



Abu Dhabi Food Control Authority
Development Sector
Research & Development Division

Technical Report تقرير فني

Title العنوان	Improve the use of Chemical Fertilizers - Cenchrus	
Project Team فريق العمل	Dr. Ihsan Abu Al-rub, Ahmed Aran, Omar Al-Nour, Abdul Aziz Awaga	
Duration فترة المشروع	From: June 2011	To: Sep 2012

Background خلفية عن الموضوع

Cenchrus ciliaris (Buffelgrass) occurs naturally in the UAE in areas having average annual rainfall as low as 100 mm (Karim & Dakheel, 2006). Since there is huge demand for forage production in the UAE to support 2.7 million heads of livestock (Ministry of Water & Environment, 2011), the available forage supplies are inadequate to maintain the livestock population. It has been reported that *Cenchrus ciliaris* is a valued forage grass for dry areas, due to its high biomass production and tolerance to low moisture conditions (Goel et al., 2010). Therefore, *Cenchrus ciliaris* is among species having the greatest potential for forage production in the UAE.

Soil of the UAE is predominately sandy textured, with very low organic matter content, leading to deficiencies in essential plant nutrients. A number of studies have found forage yields to be increased by fertilization on sandy lands. N fertilization typically increases grass dry matter yields (Quinlan et al., 1981), N concentration in forage (Rai, 1989), and seed yield (Kumar et al. 2005). With associated decreased forage soluble carbohydrate (Minson, 1990) and increased nitrate concentrations (Van Soest, 1994). Generally, P fertilization alone does not sustainably increase forage yields (Rai, 1989), but phosphorous applied with N often does (McIlvain, 1961). Singh (1970) reported that combined application of N and P significantly improved forage yield, but had no significant effect on forage total N or crude protein.

Nutritional quality of unfertilized buffelgrass in rangeland varies seasonally (Gonzalez and Everett, 1982). Improvements in forage quality with fertilization have been shown in many studies (Hansen et al., 1978). Pettit and Deering (1973) reported that ammonium nitrate produced higher quality forage in term of crude protein in sandy land. Additionally, Donaldson (2010) reported increased forage N content, digestibility, and mean daily live mass gain per sheep as N fertilization rates increased. Fertilization has also been shown to increase soil water extraction by forages and improve water use efficiency (Williams et al., 1979).

Problems التحديات

Limited data are available concerning the production of irrigated cenchrus forage under different fertilizer applications in the UAE.

Objectives الأهداف

- To improve the cenchrus production using different applications of N and P fertilizers.
- To study the effect of N and P fertilizers on cenchrus yield and crude protein content.



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Methods طريقة العمل

1. Field experiment

Field plots were established on 23rd January 2011 at Al-Salamt Research Station in Al Ain (24° 00' N, 54° 00' E) and ran for 2 successive seasons. The climate is arid with an average annual rainfall between 100 and 150 mm. Soil of the field was classified as sandy texture. Initial soil analysis revealed low total N. Nitrate, available P and K contents were 164.2, 21.6 and 128 ppm respectively. Soil pH was 7.8 and the salinity was 10.2 dS m⁻¹. The salinity of irrigation water was 3500 ppm.

The experiment was laid out in a split plot arrangement within a randomized complete block design with four replications. The main plot was assigned for N treatments with P treatments as subplots. Individual plot size was 3 X 2.5 m, consisting of 4 rows, with distance of 75 cm between rows. Seeding rate was 40 kg ha⁻¹ of *Cenchrus ciliaris* cv. Laredo.

Five N fertilizer treatments were used 0, 250, 500, 750 & 1000 kg N ha⁻¹ yr⁻¹ and four treatments of P fertilizer 0, 200, 400, 600 kg P ha⁻¹ yr⁻¹. K fertilization was constant for all plots at rate of 300 kg ha⁻¹ yr⁻¹. N was applied as urea (N 46%), P was applied as triple super phosphate (P₂O₅ 46%), and K was applied as potassium sulphate (K₂O 50 %). N and K fertilizers were applied weekly via fertigation and P was added at the soil surface once before planting.

2. Plant measurements

Plots were harvested 5 times during the first year, and 7 times during the second year as grass were mature. After harvesting and weighing the whole plot, 500 g of green grass from each plot were dried at 85C° for 24 hours for dry matter determination. The length of 10 randomly selected plants was recorded. Forage samples were analyzed for N and P, while N was determined by Kjeldahl digestion.

3. Statistical analysis

An analysis of variance for balanced data with GLM model (SAS, 1994) was used to determine differences between treatments. Comparison among treatments differences was determined by Least Significant Difference (LSD) at p≤0.05.

Results النتائج

1) Forage yield

The effect of fertilizer treatments on forage yield is presented in Fig 1. For both years, all N treatments significantly increased yields, relative to control. Maximum yields were achieved with the 250 kg N ha⁻¹ treatment, with no further increase in yield resulting from higher N rates. Neither phosphorous treatments, nor N x P treatment interactions were significant in both years for either yield or plant height.

Plant height followed yield trend. All N treatments significantly increased plant height. Maximum height was generally achieved at 750 kg N ha⁻¹ yr⁻¹, (Fig 2).

2) Crude protein content

Fig. 3 illustrates the influence of levels of N and P fertilizer on the content of crude protein in the cenchrus tissues. The crude protein content increased with increasing levels of N fertilizer. In the control, crude protein content averaged 7% whereas at 250, 500 and 750 kg N ha⁻¹ yr⁻¹ averaged 8.8%, 10% and 10.2 respectively. The results clarified that the N fertilization had a marked influence on the crude protein content in plants' tissues.



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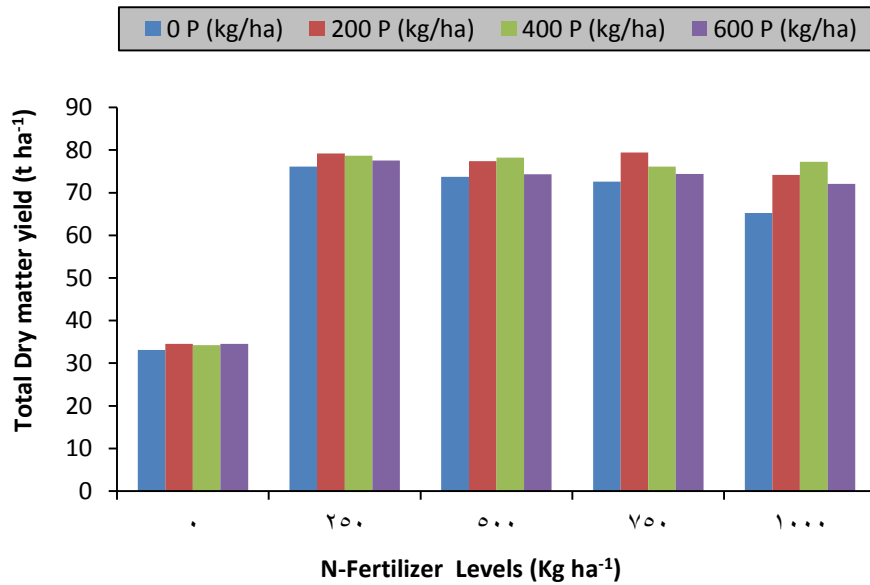


Fig.1. Total yield (ton dry matter ha⁻¹) at different N-P fertilizer levels for an average of 12 harvests. LSD at 5% N=5.3, P=ns and NXP=ns.

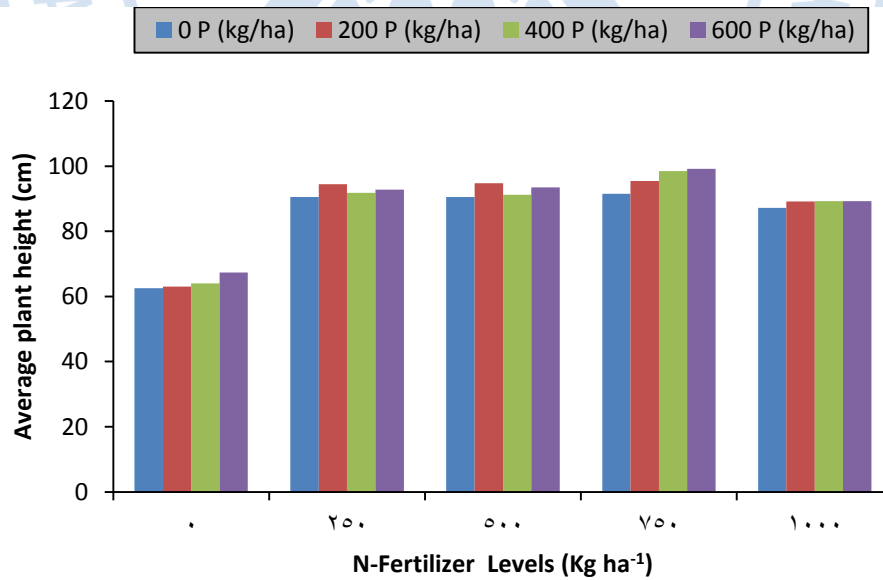


Fig. 2. Average plant height (cm) at different N-P fertilizers levels. LSD at 5% N=3.4, P=ns and NXP=ns



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3) Phosphorus content

Average phosphorus content in plant tissue increased significantly with increasing P treatment levels (Fig. 4). Significant differences in Phosphorus content were mainly observed between control and 200 kg ha⁻¹ yr⁻¹ treatments. No effect was observed for N application on the P content of the cenchrus. The only N x P interaction occurs at June, July and October harvests.

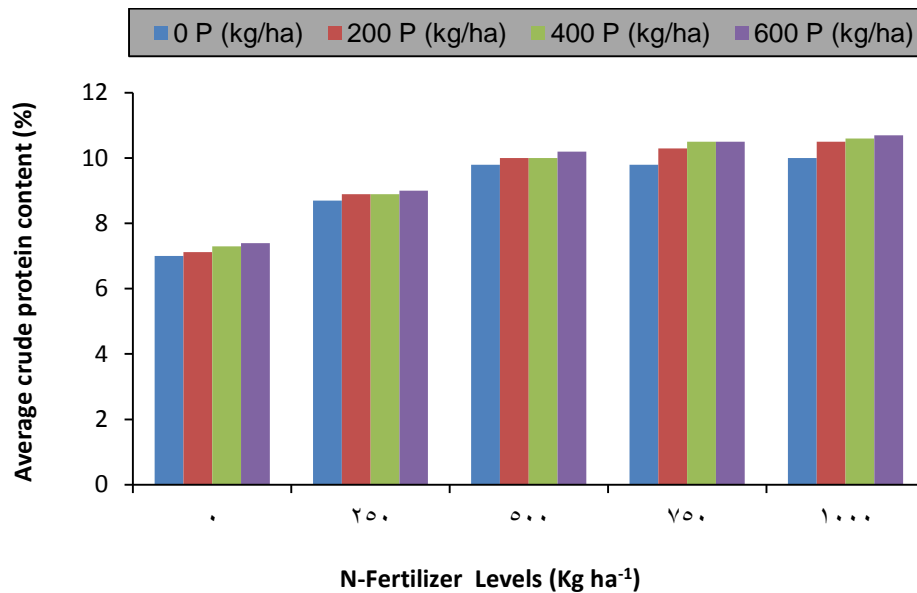


Fig.3. Average crude protein content in the cenchrus tissues at different N-P fertilizers levels. LSD at 5% N=0.1, P=0.1 and NXP=0.2

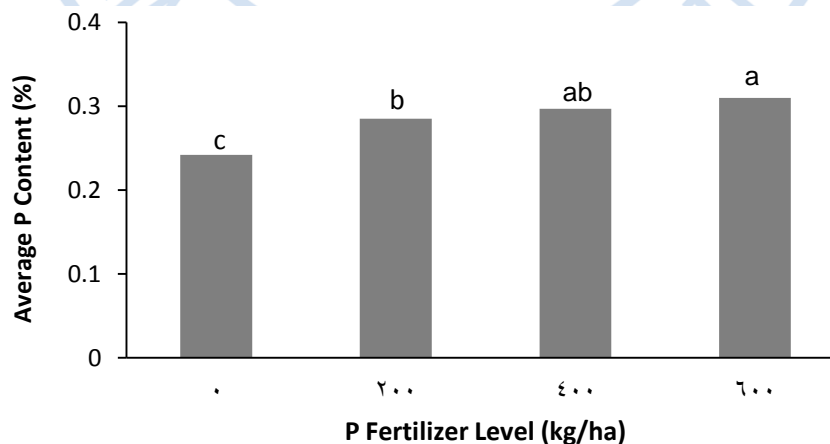


Fig.5. Average phosphorus content in the cenchrus tissue at different P application rates.



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Recommendations التوصيات

- The optimum cenchrus production can be reached by using 250 kg ha⁻¹ yr⁻¹ nitrogen and 200 kg ha⁻¹ yr⁻¹ phosphorus fertilizers in the irrigated field.
- No adding value in terms of forage yield when using fertilizer rate above than 250 kg ha⁻¹ yr⁻¹ nitrogen.
- Fertilizer application had improved the crude protein content in the cenchrus forages.
- Beneficiaries: Agriculture Affairs Sector, Farmers' Services Centre, Extension officers.

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