize the UNCCD activities at international, regional and national levels in particular by:

- Increasing dialogue and real partnership between key multilateral and bilateral agencies potentially involved in CCD activities at regional and national levels, in order to propose to countries and local populations an optimized coherent programme avoiding duplication and promoting synergies;
- Implementing a reliable assessment of desertification in order to quickly pre-identify priority geographical areas and target groups most affected by land degradation in each sub-region. This would allow speeding up the National Action Plan (NAP) preparation process and clarifying the needs in terms of investment and funding in each country;
- Immediate collection and dissemination of existing knowledge, best practices and above all lessons learnt and so called success stories within main socio-economic and environmental conditions;
- Better integration of ongoing NAPs within national plans and programmes to define clear responsibilities between stakeholders and to avoid superimposing them on the existing national economic and social plans and strategies;
- Better integration into NAPs, of ongoing related sector-based action programmes, in order to optimize resources and secure effectiveness and efficiency of field activities.

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Can Harmel (*Peganum harmala* L.) Influence Sheep Reproduction in the Dry Areas?

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Introduction

Harmel, *Peganum harmala* L. (Zygophyllaceae), is a circum-Mediterranean weed that has originated in Persia (Engler, 1931). The plant could be poisonous at certain stages (Yurchenko and Almuratova, 1987; Bailey, 1986). It also contains some materials that can be used in medication in some cases (Usher, 1974). Harmaline produced strong feeding inhibition in 24 h feeding tests (Chandra, 1987).

Harmel is one of the plants that naturally grow with wheat and barley in the rainfed area of Iraq. Sheep graze this plant when no other plants are available in the area. In Iraq, some farmers are smoking their flocks with harmel at the beginning of the mating season, believing that smoking brings ewes into estrus.

To evaluate this practice and to find the working mechanisms behind that, the Mashreq-Maghreb team in Iraq and ICARDA designed a study to investigate the relationships between harmel smoking and sheep production.

Materials and Methods

Four experiments were conducted:

In experiment 1 two groups of ewes were exposed to harmel smoke for 10 minutes and compared with a control. The first group included 60 ewes in an experimental station; the second group was a farmer flock with 450 ewes.

Experiment 2 compared sexual activity via libido test between smoking and non-smoking rams.

Experiment 3 investigated the effect of harmel smoking on the number of small and large ovarian follicles and the number of corpus luteum after 5 days of exposing ewes to harmel smoking. These ovarian measurements were used as an indication of ovarian activity and follicular development.

In experiment 4, four groups (24 ewes each) were divided as follows: non smoking ewes and rams, non smoking ewes and smoking rams, smoking ewes and non smoking rams, and smoking ewes and rams.

Results

Experiment 1 showed that smoking brought more ewes in estrus within three days both in station (40 vs. 10%) and in farmer flocks (25 vs. 10%).

The smoked rams had higher sexual activity than the non-smoked rams (Experiment 2). The smoked rams had shorter reaction time to first mount (time from ram introduction on ewes and mounting) and had more mounts (mounting the ewes without ejaculation) and services (mounting with ejaculation) during a 20-min. libido test at 1 hr, 12 hrs and 24 hrs post-smoking.

There was no significant effect ($P>0.05$) of harmel smoking on the number of small and large ovarian follicles and the number of corpus luteum after 5 days of exposing ewes to harmel smoking. However, the ovary of smoke ewes contained more small (16 vs. 8) and large (1.8 vs. 1.0) follicles and more degenerated corpus luteum (3.3 vs. 1.0). This means that the ovary of the smoked ewes was more active as indicated by more follicular growth and ovulations.

Experiment 4 indicated that lambing (100 vs. 77%) and twinning (24 vs. 10%) were higher when both ewes and rams were smoked in comparison with the control.

Discussion

Results of Experiments 3 and 4 together could be an indication that harmel smoke may induce, in certain mechanism, follicular growth, ovulation and consequently higher twinning rate.

Smoking used in the current work was done using the whole dry plant at the time prior to natural mating season of sheep. Previous works on harmel either used seed (Usher, 1974), aqueous extracts from shoots (Hussain *et al.*, 1988) or green plants (Chandra, 1987). To the best of our knowledge such relation between harmel smoking and various reproductive traits of ewes and rams was not reported earlier. This finding could be an evidence of an important relationship between harmel and reproduction in animals. Factors behind this could be certain volatile materials in the plant and/or seed which play a role to interact with the hypothalamic-puitary-gonadal axis in both ewes and rams. Two other aspects need to be thoroughly investigated: the chemical composition of harmel (plant and seed) and the effect of harmel on reproduction in sheep when used as supplementary feed at various maturing stages.

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Economic Assessment of Barley/Forage Legume Rotations Within the Framework of Risk Analysis

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Introduction

Several on-farm trials and demonstrations to introduce forage legumes into crop rotations with barley to replace fallow and/or continuous cropping have been conducted in Iraq since 1991. The decision regarding the type of rotation to be recommended for wide dissemination needs to be based on economic analysis, as there is clear trade off between expected income and yield variability associated with various rotations. Also, rainfed farming is subject to inherent risk and thus, any economic analysis that does not directly address the risk issue may lead to misleading decisions.

The present study aims at determining the stochastically efficient crop rotation within the framework of risk analysis in order to generalize its application in the whole low-rainfall area in Iraq.

Materials and Methods

Five two-course crop rotations were tested into the low-rainfall area (200-350mm) of Ninawah Province, North of Iraq: barley/common vetch (*Vicia sativa*), barley/medic (*Medicago* sp.), barley/common vetch - barley mixture, barley/barley and barley/fallow.

To better represent the targeted area for wide dissemination, on-farm researcher-managed trials were conducted in four locations: Tel-Asmer, Musltan, Hatra, and Ain-Talawi. Grain and forage yields for these trials were obtained from annual reports of the Mashreq-Maghreb project. Monthly rainfall data were obtained from the Meteorological Agency for the 1974-98 period. Enterprise budgets were developed for each crop based on input and output levels reported in the results of these trials and using input and output prices of 1996.

To estimate the production functions, the cross-sectional data for the four locations are pooled with the time series for the 1991/92-1997/98 period. This pooled time-series cross-sectional data requires an appropriate estimation procedure to efficiently estimate the unknown parameters. The Error-Component method is used to estimate nine production functions using yield and rainfall information for the study period.

In order to use the estimated production functions to predict the yield levels for longer period to better represent the possible rainfall pattern of the area, the estimated model was validated. Both in-sample and out-of-sample predictions are estimated for model validation. Three accuracy measures are used to judge the prediction performance of the estimated models. These measures are mean Absolute Error (MAE), Root Mean Square Error (RMSE), and Mean Absolute Percentage Error (MAPE).

After model validation, the estimated production functions are used to predict yield levels using the historical rainfall data for the 1974/98 period. Then, these predicted yield levels are used to calculate net returns for the five crop rotations.

To stochastically determine the efficient crop rotations, stochastic Dominance Analysis (SDA) is used. Two criteria of SDA are applied. The first-degree stochastic dominance (FSD) assumes that a decision maker prefers more to less of net return, implying that the first-order derivative of the utility function is positive. The second ordering rule is the second-degree stochastic dominance (SSD). In addition to the assumption that the producer prefers more to less of net return, the SSD requires an additional assumption. The additional assumption is that the decision maker is risk averse, suggesting that the second-order derivative of the utility function is negative.

Results and Discussion

Rainfall information

Previous agronomic studies in the study area established that a good plant growth requires about 50 mm of rainfall for germination in autumn (October + November + December), and a total of 120-150 mm of effective rainfall for the stage of plant filling in spring (March + April). Comparing these amounts of rainfall requirements with actual rainfall during the 1974-1998 period provides striking results. The percentage of years in which the average autumn rainfall is less than 50 mm is 28% with an average of 26.70mm. Whereas, the percentage of good years (>50 mm) is 72%, with an average of 110 mm. But this does necessarily means that the distribution of the autumn rainfall is good. As a result, timing of planting will be affected which, in turn, will affect yield.

For spring rainfall, 86% of the period has a rainfall below the required amount, with an average of 59.4 mm and only 14% of the years are a good season, with an average of 147.43 mm. This is an important result as it clearly indicates the riskiness of the study area. Thus, any economic analysis that ignores this fact of risk will give unrealistic results.

For a season to be classified as a drought season, the amount of spring rainfall (March + April + May) should be not less than 60 mm. Accordingly, 43% of the seasons are classified as drought years during the 1974-1998 period, with an average of 36 mm.

Production functions and predicted yields

The production functions for each crop in each course of the rotation were estimated. These estimates provide important information on the months and/or season in which the rainfall is more effective in explaining the yield variability of barley, common vetch, medic and mixture. Table 1 summarizes these results. Having estimated the production functions, the second step is to use them to predict in-sample yield predictions and compare them with actual yield levels (Table 2).

Barley after common vetch has the highest grain yield of 1139.4 kg/ha, followed by barley after mixture of 1112.69 kg/ha (Table 2). The lowest barley grain yield (750.77 kg/ha) is for continuous barley cropping. For the legume-course of the rotation, common

vetch/barley mixture has the highest dry matter yield of 1143.5 kg/ha. The estimated production functions perform well in predicting in-sample yield levels. The prediction error does not exceed 2.5% at the worst case, suggesting that the estimated production functions are valid for out-of-sample predictions.

Yield levels are forecasted using historical weather data for the 1974-1998 period for each crop in the two-course rotation. The predicted yield levels are converted into net revenues for each course of the rotation. The net returns of the two courses are, then, summed to obtain the net returns for the whole rotation, their averages are presented in Table 3. It is clear that among forage crops, the barley/mixture rotation gives the highest net return, followed by the barley/common vetch rotation. However, the barley/common vetch rotation seems to be more stable than the barley/mixture rotation as the coefficient of variation (C.V.) of the former is lower than that of the latter.

Another important result is that the barley/barley rotation gives higher net return than the barley/fallow rotation. This simply because under the barley/barley rotation you have grain yield for two consecutive years whereas with the barley/fallow rotation you have grain yield for one year only. Further, additional cost is associated with the fallow year as the common farmers practice in the study area is to have a clean fallow, which requires plowing cost. However, the barley/barley rotation is very volatile compared to the barley/fallow as its C.V exceeds that of the latter by almost threefold. It is difficult to choose among these alternative rotations unless the risk concept is directly taken into account. This is done by applying the SDA (Table 4).

According to the results of Table 4, the rotation of barley/common vetch, barley/mixture, and barley/fallow dominate the other alternatives by the means of second-degree stochastic dominance. It is interesting that the barley/fallow rotation appears as one of the efficient rotations although its net return is not the highest. The main explanation for this is that its coefficient of variation is relatively low. More information on farmers' preferences and objectives is needed for selecting any rotation of the efficient set. For farmers on mixed crop-livestock enterprises, the rotation of barley/common vetch and barley mixture are recommended as they better serve the goal of crop/livestock integration. Type of land tenure is an important factor in the selection of the rotation type. For sharecropping type of land ownership, the barley/f allow rotation may appear a sound recommendation.

Table 1. Effective rainfall months for barley/forage legume rotations.

	Effective rainfall months						
Rotation	**March**	**April**	**Nov.**	**Mar. + Apr.**	**Oct. + Nov.**	**Nov. + Dec.**	**Oct. + Nov. + Dec.**
Barley-year							
Fallow/Barley				X			X
Barley/Barley	X	X			X		
Common vetch/Barley			X	X			
Mixture/Barley	X	X	X				
Medic/Barley	X	X	X				
Legumes-year							
Barley			X	X			
Common vetch	X				X		
Mixture				X		X	
Medic			X	X			

Table 2. Actual and predicted yield levels and prediction errors for barley/forage legumes rotations, 1993-1997.

	Yield (kg/ha)		Prediction
Rotation	**Actual**	**Predicted**	**Error (%)**
Barley-year			
Fallow/Barley	928.00	927.99	0.00
Barley/Barley	750.77	732.00	- 2.50
Common vetch/Barley	1139.40	1135.00	- 0.39
Mixture/Barley	1112.69	1101.84	- 0.97
Medic/Barley	1057.82	1058.68	0.00
Legumes-year			
Barley	755.93	755.89	0.00
Common vetch	763.21	745.22	- 2.36
Mixture	1143.5	1138.86	-0.41
Medic	762.37	745.54	- 2.20

Table 3. Average net returns for barley/forage legumes rotations, 1974-98.

Rotation	**Net Returns (Iraqi Dinars/ha)**		
	Mean Value	**S.D.**	**C.V. (%)**
Barley/Fallow	5779.34	10581.99	183.10
Barley/Barley	8201.79	33397.44	407.20
Barley/Common vetch	47975.68	47636.99	99.29
Barley/Mixture	62793.66	72812.25	115.95
Barley/Medic	34579.20	40586.21	117.37

Table 4. Results of the first-degree stochastic dominance (FSD) and the second ordering rule is the second-degree stochastic dominance (SSD) for barley/forage legumes rotations.

Rotation	Location				
	Tel-Asmer	Musltan	Hatra	Ain-Talawi	Whole sample
Barley-Course					
Barley/Fallow	0	0	0	FSD	0
Barley/Barley	0	0	0	0	0
Barley/Common Vetch	SSD	SSD	SSD	SSD	SSD
Barley/Mixture	SSD	SSD	SSD	SSD	SSD
Barley/Medic	SSD	SSD	SSD	SSD	SSD
Legumes-Course					
Barley	SSD	SSD	SSD	SSD	SSD
Common vetch	SSD	SSD	SSD	SSD	SSD
Mixture	SSD	SSD	FSD	SSD	SSD
Medic	FSD	0	0	0	0
Whole Rotation					
Barley/Fallow	0	SSD	SSD	SSD	SSD
Barley/Barley	0	0	0	0	0
Barley/Common Vetch	SSD	SSD	SSD	SSD	SSD
Barley/Mixture	SSD	SSD	FSD	SSD	SSD
Barley/Medic	0	FSD	0	SSD	0

Kochia (*Kochia scoparia* L. Schrad): a Fodder Crop to Combat Desertification and Poverty

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Introduction

In Mexico, in the last decades livestock production has faced serious problems for the feeding of animals; a situation that is reinforced by strong periods of drought, erratic pluvial precipitation, high costs for pumping water, a marked index of overgrazing and the upward erosion of soils; which induces the scarcity and expensiveness of feeding products, that constitute a strong obstacle for present and future production of meat, milk and egg, indispensable elements in the feeding of 100 million Mexicans.

In Mexico, 62% of the territory (113 million hectares) is destined to animal production; in 70% processes of overgrazing are occurring, which causes shortage of forage and death of the livestock. In the costs generated by the livestock production, 70 to 80% corresponds to feeding.

This paper present results of 15 years of research and demonstration and considers three aspects: agronomical, nutritional and socioeconomical of *Kochia (Kochia L. Schrad var. Emerald)*, of the Chenopodiacea family as a fodder crop to face the urgent necessity of forage production. Kochia is an annual plant, rustic, high in protein, good palatability and well adapted to diverse ecological conditions. Kochia is receiving attention by farmers and scientists because it represents a good option as a grazing or forage crop; it can also be ensiled or baled.

Ecological Potential

The *Kochia* species and varieties found in different parts of the world are the following:

Kochia scoparia (L) Schrad, reported in the People's Republic of China, former Soviet Union, USA, Canada, Syria, Saudi Arabia, Greece, Italy, Spain, Morocco, Argentina, England, Egypt, India and Mexico (Anaya, 1996; Zahran ,1986 and Griffin, 1990); *Kochia melanoptera Bunge*, People's Republic of China, Soviet Union, USA; *Kochia prostata* (L) *Schrad var. Canescens* Moq, People's Republic of China; *Kochia prostata* (L.) *Schrad var. Villosissima* Bong and Mey, People's Republic of China; *Kochia iranica* Lity ex Bronm, People's Republic of China, Iran; *Kochia pyramidata*, Australia; *Kochia planifolia*, Australia; *Kochia sedifolia*, Australia; *Kochia georgei*, Australia; *Kochia tomentosa*, Chile; *Kochia gregori*, Chile; *Kochia triptera*, Chile; *Kochia enchylaenoide*, Chile; *Kochia indica*, India; *Kochia californiana*, USA (Anaya, 1996).

Kochia represents a good option for forage production, the following aspects relating to research and production should be considered (Anaya, 1992):

- reinforced research on adaptation of Kochia to different climate and soil conditions in order to measure the potential yield of forage and seed, this should be connected with plant breeding;
- evaluation of its quality as forage and the behavior of different animal species with varying Kochia concentrations in the ration;
- analysis of the real socioeconomic potential of Kochia;
- the urgent and necessary creation of interdisciplinary teams of researchers and producers in order to use Kochia safely and efficiently.

Kochia could be sowed in 70% of the Mexico's national territory, due to its capacity of germination under low temperatures, its radical deep root system, its adaptability to scarce precipitation and its resistance to salinity. Mexico is suffering the effects of salinity in different areas, causing soils' productivity to diminish;

more than one million hectares under irrigation are affected. Kochia tolerates pH's between 5.0 and 9.0 and also grows well in stony soils. Its cultivation could be carried out under rainfed conditions as well as in irrigated zones (Osuna, 1984; Osuna, 1985; Farias, 1985; INIFAP, 1986; Carmona *et al.*, 1993; Contreras, 1987; Anaya, 1993).

Kochia is distinguished by its low water consumption, since with only 200 to 300 millimeters it produces 50 to 70 tons of green forage per hectare (10 to 15 tons of dry matter per hectare), which means that only 180 to 200 liters of water are needed to produce a kg of dry matter. Forages like alfalfa require, for the same amount of dry matter 1.000 to 1.200 liters of water, that means from 5 to 6 times more.

According to Diaz (1995), under salinity conditions, in the Mexico Valley, seeding dates are related with the capacity of kochia to extract salts during the dry season (October to April), kochia can extract 8.7 ton/ha with a yield of 24 ton/ha of dry matter. Kochia accumulates larger amounts of minerals than conventional hays, particularly when grown on saline soils, which increases water consumption by animals. He also mentions kochia's efficiency in the use of water; kochia requires 278 liters to produce 1 kilogram of dry matter with, while alfalfa requires 1185 liters to produce one kilogram of dry matter.

Table 1. Yield of Kochia in the first cutting (70-80 days) in several regions in Mexico.

Location	Rainfall during the vegetative cycle (mm)	Irrigation (mm)	Dry matter (t/ha)	% Crude protein	Protein (kg/ha)	Water use efficiency (liters/kg DM)
Calculalpan, Tlaxcala	280		16	20	4480	175
Tecamac, Mexico	260		13	21	2930	200
Libres, Puebla	300		12	21	2520	250
Montecillo, Mexico	310		14	26	3640	221
Jalpa, Zacatecas	250		13	18	2340	192
Sayula, Jalisco	290		14	20	2800	207
Oaxaca, Oaxaca	270		13	19	2470	208
Colon, Qro.	280		12	19	2280	233
León, Guanajuato	320		17	21	3570	188
Tlahuac, Mexico	300		14	23	3220	214
Texcoco, Mexico	320		14	21	2940	228
Temamatla, Mexico	300		15	18	2700	200
Tizayuca, Hgo.	240		11	21	2310	218
Cuitzeo, Michoacan			15	22	3300	220
Comarca Lagunera, Dgo.		600	18	24	4320	333
Montecillo, Mexico		500	20	23	4600	250
Cd. Obregon, Sonora		400	16	22	3520	250
Colon, Qro.		450	16	21	3360	281
Mixquic, Mexico		500	20	20	4000	250

In the Valley of Mexico, between June and October 1998, three different clippings were taken: at 45, 60 and 75 days after the seeding date. When the first clippings were made on August 15th, Kochia was 55 cm tall and yielded 3,400 kg of dry matter per hectare with a protein content of 27%. At the second set of clippings, taken on August 30th; plants were 85 cm tall and yielded 7,500 kg of dry matter per hectare, with a protein content of 23%. At the third clipping on September 15th, plants were 115 cm tall with a yield of 10,500 kg of dry matter per hectare, this time the protein content was 18 percent (Anaya, 1999).

The following ecological improvements due to kochia have been observed:

- reinstatement of the vegetative cover in rangelands;
- control of environmental degradation upon controlling erosion and overgrazing;
- recovery of soil fertility, by increasing the deposition of organic matter;
- modification of the albedo;
- CO_2 fixation; and
- entrance of energy to the ecosystem.

Animal Nutrition

Sherrod (1971), Finley (1971) and Sherrod (1973) found very interesting results concerning production, chemical analysis and digestibility of Kochia compared with alfalfa. Protein content and digestibility of energy and protein of Kochia were similar to that of alfalfa hay. Kochia yield was 11327 kg/ha of dry matter. Diaz (1995) studied the effect of maturity on nutritive value of Kochia and found that when harvested at or before full bloom, it was quite similar in digestible nutrient intake to alfalfa when harvested at 20% bloom. Kochia is a forage with good palatability, which allows to use it like a source of protein in the elaboration of diets and balanced food (Anaya, 1999).

Several experimental treatments were evaluated using diets with different levels of kochia and alfalfa on Creole lambs. The daily increments of weight were 290 to 300 grams per day, which indicates that the results were statistically similar but with a reduction of 40 percent in the costs of lambs nutrition and production in the diet with kochia (Rodríguez, 1988; García *et al.*, 1989; Trejo, 1997).

In a research carried out in Chapingo, Mexico, five combinations (treatments) of kochia/alfalfa were

evaluated for food of Creole rabbits development and fattening phase. There was no difference between the studied treatments for the consumption of total food (308 to 432 kilograms) and nutritious conversion (3.70 to 4.74 kg of food per kilogram of meat), during a period of 30 days (Ramirez y Mendez, 1998; Santana, 1991).

Studies to evaluate the efficiency for production and quality of milk of Creole goats in kochia as substitute of alfalfa in the "Comarca Lagunera Region" of Coahuila and Durango states, indicates that kochia could be considered as an ingredient in diets, up to 40% (Flores, 1992).

In Hidalgo state, in arid and semi-arid conditions, a project succeeded to establish a productive module with kochia in an integral approach. The livestock involved included 1,057 cattle, 7,650 sheep and 5,100 goats. With the implementation of the project, the index of grazing increased from 0.06 to 1 Animal Unit (Animal unit means the necessary forage for the food and production of 1 cattle of 450 kilograms of weight or its equivalent in another type of animal) per hectare with the introduction of kochia and different vegetation to pasture land; and from 0.03 to 1 Animal Unit per hectare with the introduction of special pasture for goats (Gobierno del Estado de Hidalgo, 1995).

Economic Potential

In USA, Mexico and Canada, cattlemen have found that a grazing program that includes kochia can provide low cost/high benefits with relatively little effort in producing the forage (Fuehring, 1984; Foster,1980; Coxworth, 1988; Anaya, 1999).

In Mexico, the distribution of rains marks a strong period of drought, which indicates shortage of forage and death of livestock. It is necessary to consider that kochia requires approximately 70 days from the seeding to 5% of flowering. Also, its wide adaptation and resistance to low temperatures, allows its cultivation and the readiness of green forage during almost all year by means of the establishment of periodical seeding dates.

The stationality of the production of fodder crops and favorable forages can increment prices up to 300 to 400 percent, for which kochia represents an excellent option for producing forage. In a hectare, the cost of production until the packing doesn't exceed the 3,400 pesos per crop. Under good conditions, the production could be 100 tons of green forage per hectare per harvesting and one could obtain four harvestings per year. Ten mexican pesos are equivalent to one US$ (Trejo, 1998).

If we assume that (1) four harvests are obtained per year with a yield of 70 tons of green forage per hectare, (2) a price for kochia of 90% of the value of alfalfa in conditions of relative abundance , and a price of Alfalfa of 2,000.00 pesos per ton of dry matter; kochia could be sold for 1,600.00 pesos per ton of dry matter (Reyna, 1994).

Kochia contains 80% humidity. Supposing that the production per harvest is of 14 tons of dry matter per hectare; in four harvests 56 tons of dry matter per hectare will be obtained. When dried, the income will be 92,600 pesos and the cost of production including the packing would be 13,600.00 pesos per hectare per year. Relating the value of the production against the costs, it is observed that revenues are 79,000.00 pesos per hectare per year; the relationship benefit/cost is 5.8:1, which means that for each invested peso, 5.8 are obtained.

Impact in the social well-being

With 56 tons of dry matter per hectare per year, the readiness of forage for 12 animal units is guaranteed for one year.

On the other hand, if the consumption of milk recommended by the Food and Agricultural Organization of the United Nations (FAO), is of 180 liters per person per year, or 450 milliliters per day. If a family has 11 cattle (50% Holstein) fed with kochia, they will produce around 15 liters per day, which makes a total of 165 liters per day. For a family of 6 members, the requirement of milk is 2.70 liters per day, which means that there is a surplus of 162.3 liters per day (Trejo, 1997).

If sold at 3.00 to 3.50 pesos per liter of gruff milk, the revenues for sale would be of 489.90 to 568.10 pesos per day, or of 14.00 to 16.23 wages, which can cover the costs of production, as well as increase the investment and the saving (Trejo, 1998).

Conclusions

- Kochia is adapted to a great variety of ecosystems; it resists frost, and it is tolerant to drought and salinity. It is a good option as a fodder crop and as a protein suplement in animal nutrition.
- Cattlemen may use this fodder crop for diverse animal species by restricting it to less than 40% of the ration as a source of protein.
- Socioeconomical analysis indicates satisfactory net earning of 12000 to 14000 pesos per hectare in only 70 days with a benefit/cost ration of 6:1.
- Kochia has positive effects in the recovery of rangelands, of eroded soils, in the aquifer regeneration due to its low water consumption, and in watershed protection. Water, basic grains and forage availability are and will be basic factors for sustainable development in rural areas.

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Evaluation of Vetch Establishment under Supplementary Irrigation

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Introduction

In Jordan, the scarcity of feed resources is the major limitation to animal production. In 1989, about 550 thousand tons of grain were imported consisting mainly of barley, corn (*Zea mays*), sorghum (*Sorghum bicolor*), and cereal bran.

The area cultivated with vetch in the last ten years (1988-1997) ranged from 1458 hectares in 1988 to 1668 hectares in 1997 with an average area of 1351 hectares (Department of Statistics, 1988-1997). The total production ranged from 2218 tons in 1988 to 2892 tons in 1997.

Hay production from adapted legumes such as vetch and pea and from forage cereals such as barley, triticale and oats has been suggested as one way of increasing feed from fallow land in traditional rainfed cropping areas (Osman and Nersoyan, 1986). However, growing either legumes or cereals in a pure stand is not considered ideal for haymaking. Therefore, growing cereal-legume mixtures is suitable for haymaking; in addition to that mixtures are higher yielding than pure crops (Ababneh, 1983; Osman and Nersoyan, 1986). Vetch mixtures with barley are known for high dry matter yield and feed quality (Harb *et al.*, 1986; Osman and Nersoyan, 1986).

There are also advantages associated with the inclusion of a legume in a small grain crop. For example, Roberts *et al.* (1977) found that growing vetch in combination with wheat could reduce nitrogen fertilizer requirements for wheat.

The semi-arid to arid areas of Jordan are large and the annual rainfall ranges from 100-200 mm. The major crop grown there for long time is barley. In good years (1 out of 10) it can produce grain, however, in the bad years it is usually grazed during March and April. If water can be made available, then why do we not grow other crop? The potential productivity of dry land farming is low and fluctuates from year to year, in relation to the seasonal variation in rainfall.

Average annual rainfall at Al-Muwaggar is about 150 mm; it is irregular, sporadic and unpredictable. Rainfall fluctuates from year to year and within years. The area is characterized by having a crusted surface of soil, which reduces infiltration rate and hinders seedling emergence. These factors and others (e.g., frost) contribute to the low productivity of crop production in these areas.

Similar to other areas of very low rainfall (below 200 mm) in Jordan, Al-Muwaggar has some wadies in which floodwater run from place to place. Therefore, small earth dams were constructed to collect floodwater in order to use this water for irrigation of fruit trees, vegetables and field crops.

This present investigation was conducted with the following objectives: 1. Study the performance of vetch crop grown alone or in mixture with barley under supplementary irrigation, and 2. Study the effect of sewage sludge and/or DAP application on yield of pure vetch or vetch-barley mixtures.

Materials and Methods

This trial was conducted at Al-Muwaggar Agricultural Research Station during the 1997/1998 growing season. The station is located about 50 km southeast of Amman (38°5E, 31°53N). The climate is typical Mediterranean, arid with wet cold winter and hot dry summer (Taimeh, 1989). Rainfall varies from 80 to 200 mm with annual average of 150 mm, falling mostly during January and February (Table 1). Soil is silty-clay to silty-clay-loam.

Land preparation started in early October by plowing with a moldboard, then soil clods were broken down by a rotary plow. Then, furrows 30 cm deep, 40 cm wide, and 100 cm apart, were opened using a furrow opener. Sewage sludge (SS) and/or Diammonium phosphate (DAP) were added to the assigned plots at the bottom of the furrows and mixed with the soil. Any damage to the furrows was repaired by hand. Planting was carried out on 24 November 1997. Emergence was completed 20 days after sowing. Plots were irrigated for the first two weeks using sprinkler irrigation, then irrigation was done by the furrows. Total amount of water received was about 350 mm (irrigation + rainfall). Treatments were in a split plot design as follows:

Main plots: Diammonium phosphate (DAP) and/or sewage sludge (SS); control (nothing added); DAP alone at a rate of 100 kg/ha; SS at a rate of 30 ton/ha; SS+DAP together. Seed mixture a total of 120 kg/ha; barley-vetch percentage: 0-100; 25-75; 50-50; 75-25; 100-0.

Samples for fresh and dry matter were obtained from the two middle furrows at a length of 1 m. Before cutting five height readings were taken to determine stand height. Samples were taken when barley plants were at the boot stage. Samples were weighted directly after cutting fresh weight, then plant material was placed in a dry air oven 75°C for 48 hours, to determine dry matter yield. At maturity, *total plots* were harvested to determine straw and grain yield.

Data were statistically analyzed according to Little and Hills (1978). Mean separations for the main effects (DUNCAN) and for the interaction effects (LSMEANS) were estimated using the SAS system for a split plot design (SAS Institute, 1985).

Results and Discussion

Plant height

Plant height of the stand ranged from 38 cm for pure vetch under control treatment up to 90 cm for vetch mixed with barley at a rate of 75% to 25% with the application of sewage sludge (Table 1). These results are much higher than those found by Ahmed (1997). He found that plant height ranged from 19 to 26 cm for common and narbon vetch, respectively.

Fresh and dry weight

The highest fresh yield (11.2 t/ha) was produced from growing barley and vetch in a mixture of 25% barley to 75% vetch with the application of 30 t/ha of sewage sludge. If vetch alone is considered, it is clearly shown that the lowest amount (3.6 t/ha) was produced under the control treatment (Table 2). This can be related to the plant height differences shown in Table 1.

Differences in dry matter production were not clear. However, growing vetch alone without DAP or sewage sludge gave 0.7 t/ha (Table 3) and yield was increased as the seeding ratio of vetch was decreased from 100 to 50%. Other researchers proved that dry matter production of the mixture is higher than the legume alone (Osman and Nersoyan, 1986; Bawaleez, 1995). This is contradictory to Roberts *et al.* (1989).

These results proved the potential to grow vetch in such areas with supplementary irrigation. Ahmed (1997) found that herbage yield of common vetch at Muwaggar was about 0.5 t/ha; when animal manure was applied at a rate of 30 t/ha, yield was raised up to 1.5 t/ha. Droushiotis (1985) proved that common vetch can produce 3 t/ha if cut at early flowering.

Grain yield

Under sewage sludge application growing 25% barley mixed with 75% vetch produced 4 t/ha of mixed grain (Table 4). However, when pure vetch is considered, the results indicated the possibility to produce 1.8 ton of grain/ha. Also, it was found that the application of 100 kg/ha of DAP gave 2.6 ton of vetch grain/ha (Table 5). These results were much higher than that found by other researchers (Bawaleez, 1995; Ahmed, 1997).

Grain yield of legume-cereal mixture was 28-38% higher than that in the pure stand (Ababneh, 1983).

Straw yield

Differences are not that sharp, straw yield ranged from 3.7 to 12.7 t/ha for the different seeding ratios and DAP or SS application (Table 5). On the other hand, under the control treatment, without DAP or SS application, straw yield was increased from 1.5 to 7.5 t/ha as vetch proportion in the mixture was reduced from 100% to 25%. Growing vetch alone without DAP or SS can produce 1.5 t/ha of straw; and that was 50% higher than the straw yield found by Ahmed (1997).

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Table 1. Effect of seeding ratio, addition of Diammonium phosphate (DAP) and/or sewage sludge (SS) on plant height (cm) of barley-vetch mixtures grown under supplementary irrigation at Muwaggar Research Station during the 1997/98 growing season.

Barley:Vetch %	Control	DAP	SS	SS+DAP
0:100	38.0b*	61.0a	69.0ab	50.3a
25:75	63.3a	77.3a	89.7a	72.0a
50:50	67.7a	76.7a	63.3b	58.3a
75:25	48.3ab	75.3a	70.7ab	59.0a
100:0	55.0ab	75.7a	66.7ab	71.3a

Table 2. Effect of seeding ratio, addition of Diammonium phosphate (DAP) and/or sewage sludge (SS) on fresh weight (t/ha) of barley-vetch mixtures grown under supplementary irrigation at Muwaggar Research Station during the 1997/98 season.

Barley:Vetch %	Control	DAP	SS	SS+DAP
0:100	3.6a*	7.7a	9.5ab	4.4b
25:75	6.0a	7.2a	11.2a	8.2ab
50:50	5.9a	7.4a	6.7b	4.9b
75:25	4.8a	9.0a	6.6b	9.6a
100:0	5.3a	6.0a	5.8b	5.9ab

Table 3. Effect of seeding ratio, addition of Diammonium phosphate (DAP) and/or sewage sludge (SS) on dry weight (t/ha) of barley-vetch mixtures grown under supplementary irrigation at Muwaggar Research Station during the 1997/98 season.

Barley:Vetch %	Control	DAP	SS	SS+DAP
0:100	0.7b*	1.4a	1.9a	1.2a
25:75	1.4ab	1.9a	2.5a	2.0a
50:50	1.8a	1.8a	2.2a	1.6a
75:25	1.3ab	1.9a	2.0a	2.0a
100:0	1.5ab	1.7a	1.8a	1.9a

Table 4. Effect of seeding ratio and the addition of Diammonium phosphate (DAP) and/or sewage sludge (SS) on grain yield t/ha) of barley-vetch mixtures grown under supplementary irrigation at Muwaggar Research Station during the 1997/98 season.

Barley:Vetch %	Control	DAP	SS	SS+DAP
0:100	1.8b	2.6ab	1.8b	1.7b
25:75	3.6a	2.1ab	4.0a	2.5ab
50:50	1.4b	2.0ab	1.4b	1.8b
75:25	1.9b	1.2b	2.4b	3.7a
100:0	1.8b	3.2a	1.5b	1.5b

Table 5. Effect of seeding ratio, addition of Diammonium phosphate (DAP) and/or sewage sludge (SS) on straw yield (t/ha) of barley-vetch mixtures grown under supplementary irrigation at Muwaggar Research Station during the 1997/98 season.

Barley:Vetch %	Control	DAP	SS	SS+DAP
0:100	1.5b	6.8b	5.9a	4.5a
25:75	4.7ab	7.0b	5.9a	4.7a
50:50	6.0ab	12.5a	9.7a	4.2a
75:25	7.5a	12.7a	8.0a	3.7a
100:0	6.5ab	6.4b	5.9a	6.1a

In each column figures followed by the same letter are not significantly different at P<0.05.

Changes in Soil Physical Properties with Continuous Cropping in Northern Syria

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Introduction

With intensification of land use the issue of sustainability of the resource base and environmental protection for future generations is of major concern. The climatically harsh West Asia - North Africa (WANA) region is one such area. Despite the common features of limited rainfall and difficult production environments, considerable variation exists (Kassam, 1981). Much of the area is desert and scrubland, where rainfed cropping is possible (150 mm to 600 mm year), but there is much inter-annual and seasonal variation. Within Syria, a range of rainfall zones exist, thus reflecting weather conditions in most Mediterranean region.

Complete crop failure is common, especially in the low rainfall areas, i.e. < 200 mm. Along with drought, cold, heat, other limitations include salinity and shallow soils with low moisture-retention capacity; many soils are inherently low in nutrients, especially nitrogen (Harmsen, 1984).

The farming system is based on cool-season winter rainfall (Cooper *et al.*, 1987); cereals predominate, with barley in the drier areas. Forage and food legumes are grown in rotation with cereals. The area of fallow land is rapidly diminishing, with continuous cropping now being more common. Livestock raising, mainly sheep, is usually associated with cereal growing.

Soil properties are related to climatic conditions, past and present. Most soils have considerable amounts of calcium carbonate, which may induce deficiencies of phosphorus (P) and micronutrients (Matar *et al.*, 1992), but are low in organic matter (OM) (Ryan, 1998). The reserve of total organic N is low, as is mineral N, nitrate and ammonium. Consequently, in the 1960's and early 1970's, deficiencies of N were ubiquitous. Since that time, most countries in WANA have witnessed substantial increases in fertilizer use, especially N and P.

As in other areas of the world, sustainability of cropping systems in the long term can only be adequately gauged by long-term trials. Such trials were established ICARDA in northern Syria (Harris, 1995; Jones and Singh, 1995). Except for soil OM data in one major trial, there have been few measurements of soil parameters. Thus, this study evaluated two rotation trials at Tel Hadya and Breda in terms of aggregate stability and infiltration and hydraulic conductivity.

Materials and Methods

Two long-term rotation trials at ICARDA's main station at Tel Hadya (330 mm/yr) and its drier sub-station at Breda (280 mm/yr) were selected:
1) "New Rotation" established in 1982/83, involving two-year barley/forage legumes, fallow or barley, and
2) "Continuous" barley, established in 1986/87 and involving N x P factorial fertilizer treatments on continuous barley sequence.

The soils differed in texture, Breda *Calcixerollic* Xerochrept being siltier and Tel Hadya Chromic Calcixerert, a heavy clay (Ryan *et al.*, 1997).
The field plots were sampled to a depth of 20 cm and subsequently air-dried and analyzed for organic carbon by the Walkley-Black method and converted to OM using a factor of 1.72. The 2-mm fraction was subjected to wet sieving followed by measurement of the >0.1 mm fraction. Dispersed clay (g/100 g soil) reflected another index of stability. Field measurements were made of infiltration (cm/hr) using a double-ring infiltrometer. Hydraulic conductivity (ml/hr) was measured in the laboratory using the 2-mm soil fraction in plexiglas columns.

Results

Different rotations influenced the soil physical properties; this was related to changes in OM. Thus, in the "New Rotation" at Tel Hadya (Table 1) the highest levels of OM were associated with vetch followed by lentil, and least with fallow or continuous barley. Within any sequence, slightly higher values were associated with fertilization. These differences had an impact on other parameters; thus, higher water-stable aggregates occurred with fertilized vetch/barley (42%) and lowest with B/B with least amount of fertilizer. Though differences were not pronounced, hydraulic conductivity and infiltration values generally paralleled those of water-stable aggregates; similar trends occurred in this rotation at Breda (Table 2). However, the effect of rotation on OM was not as in Tel Hadya. This time the continuous barley gave similar OM value as lentil and vetch, with fallow being lower. The effect of fertilization was marginal. Following the OM trend, water-stable aggregates were higher for the B/B

rotation and least for B/F. Again at Tel Hadya, though differences were small, both hydraulic conductivity and infiltration followed the OM trend.

The "Continuous" barley trial indicated significant differences at both sites. Thus, at Tel Hadya (Table 4) the B/F rotation had higher OM, hydraulic conductivity, and infiltration levels, but lower dispersion, compared to the continuous barley rotation. In addition, there was a consistent effect of combined fertilization involving both N and P. While the "Continuous" barley trial at Breda (Table 4) showed the same positive effects of combined N and P, the effect of rotation differed from that at Tel Hadya. As in the "New Rotation" trial at Breda, the B/B rotation had higher OM levels and associated increases in water-stable aggregates and related water characteristics compared to the F/B rotation. The greatest effect occurred with B/B fertilized with the highest N and P levels.

Discussion

Both trials demonstrated that despite the relatively low levels of organic carbon in soils of a typical Mediterranean climate some cropping systems can favorably build up soil OM levels to a modest extent. What was more interesting was the close relationship that existed between OM and water-stable aggregates and water intake and permeability. Thus, this parameter is a good measure of soil physical properties. Better-structured soils are more resistant to erosion and a more favorable medium for crop growth. The higher OM status would be associated with a greater soil N pool and enhanced bacterial biomass as well as possible improvement in moisture availability.

Crop yield data from these trials has shown the value of vetch as a replacement for fallow (Jones and Singh, 1995) and of N and P fertilization of barley in the rotation. These practices also have a favorable effect on soil quality. While the trials have been in existence for 12 - 16 years, one can only speculate how long it will take for these legume-based cropping systems to reach a ceiling of OM under the environmental conditions that prevail in this region.

While most rotation studies conducted at ICARDA have focused on crop yields and soil moisture (Harris, 1995), the soil data presented here have additional environmental implications. Processes which remove carbon from the atmosphere and store it in the soil, i.e., "carbon sequestration", contribute towards reducing "greenhouse" gasses and mitigating the effect of global warming. Thus, intensification of agriculture in semi-arid regions through legume-based rotations and fertilizer inputs are compatible from both the production viewpoint, soil use sustainability and environmental amelioration.

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Table 1. Soil parameters in relation to crop and fertilizer regime in the " New Rotation " at Tel Hadya.

Crop	Treatment	Organic Matter %	Water-Stable Aggregates %	Hydraulic Conductivity ml/hr	Infiltration cm/hr
Vetch	NO PO / N60 P60	1.14	41.9	19.6	23.2
	N0 P0 / N40 P60	1.14	39.2	1.90	23.0
	N0 P0 / N0 P60	1.12	38.3	18.9	22.9
	N0 P0/N0 P0	1.11	38.4	18.4	22.6
Lentil	N0 P0 / N40 P60	1.11	38.2	18.4	22.8
	N0 P0 /N0 P0	1.10	37.7	17.9	22.8
Barley/Fallow	N40 P60 / -	1.09	37.3	17.6	20.7
	N0 P0 /-	1.02	36.5	17.6	20.6
Barley/Barley	N40 P60 / N40 P60	1.01	3.50	16.4	19.6
	N0 P0 / N40 P60	0.97	34.9	16.0	20.2
LSD (0.05)		0.10	3.18	1.66	1.68

Table 2: Soil parameters in relation to crop and fertilizer regime in the "New Rotation" at Breda.

Crop	Treatment	Organic Matter %	Water-Stable Aggregates %	Hydraulic Conductivity ml/hr	Infiltration cm/hr
Barley/Barley	N20P60 / N20P60	1.05	39.1	4.8	15.3
	N0P0 N20P60	1.06	39.3	4.4	15.6
Vetch	N0P0 N20P60	1.10	28.8	4.01	15.7
	N0P60 / N0P60	0.98	27.3	4.4	15.9
	N0P0 / N0P0	1.04	37.5	4.1	15.4
Lentil	N0P60 / N40P60	1.06	38.2	4.3	15.6
	N0P0 / N0P0	0.99	37.3	4.0	15.4
Barley/Fallow	N0P0 / N20P60	0.97	36.4	3.8	12.3
	N0P0 / N0P0	0.96	36.2	3.8	12.9
LSD (0.05)		0.09	3.3	1.0	3.88

Table 3: Soil parameters as influenced by rotation treatments with " Continuous Barley" trial at Tel Hadya

Treatment	Organic Matter %	Water-Stable Aggregates %	Hydraulic Conductivity ml/hr	Infiltration cm/hr
NO PO	0.87	32.6	16.7	21.7
N120 P90	0.98	39.3	19.4	24.9
LSD (0.05)	0.18	3.9	1.2	1.4
Barley/Barley	0.80	32.8	17.5	22.2
Barley/Fallow	1.01	38.7	18.3	23.9
LSD (0.05)	0.22	4.9	1.4	1.8

Table 4: Soil parameters as influenced by rotation treatments with " Continuous Barley" trial at Breda.

Treatment	Organic Matter %	Water-Stable Aggregates %	Hydraulic Conductivity ml/hr	Infiltration cm/hr
NO PO	1.21	36.8	3.8	12.9
N120 P90	1.32	40.3	4.6	15.6
LSD (0.05)	0.08	1.60	0.8	1.9
Barley/Barley	1.35	41.9	4.9	17.4
Barley/Fallow	1.27	36.50	4.0	12.3
LSD (0.05)	0.09	1.90	0.8	2.4

Effect of Feed Block Supplementation on the Reproductive Performance of Awassi ewes Grazing Cereal Stubble

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Introduction

Sheep in dry areas of Iraq are heavily dependent on cereal (wheat or barley) stubble grazing as their sole source of feed from June to October, a period which coincides with the mating season (Salman, 1996). No supplement is given during this time. This type of feeding system is likely to result in a serious protein and minerals deficiency. The use of supplementary feed, improved weight gain, cycling activity and conception rate of ewes grazing cereal stubble (Guessous *et al.*, 1991; Treacher *et al.*, 1996). This study was conducted to investigate the effect of using feed blocks (FB) as supplementary feed on the reproductive performance of Awassi ewes grazing cereal stubble.

Materials and Methods

Experiment 1: ninety mature Awassi ewes (x=39.5Kg) were allocated into control (C) without supplement, FB supplement and sunflower seed meal (SSM) supplement. Experiment 2: fifty Awassi mature ewes (x=46.5) were allocated into control (C) without supplement and FBC enriched with cottonseed meal plus vitamins AD_3E (40000 u/k) FB supplement. Experiment 3: ninety-six Awassi ewes were allocated into control (C), FBC enriched with cottonseed supplement and FBB enriched with brewer grain supplement. During the three experiments the supplements were fed to animals after returning from grazing wheat and barley stubble 28 days prior to mating and 54 days after introduction of rams. The chemical analysis of the supplements is presented in Table 1.

Two on-farm experiments were conducted at two locations. The sheep owners' flocks were divided into two groups, farmer practice cereal stubble only and FBC supplement. FBC were fed to animals after returning from grazing wheat and barley stubble in the evening 60 days. Rams were run with flocks through the experiment.

Results and Discussion

Results of experiment 1 (Table 2) showed that using FB as supplementary feed improved weight gain (70%) and conception rate (7%) over that of the control.

Results of experiment 2 and 3 (Table 2) showed that providing FB enriched with cotton seed meal or brewer grain and vitamins AD_3E resulted in considerable improvement in conception rate (11-16%), lambing percentage (25-33%) and twinning percentage (15-18%) as compared to the control groups.

Results from on-farm experiments 4 and 5 showed a similar trend to the on-station experiments. Ewes fed FB had higher weight gain (183-360%) and lambing percentage (14-44%) as compared to the farmer practice with no supplement (Table 3). The improvement in ovulation rate of Merino ewes grazing dry summer pasture following lupine grain protein was reported by Knight *et al.* (1975). The improvement in the reproductive performance of Awassi ewes due to feed blocks supplementation might be considered as a breakthrough in sheep farming in the dry areas of Iraq and other WANA countries, where sheep depend heavily on stubble grazing during mating season.

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Table 1. The chemical analysis of feed supplements.

	Dry matter (%)	Crude Protein (%)	Ether Extract (%)	Crude Fiber (%)	Ash (%)
Feed blocks (FB)	89.00	31.80	1.56	4.51	25.48
FBC enriched with cottonseed (FBC)	95.32	18.15	1.39	13.79	28.55
Enriched with brewer grain supplement (FBB)	94.68	19.31	1.44	9.79	32.76
Sunflower seed meal (SSM)	91.77	22.33	8.01	32.4	10.48

Table 2. Effect of feed blocks supplementation on the reproductive performance of Awassi ewes (On-station).

	Exp. 1			Exp. 2		Exp. 3		
	C	FB	SSM	C	FBC	C	FBC	FBB
No. of ewes	29	28	30	27	27	32	32	30
Initial weight (kg)	39.5	39.6	39.4	46.3	46.3	42.2	42.8	42.1
Weight gain (g/d)	30a	15b	44ab	-35a	5b	3a	26b	32b
Mating body condition	2.13a	2.33a	2.23a	2.36a	2.72b	2.42a	2.46a	2.52a
Conception rate (%)*	86a	93a	87a	78a	89b	81a	94b	97b
Lambing (%)**	93a	100a	93a	89a	115b	84a	109b	117b
Twinning (%)***	10a	7a	6.6a	11a	26a	3a	16a	21a
Supplement intake (g/d)	-	144	150	-	227	-	259	280

* Conception %= No. of ewes lambed / ewes joined with rams. ** Lambing %= No. of lambs born alive / ewes joined with rams. *** Twinning %= No. of ewes giving twin / ewes joined with rams.

Table 3. Effect of feed blocks supplementation on the reproductive performance of Awassi ewes (On-farm experiments).

	Exp. 4		Exp. 5	
	C	FBC	C	FBC
No. of ewes	50	50	30	30
Days on test	60	60	60	60
Initial Weight (kg)	45.7	45.3	44.2	45.2
Weight gain (g/d)	18a	51b	20a	92b
Conception (rate %)	54a	68b	43a	80b
Lambing rate (%)	54a	68b	43a	87b

The Present Natural Conditions of Semiarid Pastures of Daghestan

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The semiarid pastures of the Daghestan republic are located in the southwest part of the Pricaspian lowland. The pastures are concentrated between the riverbeds of the Terek and the Kuma and occupy nearly 1.5 million ha. These lands are used as seasonal pastures for sheep in winter from November till March; some places are grazed the whole year round. In summer sheep are taken to mountain pastures of the northeast slopes of the Greater Caucasus.

The climate of the Terek-Kuma lowland is semiarid and has a transitional character between deserts and dry steppes zones. The average annual precipitation varies from 200 to 300 mm a year. The largest amount of precipitation comes in the warm season (up to 200 mm from April to October). Cool season precipitation varies from 100 to 150 mm (November-March). The evaporation reaches 1000 mm/year. Temperatures of the coldest months vary from 2 to 4.5° C below zero, with a minimum of 33-35° C below zero in January. The frost-free period lasts for 160-180 days a year. Precipitation in the form of snow comes from December to March. The average height of snow cover

reaches 3-5 cm. Temperatures of the hottest months vary from +21 to +27° C. The maximum temperature reaches 44° C in July. There are 180-200 days with temperature above +10° C. The solar radiance is 2200-2400 hours in a year. The wind regime is characterized basically by eastern winds (Agroclimatic reference, 1963; Akayev *et al.*, 1996).

The surface of the Terek-Kuma lowland is 25-27 m below the tide-gauge of the Baltic Sea. The relief represents an initial plain, which was formed with regressions and transgressions of the Caspian Sea as a result of sea level dynamics during thousands years. The lowland is inclined a little from northwest to southeast, that's why the lowland is drained weakly. The relief is derived on a principle of an aerodynamic pipe. The flat relief of the territory is completed with eolian hills.

According to our research, the hills increase their areas and their forms become irregular moving away from the seashore to the west and northwest. At a distance of 20 km from the seashore the dimensions of the largest eolian hills reach 1000-2000 m in length and 1000 m in width. The hills with relative height approaching 3-4.5 m have a sublatitudinal orientation according to the directions of the dominant winds from the east. Special features of the morphology have their reflection in the character of soil and plant covers of the lowland.

The soil cover of the lowland is completed mainly with light-chestnut soils and solonchaks (alkali soils). Light-chestnut soils form on described hills on eolian deposits. The granulometric composition is light: loamy sands, light loams. In the direction to the northwest from the mainly windward slopes of the hills to the mainly leeward slopes, the quantity of physical clay fractions (<0.01 mm) increases, which proves the aerodynamic origin of the eolian hills. The ground water table is located below 3 meters (automorphous water regime of soils). Light-chestnut soils are the chief base for sheep pasture in winter.

Solonchaks in complex with solonetz-solonchaks (saline soils) and meadow saline soils are formed on the initial Pricaspian plain on deposits of wandering channels of the Terek river delta and on marine deposits of the Caspian Sea. The granulometric composition is heavy: loams, clays, heavy clays. The ground water table can be higher than 1.5 meters (hydromorphous regime of soils).

The common feature for all types of soils is the presence of light-leaching salts in soil profiles. There are 0.33-0.40 tons of salts per hectare in automorphous soils and 1.7-2.16 – in hydromorphous soils in the upper 0.5 m. The chemical salt composition is chiefly sulphate-chloride and chloride-sulphate. In spring and autumn the proportion of sulfates increases. Reaction of soil water extract is alkaline (pH=7.5-7.6). The content of humus is low (1.4-1.9%) in hydromorphous soils and 1.8-2.5% in automorphous soils. As the ground table water lowers from east to west the area of light-chestnut soils spreads in the soil cover of Terek-Kuma lowland. In the southwest part of the lowlands there are massifs of partially planted sands, but in the west part there are considerable areas of deflation hollows.

The peculiarities of vegetation cover are typical both for deserts and dry steppes. Wormwood and ephemeral grasses chiefly occupy light-chestnut soils. The vegetation is represented by *Artemisia Lercheana, A. taurica, A. monogyna, Kochia prostrata, Poa pratensis, P. bulbosa, Bromus mollis, B. tectorum, B. squarrosus, Erodium cicutarium, Camphorosma Lessingii, Filaga orvense.* The following species have the most feed value as plants of winter pastures: *Kochia prostrata, Artemisia Lercheana, A. monogyna, Camphorosma Lessingii.*

The detailed research of the testing plot, which was mapped on a 1:1000 scale, exposed differentiation of vegetation cover according to the characteristics of the slopes. Moving from the slopes of the highest hills to the periphery reveals an increase of the grass cover density from 35-40% to 60%. In that direction the proportion of ephemeral cereals extends; on the whole the age spectrum of *Artemisia* is rejuvenated, and, therefore, feed value of vegetation enlarges.

The vegetation of solonchaks is represented by *Halocnemum strobilaceum, Tamarix ramosissima, Salsola dendroides, S. crassa, Suaeda microphylla, Petrosimonia oppositifolia, Obione verruciferum, Limonium gmelini, L. meyeri, Cynodon dactylon, Alyssum desertorum, Eremopyron orientale, Heliotropium.*

The solonetz-solonchaks are formed under *Petrosimonia, Artemisia taurica, A. monogyna, Bromus.*

On the meadow alkali soils thefollowing species sprout: *Alhagi pseudoalhagi, Polygonum aviculare, Aeluropus littoralis, Agropyron repens, A. desertorum.* The interesting fodder for winter pastures are *Artemisia, Aeluropus littoralis, Cynodon dactylon.*

The natural factors of lowland are affected by grazing and, as a rule, overgrazing with sheep. The number of sheep often exceeds 3 animals per hectare (it should be not more than 1-1.5 ones per hectare for this region). A three year experiment to study grazing of 3-4 sheep per hectare showed intensification of soil erosion 2-3 times in comparison with a regime without grazing, temperature increase of 1.5-2.5° C, soil compression of 1.07 times in upper layers.

The salt sum of light-chestnut soils in the upper 0.5-m layer was 0.48% under grazing and 0.42% without grazing (summer season). Salt content of solonchaks and solonetz-solonchaks is high in both cases (1.93-2.75%). On account of overgrazing the grass cover density decreased up to 20-30%. Short-term overgrazing of 7-8 sheep per hectare led to appearance of *Polygonum aviculare* in *Alhagi pseudoalhagi* contour.

The establishment of the whole year round grazing and mediocre strains of sheep causes exhaustion of the soil and vegetation resources of the region. The situation can be solved with good known approaches:
fodder plant's sowing;
combined keeping of animals, which are not rivals in fodder usage (e.g., sheep and saigas);

the improvement of sheeps' strains;
the development of alternative cattle breeding.

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Treated Wastewater Project for Fodder Production Attracts Farmers' interest

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Treated wastewater could be a source of irrigation water, not only to reduce the pressure on freshwater resources, but also to protect the environment. And it is a wise thing to deal with this water as a "source" rather that a "waste".

ICARDA has initiated several activities related to the sustainable use of marginal waters for agriculture production and of course, treated wastewater or recycled water is one of these sources of water. In Central Asia for example, ICARDA in collaboration with a National scientific team from Kazakhstan started to develop some activities in that regards at the Surbolak research site.

Yields of up to double the usual forage output have given ICARDA's Central Asia Soil and Water Resources Management Project a very promising start to the use of treated wastewater for irrigation.

The treated wastewater research project in the Sorbulak area, north of Almaty, Kazakhstan, was initiated earlier this year as part of a 300-ha farm that also includes livestock. The objective is to develop a sustainable agronomic system that safely utilizes treated wastewater to produce various forage and industrial crops. Crops tested so far are alfalfa, Jerusalem artichoke, maize, sweet sorghum, broomcorn, sunflower, astragal, milk vetch, amaranth, and sudangrass.

There are about 40,000,000 m^3 of treated wastewater in the area each year available for beneficial water use (i.e. irrigation) with a salinity that does not exceed 1000 mg/l. Thus an improved cropping could be applied to 13,000 hectares of land designated as irrigated farms to produce forage crops under irrigation.

First year results of the ICARDA introduced technology yielded 50 to 100% more green fodder than the traditional practice.

ICARDA is planning to continue the research on forage for next year by further testing the varieties that were planted last season and by introducing new varieties for forage and some industrial crops. Also ICARDA in collaboration with the National scientists is planning to monitor and test the quality of the products regarding some of the suspected chemical in the irrigation water and its impact on the end users, i.e. animals and humans through the food chain.

The farmer (third from left) and some of the scientists who are involved in the treated wastewater project at Surbolak research site.

FAO activities in the Near East

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The GCP/SYR/003/ITA - Range Rehabilitation and Establishment of Wildlife Reserve in the Syrian Steppe Project

The second phase, started in 1996, ending date September 1999, with a provision for another three years duration of Consolidation Phase.

Present Phase:

Objectives:

To help national institutions to develop appropriate techniques for a sustainable use of the grazing land.
To establish an integrated model for the use and the maintenance of an area grazed by wild and domesticated animals.

Outputs:

1. An improved support base of technical expertise for the development of an integrated management scheme;
2. A range management plan;
3. Facilities for implementing the development activities. They include material to improve the grazing land and animal care.
4. A rehabilitated area and arrangements for communal management.
5. A programme of extension for women and pastoralists of Al Badia region.
6. An increased wild animal population.
7. Increased employment

New Consolidation Phase - under approval by the donor

Development Objective:

Government and community institutions are adequately prepared to ensure sustainability of introduced range rehabilitation techniques and the conservation management plan of Talila wildlife reserve is implemented through the adoption of participatory approaches in planning and implementation of the management plan.

Objectives:

1. Field tested techniques for rehabilitating rangelands under dry Badia conditions developed, ready for greater application in other areas of the Syrian Badia;
2. National counterpart institutions including local community institutions, national project staff and project target groups are prepared to take over full responsibility for project follow-up after completion of the second phase.

3 years, starting 1/10/99

The YEM/97/100 Sustainable Environmental Management in Yemen

Duration: September 1st, 1997 – August 31st, 2000.

Objectives of Sub-programme 3 (SP3): Planning for Desertification Control

Objective 1.

Strengthening the forestry sector, at central and regional levels, to acquire the capacity and necessary skills to provide general guidance and services for sound land resources management with special emphasis on desertification control planning and management, provision of training, redrafting of forest policy and forest law to reflect national priorities, and establishment of national network for desertification control.

Objective 2.

Mobilization and awareness raising among government officials, local communities, NGOs and other related institutions, programmes and projects for their direct involvement, participation and support in the process of the desertification control planning and management.
Mobilization of regional government officials, local leader communities, NGOs.
Organization of national and regional workshops/seminars.
Celebration of the word-day to combat desertification and drought.

Objective 3.

Collection of data and information as well as provision of sectoral studies in related field of land resources.

Objective 4.

Elaboration and production, through beneficiary participatory approaches, of a National Conceptual and Strategic Framework to Combat Desertification as well as Regional Action Plans focusing on areas experiencing or being threatened by desertification.

Achievements - September 97 – August 99

1. Provision of Training

On-the-job training

On-the-job training has been continuously provided to the staff of the Afforestation and Desertification Control Directorate of the GDFDC. This training dealt with planning and managerial aspects as well as the elaboration of general guidelines for the national strategic framework for desertification control.

M. Sc. Study

Two M.Sc. fellows, one from SP3 and one from SP2 were sent to Morocco and to the Netherlands respectively. The fellows are progressing well in their courses.

One-Year Diploma

Eleven fellows from SP3 were sent for one-year diploma on "desertification control", during December 97/January 98. They successfully completed their post-graduate programme. All of them returned to Yemen during December 98 and January 99. It is to be noted that some of them already started their new duties in the field of desertification activities, mainly within the

Afforestation and Desertification Control Directorate of the GDFDC.

Study tour/Meetings

The Sub-programme management organized several abroad study tours (Tunisia, Egypt, Oman...) for staff working in the field of forestry and desertification control.

The Sub-programme also assisted the government of Yemen (GDFDC and MAI) to attend all meetings organized by UN-CCD Conference of the Parties, Expert meetings.

At the request of the NPD of SP3, the CTA arranged for one-week technical visit for the Programme Manager of YEM/97/100 to FAO Regional Office in Cairo, Egypt. This visit allowed the Programme Manager to discuss pertinent issues dealing with the involvement of FAO in different programmes in Yemen mainly those related to YEM/97/100.

2. Redrafting of Forest Policy and Forest Law

This activity was jointly carried out by two FAO consultants (one for forest policy and one for forest legislation) during the period April 27-May 25, 1999. During this period the two consultants and the national team from the GDFDC were able to meet with all concerned parties from different ministries and national agencies and authorities. Community consultations were also conducted by the mission in each of Mahweet, Hodeida, Zabid, Taiz, Al-Mahara, and Hadramout. The trip to Al-Mahara and Hadramout governorates was requested by the Assistant Minister of Agriculture and Irrigation. The aim of these community consultations was to discuss the customary and traditional use of land resources as well as the need for forest policy and legislation guidelines.

At the end of the mission, the consultants presented their findings and recommendation to a seminar organized at the GDFDC. The consultancy reports have been cleared by FAO-HQ and sent to the government.

3.Establishment of National Network for Desertification Control

As recommended by UN-CCD, efforts related to establishment of a national network for desertification control have been started since 1998. Up to now 18 Regional Agricultural Offices have officially nominated their respective focal point. The national network is presently operational.

4. Participation/Organization of Workshops, Seminars and Awareness Days

- The CTA and NPD of the Sub-programme 3 attended and participated in the workshop on "Land Resource Management – Traditional Water Use Systems" organized by Sub-programme 4. The workshop was held in Seiyun (Hadramout) from 10 to 14 March 1999. During this workshop the FAO consultant on water engineering presented his findings and recommendations. The Assistant Minister, Assistant Deputy Minister of Agriculture and Irrigation, Chairman of the Environment Protection Council, as well as local authorities attended this workshop and participated in field trip organized by Hadramout unit of Sub-programme 4.
- SP3 management assisted the GDFDC and the MAI to attend the third conference on forestry organized by FAO. This conference took place in Geneva 3-14 from May 1999. The NPD of SP3 and a representative of the MAI attended this international conference.
- NPD of SP3 also was nominated by the MAI to attend the conference on the protection and preservation of land resources. This conference was organized by the Arab Organization for Agricultural Development. It took place in Cairo during 19-21 June, 1999.
- Concerning the national workshop to review the National Plan of Action to Combat Desertification and Land Degradation, the CTA assisted the GDFDC to mobilize resources from SP2, SP4, Watershed Management Project (GCP/YEM/026/NET) as well as the UNCCD. In this context, SP3 management, with the support of PMU, succeeded to mobilize funds from SP2, SP3 and SP4 in order to undertake this activity. Also, the CTA succeeded in getting grant from UNCCD to the GDFDC to support the organization of the national workshop as well as community consultation in most affected areas. The grant amounted to US$ 10,000.

Therefore, the above-mentioned workshop took place in Sana'a during the period May 30-June 2, 1999. It was organized in close collaboration with the above Sub-programmes and Projects. About 125 participants representing different ministries, regional Agricultural Offices/Authorities/Projects, universities, research institutions, NGOs, UN Agencies, and donor community attended the workshop. The opening ceremony was chaired by the Minister of Agriculture and Irrigation and the Chairman of the Environment Protection Council.

This workshop was an opportunity to bring all concerned parties and responsible to share experiences, draw out some of the lessons learned and explore together appropriate mechanisms to review the present National Plan of Action to Combat Desertification.

GDFDC and SP3 organized one-day seminar on forest policy and forest legislation. The seminar took place at the GDFDC on May 24. During this seminar the FAO consultants presented their findings and recommendations.

SP3 assisted the GDFDC in the celebration of the UN-day to combat Desertification (17 June). During the period June 16-18 several awareness activities have been conducted. These activities included central and regional TV and radio programmes interviews, TV flashes and films as well as publication of articles in national Newspapers.

5. Information/Data Collection and Community Consultation

Several national strategies were provided and documented. These strategies included Agricultural

Strategy Note, National Water Strategy, National Population Strategy, Natural Resources Management Note....

Also, and following the recommendations of the National Workshop to Review the National Plan of Action to Combat Desertification, community consultations were conducted in most affected areas as suggested by the workshop during the period June 10-23, 1999. To carry out this activity the GDFDC designated three persons, each of them responsible for the coastal zone, highland areas, and saharian zone. Among 140 communities identified and proposed by the workshop as the most affected communities, 73 communities has been visited and consulted.

The main objective of these community consultations was to discuss all together with the community/village leaders, local NGOs, and regional officials the desertification causes as well as the priority actions needed to combat desertification for the specific site. This approach of community participation/consultation will allow and lead to the elaboration of specific regional programme of action.

6. Assessment of Externally Supported Projects on Desertification Control

This activity was supposed to be carried out during the last quarter of 1997 by government and UNEP consultants. In SP3 workplan for 1999, the study was rescheduled for September 1999. This delay negatively affected the overall process for desertification control planning. It is to be noted that SP3 and government technically cleared the fielding of UNEP consultant for September 1999.

7. Study on the Underlying Causes of Desertification

Government and FAO consultants conducted this activity for a period of two w/m during the last quarter of 1997.

8. Elaboration of National Conceptual and Strategic Framework to Combat Desertification

Planning and coordination meetings were continued with the staff of the Watershed Management and Wastewater Reuse in the Pre-Urban Areas in Yemen – (WWPU- GCP/YEM/016/NET), and jointly with the staff of the Afforestation and Desertification Control Directorate of the GDFDC. Proposal for a national strategy outlines to review the National Plan of Action to Combat Desertification has been elaborated. It is now under discussion. The National conceptual Strategic Framework to Combat Desertification is now under preparation.

9. Elaboration of Regional Action Plans for Pilot Areas

As stated in the PSD and the SP3 workplan, this activity will be carried out during 1999-2000. Steps towards the preparation of regional action programmes were prepared and presented to the national workshop on desertification held in Sana'a during May 30 – June 02, 1999. These steps were adopted and are now under implementation.

10. Consultancy on Traditional Grazing Management Systems (SP4)

This activity has been completed by an FAO and government consultants during 1997/1998.

11. Consultancy on Water Engineering (SP4)

The FAO "Water Engineering" consultancy for Sana'a/Taiz and Shabwa/Hadramout Units of Sub-programme 4 was conducted during 1998 and early 1999 respectively.

12. Consultancy on Database (SP2)

The FAO consultancy on database management was completed during the first semester of 1999.

13. Backstopping Mission

The Regional Range Management and Fodder Production Officer from RNE conducted a backstopping mission for SP4 on grazing and range management during 1998.

During end 1998 and early 1999, a backstopping mission was fielded from FAO-HQ to support SP4 in community participation land resource management.

During the first semester of 1999, the FAO-RNE fielded a backstopping mission to review the 1999 workplan.

NETWORKS NEWS

Regional Workshop on Establishing a Coalition for Implementing the CCD in South Asia, by SCOPE

A Regional Workshop to "Establish a Multi-Stakeholders Coalition for the Implementation on UN Convention to Combat Desertification (CCD) in Asian Region" was held at Islamabad, 24-26 May 1999. This workshop was organized by the Society for Conservation and Protection of Environment (SCOPE), in collaboration with Japan Foundation, United Nations Secretariat of Convention on Combating Desertification, United Nations Environment Programme (UNEP), Commonwealth Foundation and Ministry of Environment, Government of Pakistan.

The principal aim of this meeting was to brainstorm on the possibility of establishing a multistakeholders coalition at Asian regional level, to support the process of implementation of UN Convention on Combating Desertification and Drought (CCD) and its Regional Action Programme (RAP) for Asia.

The workshop was attended by representatives of CCD Secretariat, UNEP, Governments, and international research organizations such as ICRISAT, ICARDA, CGIAR, DESCONAP and NGOs from Jordan, Philippines, Kenya, India, Bangladesh, Sri Lanka, Syria, Iran, Azerbaijan, Tajikistan and Niger. From Pakistan, besides NGOs/CBOs and Governmental agencies, specialized institutions working on desertification related subjects, participated which include Sindh Arid Zone Development Agency (SAZDA), Arid Zone Research Institute (AZRI), Pakistan Council for Research on Water Resources

(PCRWR), Pakistan Agriculture Research Council (PARC), International Waterlogging and Salinity Institute (IWASRI).

The workshop observed that the desertification process is rapidly degrading the natural resource base and affecting livelihoods of large populations in the Asian region. The CCD requires from member country parties to prepare national action programmes (NAP) with the consultation of affected populations in the drylands.

Mr. Masanori Kobayashi, from the Asia Division of the UN-CCD Secretariat said that besides NAPs, the CCD also has provision of preparation of regional action programmes (RAP). The RAP for CCD for the Asia region was conceived and elaborated at various meetings held at Beijing, New Delhi, Japan and Bangkok. The RAP is launching six thematic programme networks (TPNs) as part of RAP in Asia. These TPNs are related to: desertification monitoring, soil conservation and forestry, range land management and sand dune fixation, water management in the dryland, drought preparedness and local area development initiatives. Each of these TPNs will be hosted by a particular country in the Asian region.

The workshop felt the urgent need to support and push the CCD implementation process in the region. The participants unanimously supported the idea of establishing a broad based coalition of stakeholders of the CCD. This coalition will include governments, civil society organizations, donors, technical institutions and the private sector. The workshop gave a mandate to SCOPE to organize this coalition within the next two years.

The workshop adopted the following declaration and action programme:

The forum of Regional Coalition of all stakeholders representing Asian countries, comprising 50 delegates, assembled at Islamabad, Pakistan, and deliberated on various aspects of the Convention to Combat Desertification (CCD). Great need was felt for the Establishment of a Regional Coalition of stakeholders of CCD to steer up the process of the implementation of the Convention. A declaration was issued to highlight the effort of the forum.

TRAINING OPPORTUNITIES

ICARDA - Course Schedule and Training Opportunities 2000

Headquarters Training Courses (Aleppo, Syria)

Short-term Training Courses*		**Organizers/Cooperators**
7-18 May	Genetic resources documentation and data management	ICARDA/IPGRI
14-25 May	Legume mechanization	ICARDA
28 May-8 June	Forage and pasture seed production	ICARDA
3-14 September	Statistical analysis of data	ICARDA
12-16 November	Scientific writing	ICARDA

Non-headquarters Training Courses

Regional/Sub-regional Short-term Training Courses		**Location**	**Organizers/Cooperators**
8-19 October	Utilization of expert systems in agricultural research and production	Egypt	ICARDA/CLAES-Egypt
In-country* Short-term Training Courses*		**Location**	**Organizers/Cooperators**
9-15 July	Seed processing	Syria	ICARDA/Syria
17-23 October	Economics of seed production	Algeria	ICARDA/Algeria/GTZ

For additional information, please contact the: Human Resources Development Unit. *ICARDA, P.O. Box 5466, Aleppo, Syria. Tel.: (963-21) 2225112, 2225012, 2213433, 2213477. Fax: (963-21) 2225105 or 2213490. E-mail: ICARDA@cgiar.org*

CIHEAM Zaragoza Courses 1999-2000

Course	**Date**	**Place**	**Organizers**
*Animal Production	4 Oct. 99/9 June 00	Zaragoza	IAMZ
Breeding and genetics	10 Jan. 00 – 24 Mar. 00		
Reproduction	27 Mar. 00 – 9 Jun. 00		
Valorization of sheep and goat dairy products in the Mediterranean. Present technologies and market perspectives	10-19 Apr. 00	Surgères	IAMZ/ENILIA
Agroecological characterization for resource management in dry areas: use of GIS, remote sensing and modeling	13-23 June 2000	Ankara/Turkey	IAMZ/CRIFC/EC

* Post-graduate Specialization course for a Master of Science degree.

For further information contact: Instituto Agronomico Mediterraneo de Zaragoza. Appartado 202, 50080 Zaragoza. Spain. E-mail: iamz@ciheam.mizar.csic.es.

UP-COMING EVENTS

10th Meeting of the FAO-CIHEAM Sub-Network on Mediterranean Pastures and Fodder Crops: *Legumes for Mediterranean Forage Crops, Pastures and Alternative Uses.* 4-9 April 2000, Sassari, Italy.

Topics

Papers dealing with the general topic of the meeting are solicited; they will be discussed into the following 6 main sessions:

1. Germplasm collection and improvement. Results of breeding activity.
2. Agronomic aspects of forage legume management and forage quality.
3. Eco-physiology at plant and community level.
4. Legume-rhizobia relationships.
5. Persistence, seed production and sward regeneration.
6. Role of legumes in forage systems, alternative uses of legumes.

For further information:

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The future of the Mediterranean Rural *Environment*: Prospects for sustainable land use and management

Spring 2000, Menemen, Turkey.

International Conference jointly organized by Cranfield University, UK and the General Directorate of Rural Services – GDRS, Turkey. The conference aims to identify future strategies of sustainable land use and management in the Mediterranean rural sector, by examining processes of political, socioeconomic, technological and biophysical change in an integrated manner. For further information, please contact:

Gill Burrows, Cranfield University, Silsoe, Bedford, MK45 4DU, UK.
Tel: (+44 0)1525 863349. fax: (+44 0)1525 863344.
E-mail:g.burrows@cranfield.ac.uk

International Symposium on Desertification 13-17 June 2000, Konya, Turkey.

Organized by Soil Science Society of Turkey, Selcuk University, Konya and General Directorate of Rural Services of Turkey

Scope of the Symposium:
1. Assessment and monitoring of land and water degradation
2. Land use and management
3. New technology for sustainable use of natural resources
4. Soil survey for land and water conservation
5. Impacts of global climate change
6. Conservation of bio-diversity
7. GIS and RS applications on natural resources survey
8. Impact of degradation on soil fertility
9. Economical aspects of land and water degradation
10. Socio-economic limitations for sustainability accomplishment

The organizers welcome papers or posters;
For further information contact:
Symposium Secretary
Dr. Fikret Eyupoglu
Soil and Ferilizer Institute
PO Box 54 Yenimahalle
06172 Ankara, Turkey
Tel.: +90 312 315 50 56. Fax: +90 312 315 50 56.
E-mail: feypoglu@superonline.com

The conference is conducted in the Konya basin of Central Anatolia with a very successful example of management of wind erosion nearby.

NEW RELEASES

ICARDA Caravan No. 10 Winter/Spring 1999

- Scientific and technology transfer achievements highlighted at ICARDA's Annual Presentation Day (Page 4).
- Innovative biodiversity and species conservation is placed firmly in the field in a pioneering project (Page 6).
- Restoring Yemen's mountain terraces can give work and provide food for an increasing population (Page 8).
- Can small ruminants regain a rightful place in the Central Asian economy (Page 11).
- How two simple and cheap-to-build machines are, literally, leaving their marks on rangeland as scientists try out effective low-cost techniques for regenerating native species of range vegetation (Page 13).
- Millions of dollars may flow back into WANA farms, thanks to genetic advances in pest resistance (Page 16).
- Giving the farmer a say alongside the professional barley breeder brings an extra

dimension to cereal breeding for the dry areas (Page 18).
- Investment Opportunities for Donors (Page 20).
- Donors to ICARDA (Page 23).

Caravan is published four times a year by ICARDA.
Executive editor: Dr Surenda Varma.
Editor: David Millar.

THE ARID LANDS NEWSLETTER #45

Editor's note:
"*Water in Cities*": An Artificial Divide, by Katherine Waser
Australia's Urban Water Program: An Integrated, Nationwide Initiative, by Andrew Speers
Integrating Urban and Agricultural Water Management in Southern Morocco, by Thomas E. Rhodes
Water and Cities in Arid Central Asia, by David R. Smith
Constructed Wetlands in Southern Arizona, by Martin M. Karpiscak, Roland D. Wass, Robert J. Freitas and Susan B. Hopf
Water Stress and Global Mitigation: Water, Food and Trade, by J. Anthony Allan
Special News Report:
Regional Workshop on Establishing a Coalition for Implementing the CCD in South Asia, by SCOPE
Briefly noted:
Selected resources of interest, annotated by Elaine Cubbins
Selected news of interest, annotated by Katherine Waser
Please address letters of comments, article proposals, news items or any questions you may have about the Arid Lands Newsletter to:
Katherine Waser, Editor,
The Arid Lands Newsletter,
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Papanastasis, V.P., C.N. Tsiovaras, O. Dini-Papanastasi, T. Vaitsis, L. Stringi, C.F. Cereti, C. Dupraz, D. Armand, M. Meuret, L. Olea. 1999. **Selection and Utilization of Cultivated Fodder Trees and Shrubs in the Mediterranean Region**. *Options Méditerranéennes*. SERIE B: Etudes et Recherches. Numéro 23. CIHEAM.

International Potash Institute. 1997. **Food Security in the WANA region, the essential need for balanced fertilization.** Proceedings of the Regional Workshop of the International Potash Institute held at Bornova, Izmir, Turkey, 26-30 May 1997.

NEW SUBSCRIBERS

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I continue to research in the areas of tropical forage genetic resources and biodiversity as I have done since the mid 1980s first at CIAT, then at ILRI until early 1999. Main current subjects of research are *Lablab purpureus*, and the development of a *L. purpureus* core collection; g x e interactions of *Arachis pintoi* germplasm; among others. Within the MSc course on tropical agriculture, I also offer a new lecture on agro-biodiversity and plant genetic resources at the German University of Goettingen. I am looking for potential collaboration within research projects and hope to supervise MSc and PhD students, soon.

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I work at the genesis of soils solonetz-solonchakcs in soil cover, as a result of inner connections of semiarid landscapes like the Terek-Kuma lowland. It was found the dependence of studied soils' contour on the slopes shapes of eolian hills. Due to this dependence one can forecast the existence of solonetz-solonchakcs soils at the foot of these hills.

LAST SEMESTER SHARE
Saltbushes (*Atriplex* spp.)

Dear readers,

The editors are pleased to present some national experiences with saltbushes (*Atriplex* spp.) in Mediterranean semi-arid and arid zones. These are summaries from presentations during a workshop held in Tunisia in 1996. See also issue 13, 1997.

If the objective of the plantation is to provide protein during the dry season, then total shrub biomass could be increased with higher shrub density. However, if the plantation is to be used during the spring to graze herbaceous vegetation, shrub density should be decreased to allow for more biomass from the annual vegetation. It is, therefore, imperative that studies be conducted to understand the relationship between shrub density and total biomass output from both shrub and herbaceous vegetation per unit area. This will obviously vary with soil and rainfall conditions.

PAKISTAN

Dr. Sarwat N. Mirza,
Arid Zone Research Institute, PARC, Quetta, Pakistan

Fodder shrubs and trees are being planted as part of the range improvement activities of various projects implemented by the Range Management Divisions of Forest Departments, Pakistan Forest Institute, various institutes of Pakistan Agricultural Research Council and NGOs involved in natural resource management. However, very few projects of development nature for planting fodder shrubs/trees have been undertaken in the country. Generally speaking, most of the plantation of multi-purpose trees/shrubs is carried out by the farmers on their farmlands as agro-forestry practices which not only provide farmer with income from wood and timber but also provide valuable fodder for his stock during droughts and lean period. Recently, some NGOs have shown interest in the plantation activities on large scale mainly for bio-diversity and environmental conservation. These include National Rural Support Porgramme, Sarhad and Balochistan Rural Support Programmes, Agha Khan Rural Support Programme, Sind Arid Zone Development Authority, Universities and Banks, Private sector agencies, etc.

A few of the projects initiated in the past regarding the plantation of fodder trees/shrubs on large scale in the country are highlighted as under:

Productivity Enhancement Program (PEP) of Pakistan Agricultural Research Council (PARC) entitled "Out-reach project on utilisation of salt affected soils" was started by Range Section of AZRI in 1993 and completed during 1995. The project activities were confined to various parts of Mediterranean highland Balochistan including Quetta, Kanak, Mastung, Panjpai, Kovak, Kalat, Pishin, Muslim Bagh, Qilla Saifullah, Sanjavi, Loralai, etc. Through the integrated efforts of AZRI and provincial line departments as well as NGO's, a total of 1,700,000 seedling of fourwing saltbush (*Atriplex canescens*) and quail saltbush (*Atriplex lentiformis*) have so far been planted on approximately 170 acres of marginal land in highland Balochistan. Because of the initiation of the saltbush planting campaign under PEP project, a lot of interest has been generated among NGO's and provincial forest and livestock departments to continue collaboration with AZRI in the nursery seedling production and future planting of the seedlings on marginal lands of highland Balochistan and high altitude areas of other provinces of Pakistan.

As a result of introduction of fourwing saltbush as a promising shrubs to be planted for forage as well as fuelwood purpose, Balochistan Forest Department is initiating a project named "Range/Watershed Rehabilitation Programme" under World Bank's larger project on Balochistan "Natural Resource Management". Under the technical assistance of AZRI, BFD would plant a large area with the Atriplex seedlings for forage and fuelwood as well as for watershed management at Maslakh, Killa Saifullah, Loralai, Ziarat and Zhob areas. Balochistan Forest Department has already established a nursery of fourwing saltbush seedlings at AZRI fields during July-August, 1995 which has the capacity of holding 200,000 seedlings at a time. Another nursery of 200,000 seedlings has been established at Loralai under the above mentioned project.

Large scale plantation of saltbush has also been started by the Integrated Range/livestock Development and Watershed Planning and Management projects being implemented by the FAO/UNDP and Balochistan Forest Department in highland Balochistan. A large area near Quetta (Karak/Aghbarg/Nohesar), and Loralai will be planted with Atriplex and other promising fodder shrubs by using water harvesting techniques. At Karak/Aghbarg, about 120,000 seedlings have already been planted on watershed areas. FAO Watershed Planning and Management Project has recently established two nurseries at Zangi Lora, and at AZRI fields, Quetta each having the capacity to produce about 200,000 seedlings.

A careful evaluation of the research and extension work done so far by AZRI on various aspects of fourwing saltbush propagation and utilisation suggests that this should not be seen as a remedy to reverse the advancing range degradation. Instead, it is emphasised here that the saltbush is suitable for growing on lands marginal for crop production with deep soil and less competition from existing vegetation. Hence, the technology should be used for establishing forage reserves on land owned by farmers which has the advantage of being under the control of the farmer. These forage reserves should be utilised in lean periods as a supplement to natural grazing instead of revegetating degraded rangelands.

Pabbi Range Management Project, Kharian

Pabbi range is located in the sub-tropical sub-humid Pothwar scrub forest zone in Punjab province near Kharian over an area of more than 10,000 acres. The climate is sub-tropical monsoon with high summer temperatures of 40°C in June. The main range improvement activities include grass reseeding of *Cenchrus ciliaris* and *Panicum antidotale*. In addition, a large area is planted with fodder trees and shrubs by using various moisture conservation techniques. The major fodder tree/shrub species planted on approx. 1000 acres is *Leucaena leucocephala* (ipil-ipil). This fast growing leguminous fodder shrub/tree is well adapted to the sub-tropical sub-humid zone and is grown on large scale under rainfed conditions for fodder/fuelwood purpose. The range management division of Punjab Forest Department allows lopping for fodder and also issues permits for browsing on leaves and pods. Ipil-ipil is very

popular fodder shrub/tree and is planted throughout the region by the farmers on their farmlands.

Range Management Project (Dagar Kotli Thal desert)

Dagar Kotli is located in the Thal desert of central Punjab and is ecologically categorized as tropical plains sandy. The rainfall varies from 133 mm in the southern areas to 300 mm in the northeastern region. Range improvement activities mainly involved reseeding of large tracts with *Cenchrus ciliaris* and *Lasiurus sindicus* bunch grasses. While a number of fodder tree/shrub species were planted by using various micro-catchment techniques for moisture conservation as research and demonstration activities on approximately 700-800 acres in Dagar Kotli. Similarly, in Rakh Karluwala, about 2000 acres of plantation has been carried out by using drip irrigation system. The main fodder tree/shrub species planted in the area include *Acacia modesta, A. tortilis, A. nilotica, A. victoria, A. albida, Prosopis cineraria, Ziziphus mauritiana, Tecoma undulata* and *Leucaena leucocephala*, etc. The fodder from these species is lopped during drought periods and permits are issued by the project authorities for grazing and browsing leaves and pods during periods of droughts.

Other Plantations of Fodder Trees/shrubs

Large scale plantation of fodder shrubs/trees has also been carried out at Dhabeji Range Management project, Kohistan, Sind. The main species planted at this site include *Acacia nilotica, Tecoma undulata, Leucaena leucocephala, Prosopis cineraria, Opuntia ficus indica* (spineless cactus), etc.

Sind Arid Zone Development Authority (SAZDA) in cooperation with Swiss Development Cooperation (SDC) also initiated large scale plantation of fodder tree/shrubs in the Tharparkar desert of Pakistan under "Range Management and Agro-forestry Action Research in Thar and Nara Region, Sind". Large scale plantation for sand dune fixation and fodder production is being carried out as part of the action programme of range and agro-forestry in Thar and Nara regions of Tharparkar desert (IUCN, 1992). The main fodder tree/shrub species include *Acacia nilotica, Acacia senegal, Atriplex halimus, Leucaena leucocephala, Prosopis cineraria, Tecoma undulata, Ziziphus mauritiana*, etc.

Cost estimates of establishing different shrub species

Although fodder trees/shrubs have been planted in different parts of the country since long, economics of these activities have generally not been carried out. In very few cases, cost of planting fodder shrubs/trees have been estimated because most of the activities were carried out as research and demonstration under various projects. However, in some cases, costs for nursery grown seedlings were calculated as Rs. 2/- per plant. Similarly, the cost for planting and initial watering can be estimated at Rs. 2/- per plant. Therefore, planting of 1000 tree seedlings per ha would cost Rs. 4000/- or US $ 133. The cost for transportation and maintenance, however, is not calculated.

Cost estimates were prepared for *Atriplex* plantation as fodder species in highland Balochistan under Productivity Enhancement Programme. According to the 1994 estimates, nursery raising and planting costs of Atriplex seedlings (2500 seedlings per ha) was Rs. 3000/- or US$ 100 per hectare. The cost for land preparation (hand dug holes/contour ridges) was estimated to Rs. 3500/- or US $ 117 per hectare. The cost for transportation of seedlings and maintenance of such plantations was not calculated.

Fodder tree/shrub plantation carried out by the farmers themselves under agro-forestry systems would cost them only the price of seedlings which is about Rs. 2/- per plant at present. Therefore, one ha plantation (1000 plants/ha) would cost only Rs. 2000 or US $ 57/ha if the plantation is carried out by the household during the tree plantation season.

EGYPT

El Shaer H.M and H.M. Kandil
Animal Nutrition Department, Desert Research Center. P.O. Box 11753, Cairo, Egypt

The irrigated agricultural land represents only 5% of Egypt's area where more than 90% of the population is accommodated. The use of salt-affected wastelands and saline water to produce non-conventional crops has a practical magnitude. Halophytes such as *Atriplex* spp. to supply the needed animal feeds have a wide application. This article focuses on the *Atriplex* species as livestock fodder and on its best potential use. There are four native *Atriplex* species: *A. halimus. A. farinosa, A. leucolada* and *A. vesicaria*. The exotic ones are *A. nummularia. A. conescens. A. semibaccata* and *A. glauca*. These shrubs are varied in their playability chemical composition and nutritive values. Most of *Atriplex* species are rich in nitrogen but need to be supplemented with soluble carbohydrate resources. The main constraints that limit the intake and utilization of *Atriplex* spp. Are high salt and fibrous contents deficit in energy content. Utilization of *Atriplex* spp. as fodder can be improved by various pre-treatments to enhance their palatability and nutritional value. Ensiling *Atriplex* shrubs with other feed ingredients in the most efficient processing method. Therefore, the feed gap in Egypt can be satisfactory filled through the plantation of saltbushes and using the processed *Atriplex* spp. which will promote availability of animal feed resources all year round.

ALGERIA

Noureddine Redjel and Jamal Boukheloua
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The legal status of the rangelands and their access are two vital issues for rangeland rehabilitation and re-establishment in the Algerian steppe. National experience with fodder shrubs plantation has been dominated by two major development approachs. The State controlled-

approach, undertaken from the 1960s to the early 1990s, was implemented through the Association of Pastoral Livestock Development (ADEP), the Cooperative of Agrarian Revolution Pastoral Livestock (CEPRA), the Green program. The organizational structures and traditions of the local population were not incorporated into programs that were essentially imposed upon the steppe from the state, using models from other countries. Management was inexistent. This approach led to the following: i) a 75% decrease in forage production on the rangelands since 1978; ii) a 100% increase in the cereal crop area from 1,100,000 ha in 1968 to 2.200,000 ha in 1993; and iii) the capitalization of technological packages.

The participatory approach started on a small scale in 1992. It was based on the principle of active participation by the indigenous population during all stages—conception, implementation and evaluation—of a rangeland project. Pastoral communities and the state agree to proceed according to local tradition. This experience, which is still in its early stages, has already reached the double objective of: i) decreasing the cost of state investment by 55%; and ii) sensitizing local populations to the importance of rangelands, and of the need to replace activities that degrade the land with those that result in revegetating and restoring it.

Restored rangelands have increased from 20 ha, planted by 10 beneficiaries in 1992/93, to 12,000 ha, planted by 8,146 beneficiaries in 1995/96. These experiences show that using indigenous knowledge, local organizational structures, and traditional rules is fundamental to rangeland development.

TUNISIA

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Rangeland improvement

From 1956 to 1989, some 272.000 ha were planted with shrubs, mainly spineless cactus, *Acacia* sp. and *Atriplex* sp. (Table 1).

Most (80 %) of the rangeland improvement activities were realized in arid and semi arid areas.

The actual strategy of rangeland improvement started in 1990 and aimed to (i) plant some 600 000 ha of shrubs (200 000 ha on private farms) and (ii) to use other techniques (reseeding, fertilizer, etc..) for 2.2 million ha. Three Departments from the Ministry of Agriculture are in charge of this strategy, namely Forestry Department (common lands), Livestock and Pasture Office (Private lands), and Water and Soil Directorate (CES).

Spineless cactus is widely spread today in arid and semi-arid areas. OEP has already established some 43000 ha of cactus for the period from 1990 to 1993, and this is on private land ! What are the risks of such " monoculture " ? What is left of the plantations of the 1960s ?

The positive aspect of this strategy is shrub plantation on private lands implemented by Livestock and Pasture Authority (OEP). During the period 1990-1995, some 50 000 ha were planted by shrubs, mainly cactus (Table 2).

Establishment costs of shrub plantations

Total establishment costs for a plantation of spineless cactus and shrubs (*Acacia cyanophylla, Atriplex*) estimated by the Pasture and Livestock Office (OEP) in 1994 are reported in (Table 3).

Table 1. Shrubs Plantation: achievements from 1956 to 1989.

Operators	1000 ha
Forestry Department	53.60
Water & Soil Preservation	11.20
Livestock & Pasture Office (O.E.P)	24.25
Word Feed Program (P.A.M.) Project	177.20
Development of Central Tunisia Office	2.65
O.P.P.I. Souassi	3.80
Sylvo-Pastoral Development of NW Office	-
O.P.P.I. Kef	0.10
Total	272.80

Table 2. Areas of shrubs established by the Pasture and Livestock Office in private farms from 1990 to 1995.

Zones	Spineless cactus (ha)	Other fodder shrubs (ha)*
North East	1669	1623
North West	2772	1449
Centre East	9674	1495
Centre West	33099	528
South	2712	2265
Total	49926	7360

*Main shrub species are: *Acacia cyanophylla* Lindl., *Atriplex nummularia* and *Medicago arborea.*

Table 3. Estimated costs of shrub establishment (Tunisian Dinar/ha).

Item	Cactus	Other shrubs
Plowing (tractor, 1.5 hours)	27	27
Plant shopping	80	50
Plant transport	60	40
Labor (for plantation)	100	125
Replacement plants	12	30
Labor (for replacement)	25	25
Irrigation	-	300
Safeguard (60 days)	300	300
Subsidies (3 first years)	150	150
Total	754	1047

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Please include a brief description of your current research and interests related to pasture or forage and range activities or applications. We also welcome comments, stories, small abstracts of your work, job or meeting announcements, requests, etc.