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EFFECT OF JATROPHA PLANTATION ON THE SOIL PROPERTIES UNDER ITS PLANTATION

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ABSTRACT

Jatropha curcas is an oil yielding plant of family *Euphorbiaceae*, with highly variable seed yield. *Jatropha* leaves are not browsed by animals hence plant sheds all its leaves in winter resulting in the changes in the properties of the soil. This study was undertaken to find out the effect of *Jatropha* plantation on the soil under its cultivation. Soil samples were collected randomly from 0-10cm depth of the Bio-fuel Park, Harshola, Mhow (MP) for its fertility status. It was observed that *Jatropha* biomass has positive effect on the organic carbon (0.53-0.75%), available nitrogen (218-268kg/ha), phosphorous (13.6-21.6kg/ha) and potash (560-760kg/ha). Micronutrients like Zinc (0.59 to 0.62), Cu (0.44 to 0.48), Fe (5.20 to 5.60) and Mn were (4.47 to 4.68) mg/kg. Due to the leaf biomass incorporation in the soil its bulk density also found to decrease and hence increasing the soil porosity for better growth of the plants. *Jatropha* plantation has thus positive effect on the soil health of the soil under its cultivation.

Key words : *Jatropha* biomass, Bio-fuel Park, Micronutrients, Bulk density, Soil porosity.

Introduction

Jatropha curcas is an oil yielding plant of family *Euphorbiaceae*, with highly variable seed yield (50g to 2.0 kg/plant). It is a drought resistant oil yielding shrub of family *Euphorbiaceae* widely distributed in central and South America, Africa, India and South East Asia (Cano-Asseleih, 1986; Cano-asseleih *et al*., 1989). It grows well in tropics and subtropics (Fairless, 2007; Carels, 2009; Makkar and Becker, 2009). The plant is monoecious and flowers are unisexual, occasionally hermaphrodite flower also occurs (Dehgan and Webster, 1979). There was a huge variation in seed yield of this plant. It varies from 0.1 to15 tones/ha/year (Ouwens *et al.*, 2007). Different researchers have reported different amount of oil content ranging from 24% to 60% (Liberalino *et al.*, 1988; Gandhi *et al.*, 1995; Sharma *et al.*, 1997; Wink *et al.*, 1997; Makkar *et al.*, 1997; Openshaw, 2000).

In permanent agricultural systems, soil fertility is maintained through applications of manure, other organic materials, inorganic fertilizers and inclusion of legumes in the cropping systems or combinations of these. Assessing soil fertility status is difficult because most soil chemical properties either change very slowly or large seasonal fluctuations. Soil fertility decline is considered as an important cause for low productivity (Lal, 1986 and Sanchez, 2002). DIBER Bio-fuel Park (Fig. 1) was in tropical conditions where previous studies revealed that nitrogen and phosphorous are low and hence limiting the crop production (Lal, 1986).

Materials and Methods

DIBER Project site was having 116300 *Jatropha* plants in 100 hectares of land. Entire Bio-fuel Park land was not uniform and hence 09 soil samples (S-1 to S-9) were collected randomly from different locations of the Bio-fuel Park at a soil depth of 0-10cm. Samples were collected in polythene bags. After collection samples were dried and grinded to make them fit for analysis. Samples were analyzed for pH, E.C, Organic carbon, available nitrogen, phosphorous and potash. Bulk density was also analyzed. Micronutrients like Zn, Cu, Fe and Mn were also evaluated. The soil samples analysis was conducted by Choksi Laboratories at Indore (MP). The data of all

Fig. 1 : *Jatropha* plantation in Biofuel Park.

three years were pooled and analyzed as per standard statistical procedures (Panse and Sukhatme, 1986).

Results and Discussion

The soil sample analysis results revealed slight increase in the organic carbon content due to the continuous addition of the leaf biomass in the soil. pH of the collected samples ranges from 6.80 to 7.40 which is within the range of neutrality. EC of the soil samples ranges from 0.19 to 0.58 dsm^{-1}. Available nitrogen was in the range of 218-274 kg/ha, phosphorous was in the range of 13.6 to 21.6 kg/ha and potash was in the range of 560 to 720 kg/ha, which was slightly at the higher side. The range of data of all the 9 soil samples are given in Table 1 and Figs. 2 & 3.

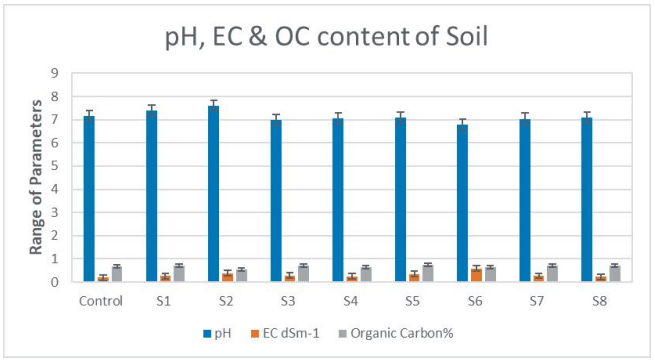

Fig. 2 : pH, EC & OC content of different soils samples of Biofuel Park.

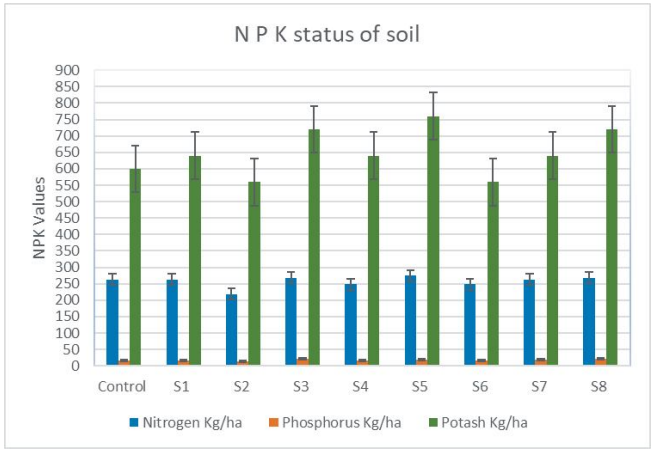

Fig. 3 : N.P.K Status of soils samples of Biofuel Park.

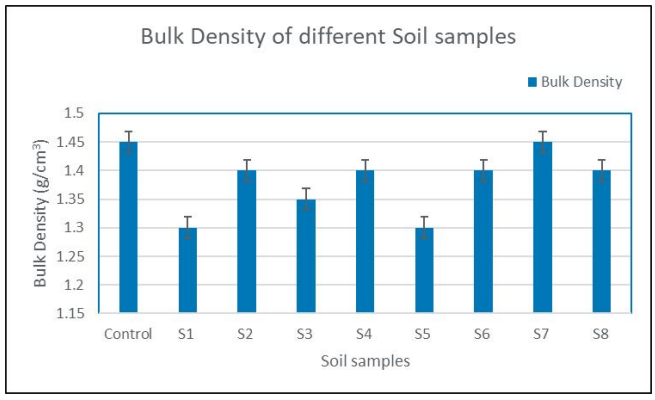

Fig. 4 : Bulk Density Content of different soil samples.

Table 1 : Details of Soil samples parameters studied of the Biofuel Park.

S. no	Sample	pH	EC dSm^{-1}	Organic Carbon%	Nitrogen Kg/ha	Phosphorus Kg/ha	Potash Kg/ha
1	Control	7.16	0.19	0.68	263	16.0	600
2	S1	7.40	0.26	0.70	263	16.8	640
3	S2	7.61	0.38	0.53	218	13.6	560
4	S3	6.98	0.28	0.72	268	21.6	720
5	S4	7.06	0.24	0.65	249	16.0	640
6	S5	7.10	0.34	0.75	274	19.2	760
7	S6	6.80	0.58	0.65	249	16.8	560
8	S7	7.04	0.27	0.70	263	19.2	640
9	S8	7.10	0.23	0.72	268	21.6	720
Mean	7.14	0.31	0.68	257.22	17.87	648.89	
STD Dev		0.24	0.12	0.06	16.91	2.71	71.49
CD (P = 0.05)		0.16	0.07	0.04	11.24	1.79	44.19

Micronutrients of the soil samples were also analyzed. Zinc ranges from 0.59 to 0.62, Cu range was 0.44 to 0.48, Fe was 5.20 to 5.60 and of Mn was 4.47 to 4.68 mg/kg. The data range reveals that micronutrients content is increasing with duration of *Jatropha* plantation.

Bulk density is an indicator of soil compactation. The lower the bulk density the porous the soil. High bulk density is not good for the plants for better growth. The continuous addition of biomass due to the *Jatropha* plantation have a positive effect on the bulk density and thus reducing the compactation and bulk density. The bulk density details of all the soil samples are given in Fig. 4.

Soil plays a very important role in the establishment of the plant and its further production. There is a general belief that plantation of *Jatropha* in soil generally results in degradation of the soil or make it barren but the analysis of the soil here tells the story other way around. *Jatropha* plantation has added the organic carbon to the soil and all the macro as well as microelements were found to increase with the duration of *Jatroph*a plantation. Main reason behind this is that animals generally does not browse any part of *Jatropha* due to the presence of certain bio-chemicals in it. Hence all the leaves fall on the ground and degrade in the soil during rainy season and contribute to the soil enrichment. Thus, it can be concluded that the *Jatropha* plants resulted in enhancing the soil properties under its cultivation.

References

Cano-Asseleih, L.M. (1986). Chemical investigation of *Jatropha curcas* L. seeds. *PhD Thesis*. University of London, UK.

Cano-asseleih, L.M., Plumbly R.A. and Hylands P.J. (1989). Purification and partial characterisation of the hemagglutination from seeds *of Jatropha curcas*. *J. Food Biochem*., **13**, 1-20.

Carels, N. (2009). *Jatropha curcas* : A review. In: Kader, J.C. and Delseney M. (eds). *Advances in botanical Research*. Academic Press, NewYork. Pp 39-86.

Dehgan, B. and Webster G.L. (1979). Morphology and Intrageneric relationships of the genus *Jatropha* (Euphorbiaceae), Vol. 74. University of California, Publications in Botany.

Fairless, D. (2007). The little shrub that could-may be. *Nature*, **449**, 652-655.

Gandhi, V.M., Cherian K.M. and Mulky M.J. (1995). Toxicological studies on ratanjot oil. *Food Chem. Toxicol*., **33**, 39-42.

Lal, R. (1986). Soil surface management in the tropics for land use and high and sustained productivity. In: Steward, B.A. (eds). *Advances in soil Science* (vol **5**). NewYork, USA: Springer-Verlag.

Makkar, H.P.S., Becker K., Schmook B., Sporer F. and Wink M. (1997). Studies on nutritive potential and toxic constituents of different provenanaces of *Jatropha curcas*. *J. Agric. Food Chem*., **45**, 3152-3157.

Openshaw, K. (2000). A review of *Jatropha curcas*: an oil plant of unfulfilled promise. *Biomass Bioenergy*, **19**, 1-15.

Ouwens, D.K., Francis G., Franken Y.J., Rijssenbeek W., Riedacker A., Foidl N., Jongschaap R. and Bindraban P. (2007). Position paper on *Jatropha curcas*. State of the art, small and large scale project development. *Factundation*, URL:http://www. factfuels.org/en/ FACT_ knowledge_ centre/ FACT_Publications.

Panse, V.G. and Sukhatme P.V. (1986). *Statistical methods for Agricultural workers*. ICAR, New Delhi.

Sharma, G.D., Gupta S.N. and Khabiruddind M. (1997). Cultivation of *Jatropha curcas* as a future source of hydrocarbon and other Industrial products. In: Gubitz, G.M., Mittelbach M. and Trabi M. (Eds). Biofuels and Industrial Products from *Jatropha curcas*. DBV Graz.19-21.

Wink, M., Koschmieder C., Sauerwein M. and Sporer F. (1997). Phorbol esters of *J.curcas*-biological activities and potential applications. In: Gubitz, G.M., Mittelbach M. and Trabi M. (Eds). Biofuels and Industrial Products from *Jatropha curcas*.DBV Graz.160-166.