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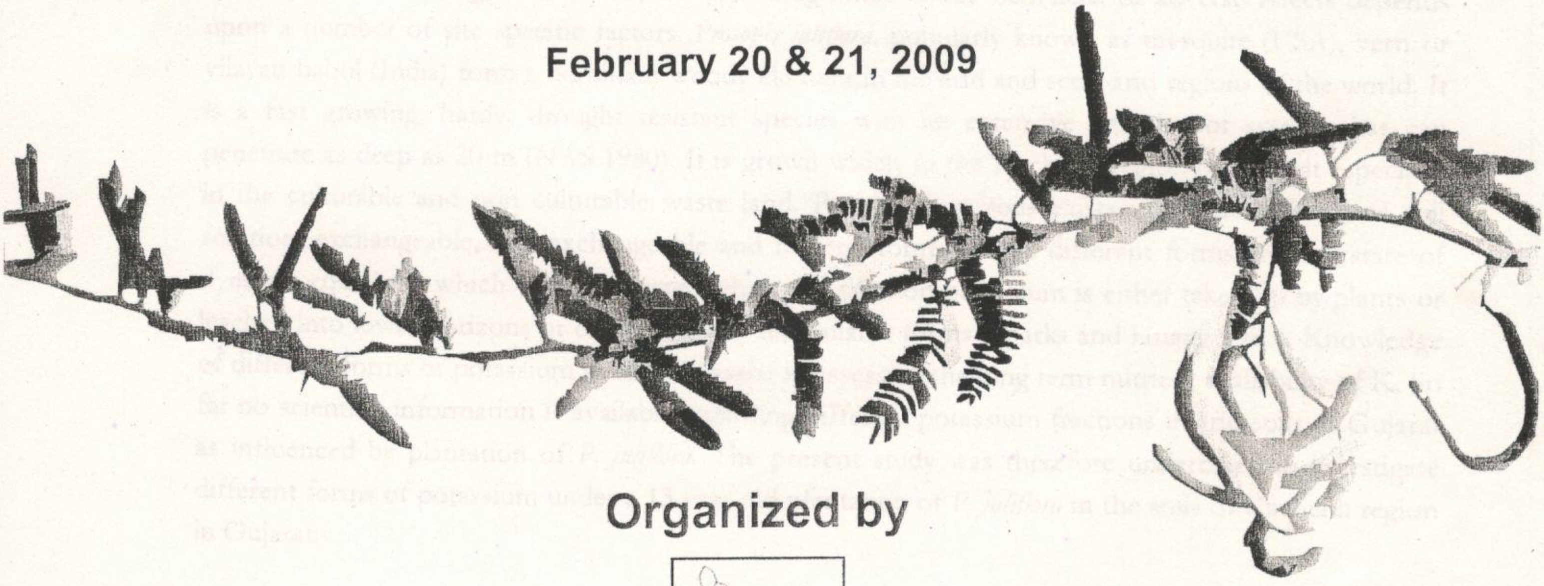

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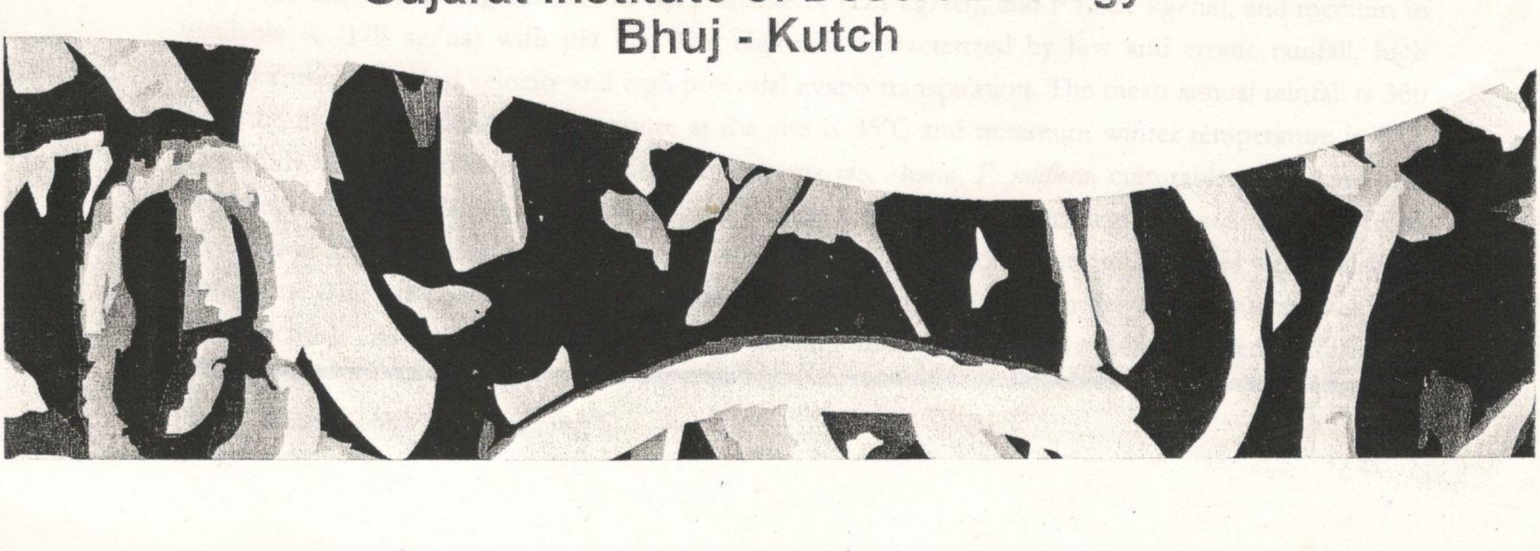

Impact of *Prosopis juliflora* on Different Fractions of Potassium in Soils of Kachchh Region of Gujarat

M. Shamsudheen, Devi Dayal, S. L. Meena, Bhagirath Ram, L. N. Harsh and M. L. Swami

Central Arid Zone Research Institute, Regional Research Station, Kukma, Bhuj, 370 105, Gujarat

Email: shamsudheen@cazri.res.in (M. Shamsudheen)

Introduction

The trees impart a series of changes in physico-chemical and microbiological properties of soils. These changes are dependent on the type of vegetation, its rooting pattern, canopy architecture, type and quantity of litter fall, growth habits, etc. The magnitude of the beneficial or adverse effects depends upon a number of site specific factors. *Prosopis juliflora*, popularly known as mesquite (USA), vern or vilayati babul (India) form a dominant woody element in the arid and semi-arid regions of the world. It is a fast growing, hardy, drought resistant species with an extensive lateral root system that can penetrate as deep as 20 m (NAS 1980). It is grown widely in the Kachchh region of Gujarat especially in the culturable and non culturable waste land. Potassium in soils exists in different forms as soil solution, exchangeable, non exchangeable and mineral forms. These different forms are in a state of dynamic equilibria, which will be affected when soil solution potassium is either taken up by plants or leached into lower horizons or converted into unavailable forms (Sparks and Huang 1985). Knowledge of different forms of potassium in soil will assist in assessing the long term nutrient availability of K. So far no scientific information is available regarding different potassium fractions in arid soils of Gujarat as influenced by plantation of *P. juliflora*. The present study was therefore undertaken to investigate different forms of potassium under a 13 year old plantation of *P. juliflora* in the soils of Kachchh region in Gujarat.

Materials and Methods

The investigation was carried out at the research farm, Central Arid Zone Research Institute, Regional Research Station, Kukma, Bhuj, Gujarat, India (23° 12' to 23° 13' N latitude and 69° 47' to 69° 48' E longitude). The soil of the experimental site was gravelly sand to loamy sand in texture with shallow depth (21 cm), low in organic C (0.25%), available N (121 kg/ha), and P (3.21 kg/ha), and medium in available K (179 kg/ha) with pH 8.6. The region is characterized by low and erratic rainfall, high temperature, high wind velocity and high potential evapo-transpiration. The mean annual rainfall is 360 mm, the maximum summer temperature at the site is 45°C and minimum winter temperature is 1°C. The study was undertaken in four different systems *viz*, *Acacia*, *P. juliflora*, culturable waste land and degraded land. The plantations of *Prosopis* and *Acacia* were established in degraded soils in 1995 from seedlings at 3x3 m spacing and raised under rain fed conditions. Composite soil samples were collected from these land use classes in three replications for both surface (0-15 cm depth) and sub surface (15-30 cm depth). The processed soil samples after passing through 2 mm sieve were analyzed for different physical and chemical properties using standard methods (Black 1965). Different forms of potassium namely water soluble K (1:2 Soil : water), exchangeable K (by leaching with neutral (N) ammonium acetate, non exchangeable K by boiling with 1N HNO_3, total K by HF-$HClO_4$ digestion, Morgan K and $CaCl_2$ extractable K (Helmke and Sparks,1996) were extracted. In all the extracts potassium was measured by flame photometer.

Results and Conclusion

Total K content in the surface soils ranged from 2640.8 to 6714.27 mg kg^{-1} (Table 1). The culturable waste land recorded the lowest K followed by degraded land. Generally the total K content was higher in the sub surface than in surface layers. The plantations of *P. juliflora* recorded a total K content of 6714.3 mg kg^{-1} that was comparable with those recorded with the plantations of *Acacia* (6674.0 mg kg^{-1}).

Table 1. Surface and subsurface distribution of total K, Morgan's K and $CaCl_2$ K (mg kg^{-1}) under different land use classes in Kachchh

Land use classes	Total K		Morgan's K		$CaCl_2$ K	
	Surface	Sub surface	Surface	Sub surface	Surface	Sub surface
Acacia	6674.04	7334.26	79.57	74.36	46.96	57.93
P. Juliflora	6714.27	7117.96	63.68	51.97	45.98	36.00
Culturable Waste land	2640.89	2730.39	45.17	41.21	23.26	21.42
Degraded land	3248.81	3580.56	35.50	24.95	22.91	14.52

Water soluble K under various land use classes ranged from 5.47 to 25.45 mg kg^{-1} (Table 2). The surface soils recorded higher amount of water soluble K than sub surface except for culturable waste land. Degraded land and culturable waste land registered low amount of water soluble K (6.2 and 6.4 3 mg kg^{-1}, respectively). Water soluble K accounted for 0.19 to 0.38% of the total K in soils under this study. The surface soils of both *Prosopis* and *Acacia* behaved comparably in water soluble K contents.

Exchangeable potassium content in soils under different land use classes ranged from 56.73 to 97.02 mg kg^{-1} in the surface and 38.75 to 92.29 mg kg^{-1} in the subsurface soil. In these soils, the exchangeable K constituted 1.17 to 2.67 % of the total K and in sub surface 0.87 to 2.69 %. The degradation of the land has reflected in the lower K content compared with the soils planted with *Prosopis*.

In soils under *P. juliflora*, the non exchangeable potassium content was 516.74 mg kg^{-1} in the surface soil which is 32.3 % more than the degraded land, whereas *Acacia* plantation recorded 27.3% more than degraded land. The Morgan's K content ranged from 35.5 to 79.57 mg kg^{-1} in surface and 24.95 to 74.36 mg kg^{-1} in the subsurface soil and the highest content were recorded under *Acacia* plantation as in the case of water soluble, exchangeable and non exchangeable K.

The $CaCl_2$ K ranged from 22.9 to 47.0 mg kg^{-1} in surface soils under different land use classes. The highest content was recorded in soils under *Acacia*. The plantations of *Prosopis juliflora* has contributed significantly to the improvement of the various fractions of potassium in soils which was comparable to the improvement brought by plantations of *Acacia* in degraded lands of Kachchh.

Table 2. Water soluble, exchangeable and non exchangeable potassium (mg kg^{-1}) under different land use classes in Kachchh

Land use classes	Water soluble K		Exchangeable K		Non exchangeable K	
	Surface	Sub surface	Surface	Sub surface	Surface	Sub surface
Acacia	25.45	23.94	97.02	92.29	612.21	623.19
P. Juliflora	21.29	16.23	78.67	62.05	516.74	464.29
Culturable Waste land	6.41	7.10	70.57	73.39	292.78	213.47
Degraded land	6.20	5.47	56.73	38.75	166.84	140.62

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