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NITROGEN RESPONSE TO PEARL MILLET (*Pennisetum typhoides* S+H) GROWN ON SOIL UNDERNEATH *P. Cineraria* AND ADJACENT OPEN SITE IN AN ARID ENVIRONMENT

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ABSTRACT

The response of fertilizer N to pearl millet grown on two soils i.e. soil under *Prosopis cineraria* tree(*Khejrt soil*, and adjacent open site soil (non-*khejrt* soil was studied under greenhouse condition. An increase in dry matter yield to the extent of 73 per cent on *khejri* soil over non *khejri* soil indicated an enhanced fertility build up in soil underneath *P. cineraria*. The N-use efficiency increased from 27% (non-*khejri* soil) to 46% in *khejri* soil at 140 mg N kg^{-1} soil application. The response to N on dry matter yield was observed upto 280 mg N kg^{-1} soil. The uptake of N,S, and P and percent N in plant was higher on *khejri* soil as compared to non-*khejri* soil at all the N-levels.

INTRODUCTION

Prosopis cineraria (khejri) is an important leguminous tree widely distributed in western Rajasthan and its density ranges from 150-200 trees per hectare (Vinod Shankar 1980). There is a general belief that the crop growth is better under *khejri* than the adjoining areas under similar management conditions. Aggarwal et al. (1976) reported a higher build up of organic matter, nitrogen, phosphorus and potassium in soils remaining under *P. cineraria* for a longer period and this enrichment might be the contributing factor for better growth of pearlmillet. Increase in total nitrogen content over open field soil was nearly double in soil where *P. cineraria* had grown for more then 15years. Present study was carried out to investigate the nitrogen supplyi-g power of soil underneath *P. cineraria*.

MATERIAL AND METHODS

Surface soil samples (0-15 cm) were collected from two sites viz; one from beneath the *P. cineraria* grown for over 15 years (designated as *khejrt* soil) and other from adjacent open field without any tree vegetation (designated as non *khejri* soil). Both the sites were selected at the Central Research Farm of Central Arid Zone Research Institute, Jodhpur. The soil belonged to the order Aridisol having loamy sand texture. The chemical characteristics of two soils are reported in Table 1. The soils were air-dried, and passed through 2 mm sieve and filled in polyethene lined earthen pots.

Treatment consisted of four levels of nitrogen (0, 140, 280 and 420 mg N kg^{-1} soil in the form of urea equivalent to 0,40,80 and 120 kg N ha^{-1}) with four replications. Basal dose of P and K @ 60 mg P kg^{-1} soil and 90 mg kg^{-1} soil in the form of single super-phosphate and muriate of potash were also given. The pots were arranged in a completely randomised design. In the first week of July, seeds of pearl millet (cv. BJ-104) were sown. After germination three plants in each pot were kept. The crop was harvested at earhead emergence stage (45 DAS) and were oven dried at 65°C to record the dry matter yield.

Table 1. Chemical characteristics of surface soil (0-15 cm) of *P. cineraria* (Khejri) and adjacent open soil (non-*khejri*)

Characteristics	Non-khejri soil	Khejri soil
pH_2	8.20	8.00
OM %	0.37	0.57
N %	0.02	0.04
S %	0.02	0.03
P %	0.03	0.04
Available nutrient (Kg ha^{-1})		
N	190.0	250.0
P	7.7	22.4
K	370.0	633.0

The plants sampels were analysed for N,P and S using the methods described by Bremner (1965).

RESULTS AND DISCUSSION

Drymatter yield and N-response

The data on dry matter yield and response to applied N indicated significant effect of soil differences (Table 2). An increase of about 73 per cent in dry matter yield was obtained from the treatment receiving no nitrogen under *khejri* soil as compared to that of non *khejri* soil. Although, there was increase in dry matter yields in *khejri* soil at each comparable-N treatments of non *khejri* soil, however, the response to N applied was only apparent up to 280 mg N kg^{-1} soil in both of the soils under study. The higher level of increase in yield from *khejri* soil in treatment receiving no-nitrogen indicates its enhanced inherent N supplying capacity, which is due to the increased organic matter status (Aggarwal 1980).

Response of pearlmillet to N applications was descernible at 280 mg Nkg^{-1} soil in both the soils. Drymatter yield increased significantly upto 280 mg Nkg^{-1} soil. Beyond that there was decrease in yield under both the soils. However, this dec-

Table 2. N-response to pearl millet grown on "Khejri" and "Non-Khejri" soil

N-level mg N kg^{-1} soil	Non-khejri soil				Khejri soil			
	Drymatter yield g/pot	N % in plant	N-uptake (mg/g plant)	% N-use efficiency	Drymatter yield g/pot	N % in plant	N-uptake (mg/g plant)	% N-use efficiency
Control	27.3	2.31	64.7	—	47.3	2.76	130.6	—
140	32.3	2.34	75.5	27.0	51.0	2.92	148.9	46.0
280	39.3	2.70	104.2	49.4	60.6	3.04	182.8	62.8
420	39.1	2.71	106.1	34.5	57.4	2.94	169.3	32.5

rease in yield was sharp in *khejri* soil. Further a higher N per cent and uptake in plant growth on *khejri* soil was observed as compared to non *khejri* soil (Table 2). Soil and N levels interaction on N uptake was significant. The higher N per cent and N uptake in *khejri* soil seems to be due to higher availability of soil N as well as the applied N. The yield and N-uptake obtained in treatment, receiving no nitrogen in *khejri* soil was much higher than obtained with 280 mg N kg^{-1} soil from non *khejri* soil. This suggests that *P. cineraria* has enabled the soil to build its fertility with respect to nitrogen. The subsequent increase in yield and N uptake with fertilizer N suggest the need for additional supply of N for getting higher yields. However, N application beyond 280 mg N kg^{-1} soil gave no response to yield in both the soils.

The data on N-use efficiency suggest that application of N is more beneficial in *khejri* soil than in non *khejri* soil. In non *khejri* soil, the N-use efficiency was only 27 per cent which increased to 46 per cent in *khejri* soil at the level of 140 mg N kg^{-1} soil. The lower N-use efficiency in non *khejri* soil has been reported to be due to higher loss of N through volatilization (Aggarwal and Kaul 1978).

Phosphorus and sulphur uptake

Uptake of phosphorus and sulphur was significantly higher in *khejri* soil over non *khejri* soil (Table 3) and the magnitude of difference recorded was about 100 per cent. The higher uptake of these two nutrients in *khejri* soil seems due to higher build up of S and P (Table 1) and increased availability due to favourable microbial activity. Nitrogen application has no effect on S-uptake but significantly enhanced the P-uptake. Significantly higher P-uptake was recorded on *khejri* soil receiving 280 mg N kg^{-1} soil.

Table 3. Effect of N-application on S and P-uptake (mg/g plant) by pearlmillet in two soils.

N-levels mg N kg^{-1} soil	Non-Khejri soil		Khejri soil	
	S-uptake	P-uptake	S-uptake	P-uptake
Control	4.4	1.68	8.6	3.63
140	5.4	1.82	11.2	4.25
280	7.4	2.35	15.1	5.23
420	7.1	2.35	10.8	4.27

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