

# An Assessment of Fertility Status of Paddy Soils of Karnah Valley

**Parvaiz Ahmad and G. A. Bhat**

P. G. Department of Environmental Science, University of Kashmir, Srinagar 190006, Jammu and Kashmir, India.

## ABSTRACT

A preliminary study on the chemical properties of the paddy soils of Karnah valley was carried out to assess their fertility status. The paper presents the results of the study of nine different paddy field sites located at the length and breadth of whole Karnah valley. Data on various parameters like pH, conductivity, organic matter, organic carbon, nitrogen, and phosphorus was obtained which revealed that the paddy soils in the valley are low to average fertile.

*Key words:* Paddy soils, Karnah valley, Fertility status

## INTRODUCTION

Soil is a dynamic resource that supports plant life and maintaining soil fertility is a key prerequisite to sustain crop productivity. Rice being the major food crop is produced in every continent (Lu and Chang, 1980). It is grown as a dry land crop, as a rain fed crop under alternately flooded and dry conditions and as continuously flooded crop (Brady, 1981). In Karnah valley, most of the arable land available was primarily used for paddy cultivation as a single crop in a year. However, from the last 10-15 years, oats as fodder is also being grown during winter season in almost 80% of the paddy fields, to feed the growing population of cattle, which probably has resulted in decline of soil fertility. A high fertility paddy soil provides the potentiality for obtaining high yield of rice as well as upland crops (Jia-fang and Shi-ye, 1981). The assessments made in the present study, being preliminary, is an attempt to assess the current fertility status of the paddy soils in the area.

## MATERIAL AND METHODS

For the present study nine sites were selected for soil sampling representing the whole Karnah valley (Fig. 1). Sampling was done in the month of May, 2005. Composite soil samples (0-10 cm deep) were collected in polyethylene bags and subsequently brought to the laboratory. The samples were then air dried, slightly crushed with the help of pestle and mortar and sieved using 2mm sieve. pH and electrical conductivity were determined on a 1:2 soil to water paste (Gupta, 2002). Soil organic matter and organic carbon concentrations were estimated by Walkley-Black method (Walkley-Black, 1934). Total nitrogen content was

determined by Kjeldahl method (Saxena, 2000). Available phosphorus was estimated using Olsen's method (Olsen and Somers, 1954), whereas total phosphorus was determined following the method given by Piper (1966).



**Figure 1.** Outline map of Karnah valley (not to scale) showing study sites

## RESULTS AND DISCUSSION

The results of the chemical analysis of paddy soils in Karnah valley are presented in Table 1. The pH of the soil samples was found to vary between 4.80 at site 2 and 7.50 at sites 7 and 9. The values for pH observed at various sites during the present study showed mixed results of both low and high fertility status as per the ranges (low: 4.6-7.3 and high: 5.8-7.6) given by Jia-fang and Shi-ye (1981). On the other hand, Dudal *et al.*, (1981) reported that a pH range of 4.5 to 6.6 seems to be the most suitable range for rice production. However, they also opined that the negative effects associated with low pH in strongly leached soils are more the results of low fertility than the pH itself. In the study it was observed that soils with

pH more than 5 were found to be more productive than that of low pH soils i.e., at site 2. The conductivity values ranged between 90  $\mu\text{S}/\text{cm}$  at site 6 and 340  $\mu\text{S}/\text{cm}$  at site 2 showing no clear correlation with any of the other parameter. However, the high value of conductivity at site 2 can be related to the mobility of cations and anions due to very low pH observed at that site. Soil organic matter and carbon has been implicated as a key factor relating to the quality and sustainability of agricultural soils (Doran *et al.*, 1994). Though the organic matter in the form of green manure is being applied in almost 80% of the paddy fields in Karnah valley, yet the values of organic matter estimated ranged between 0.77% at site 6 and 4.57% at site 2 which falls in low fertility range (low: 1.0-4.7% and high: 2.2-3.2%) as per Jia-fang and Shi-ye, (1981). The probable reason for the comparatively high organic matter and hence the organic carbon at Tangdhar and Khowarpara is that the paddy is cultivated as the only crop in these two localities. The organic matter content of below 2% is being considered insufficient for paddy cultivation (Jia-fang and Shi-ye, 1981) as has been the case with the soil samples studied. Likewise the total nitrogen content of all the soil samples was found to be low and ranged from 0.04 to 0.13%.

**Table 1. Chemical features of paddy soils of Karnah valley**

S. No.	Sites	pH	Parameters					Available phosphorus ( $\mu\text{g}/\text{g}$ )	Total Phosphorus ( $\mu\text{g}/\text{g}$ )
			Conductivity ( $\mu\text{S}/\text{cm}$ )	Orgabuc Carbon (%)	Kjeldahl nitrogen (%)	C/N Ratio			
1	Tangdhar	5.46	116.356	2.06	0.09	22.8	115	895	
2	Khowarpara	4.80	340.457	2.65	0.13	20.3	165	1005	
3	Kandi	5.12	174.137	0.80	0.10	8.0	65	925	
4	Dildar	5.55	188.161	0.93	0.11	8.4	335	885	
5	Tarboni	6.16	136.154	0.89	0.08	11.1	185	680	
6	Chanipora	5.42	90.077	0.44	0.05	8.8	385	710	
7	Chamkote	7.50	118.127	0.74	0.04	18.5	510	790	
8	Taad	5.70	170.141	0.81	0.04	20.2	505	735	
9	Teetwal	7.50	150.164	0.95	0.06	15.8	520	780	

Nitrogen is a critical factor for rice production because even if fertilization is high, about two-third of the nitrogen taken up by rice plant comes from soil (Koyama *et al.*, 1973 and Broadbent, 1978) and the deficiency in nitrogen limits the rice production. The C/N ratio observed also exhibited the same trend of low to average fertility of the paddy soils. Jia-fang and Shi-ye (1981) have reported the high fertility range of C/N ratio for paddy soils as being

9.4 13.4 where as Brady (2000) has reported the representative range for fertile soils being 10.1 12.1. It is important to note that even if the values of C/N ratio at sites 3, 4, 5 and 6 seems to be quite favourable but the parent values of both carbon and nitrogen were observed to be low. The estimated values of available phosphorus and total phosphorus which ranged between 65  $\mu\text{g/g}$  at site 3 and 385  $\mu\text{g/g}$  at site 6 and 680  $\mu\text{g/g}$  at site 4 and 1005  $\mu\text{g/g}$  at site 2 respectively were found to be favourable for the rice crop at almost all the sites except that situated at Kandi where the available phosphorus was comparatively present in very low concentration (65  $\mu\text{g/g}$ ).

## CONCLUSIONS

In conclusion, the results of the present study suggest that the paddy soils of the Karnah valley were found to be low to average fertile as depicted by the low concentrations of organic matter, organic carbon, total nitrogen and C/N ratio. In order to meet the demand of growing population (about 50 thousand at present), an effective management of soil fertility is necessary to enhance the cropland productivity. Therefore, the improvement in soil fertility through adequate and harmonized chemical and organic fertilization of the paddy soils in the area is suggested.

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