Indian Journal of Agriculture and Allied Sciences
*A Refereed Research Journal*

**ISSN 2395-1109**
**e-ISSN 2455-9709**
**Volume: 2, No.: 3, Year: 2016**

www.mrfsw.org

*Received: 16.09.2016, Accepted: 25.09.2016*

# AVAILABLE MACRONUTRIENT STATUS IN SOILS OF MUJEHRA VILLAGE OF MIRZAPUR, U.P.

**M .Tariq, P. K. Sharma and Y. V. Singh**
*Department of soil science and Agricultural Chemistry, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, E-mail: pksssac@gmail.com, Corresponding Author: P K Sharma*

***Abstract:*** *Soil samples were collected from (0-15 cm) Mujehra villages of Mirzapur and analyzed for various chemical properties and available nutrients in laboratory following standard procedures. Correlation study of soil properties with available nutrients was also done. The pH of surface soils of Mujehera village from 6.5 to 8.4, soil samples are generally neutral to alkaline in reaction.The electrical conductivity of soils ranged from 0.63 to 0.98 dS m-1 with a mean value of 0.77 dS m-1. Organic carbon ranged from 0.24 to 0.48 with a mean of 0.38, respectively. All soil sample were low in available nitrogen content. Available phosphorus content in the soils ranged from 8.10 to 12.20 kg ha-1 with a mean of 10.35 kg ha-1. Available potassium content varied from 120 to 140 kg ha-1 with a mean of 131.34 kg ha-1. Available Sulphur content ranged from 6.10 to 8.20 kg ha-1 with a mean of 7.20 kg ha-1. Soil samples were in low range for available sulphur. Exchangeable calcium content and exchangeable magnesium varied from 3.60 to 5.80 C mol (p+) kg-1 and from 2.11 to 2.40 C mol (p+) kg-1 respectively . All samples were sufficient in exchangeable calcium and magnesium.*
***Keywords:*** *Macronutrient, sulphur,soil fertility, organic carbon Mirzapur*

**Introduction:** Macronutrients in soil are released to the soil from rocks, organic matter or other parent materials by weathering and soil-forming processes. Macronutrients are normally present in the soil in complex organic or inorganic combinations that must be converted to simpler compounds and then to ionic forms prior to their uptake by plants. All of the macronutrients except K are found in the soil in both organic and inorganic combination. Potassium is found only in inorganic combinations [1]. Approximately 97 to 99 percent of soil N is present in soil organic matter largely in proteins and amino acids. Sources of macronutrients in soil serve as a storehouse for plant nutrients and normally provides a substantial amount of the crop nutrient requirements. Total and available concentrations of nutrients vary greatly between soils and crops. The application of commercial N, P and K fertilizers has contributed to a tremendous increase in yields of agricultural crops that feed the world's population . If the concentrations of macronutrients in a readily available form are inadequate, then commercial fertilizers can be applied to ensure an adequate supply of readily available nutrient for plant utilization. There is a broad range in concentration of the macronutrients in soils. The total concentration of the elements is not considered as important in their availability to plants as their chemical form. Soil fertility research has identified levels of macronutrient concentrations in the soil that are sufficient for field crop production without further additions. Therefore, it is important to investigate the soil macronutrient status and may provide valuable information to the farmers. Mujehra village of Mirzapur district has different types of soils and subjected to intensive agriculture practices with variety of crops of varying nutrient uptake characteristics for a long time which leads to nutritional imbalance particularly in N, P, K, Ca, Mg and S as well as availability range of some nutrients is low and medium. Concept of Nutrient Index gives the basic data regarding available nutrients in the soil and their association with other soil characteristics. This can be widely utilized in specific set of soil condition. Very meagre collective work on these widely spread soils have been carried out with respect to soil

characteristics and nutritional status. Mujehra is one of the developing villages of Mirzapur district, with varied soil type, so present investigation was undertaken to study the physico-chemical properties and available nutrients status in soils of Mujehra village of Kone block of Mirzapur. Owing to all above points, the present investigation was conducted to study the study the available macronutrient N, P, K, Ca, Mg, S content of soils of Mujehera village of Mirzapur district and correlation among the macronutrient content and soil properties.

**Materials and Methods:** The study area Mujhera village of Kon Block, Mirzapur district comes in Agro Climatic Zone IV$^{th}$ which is situated in Vindhyan plateau and middle Gangetic plain region. (Fig.1) The geographical area of district is 452.508 ha which is divided in 197 villages. Vindhyan region of district Mirzapur (25º 10' latitude, 82º 37' longitude and altitude of 147 meters above mean sea level) . The climate of the district is congenial for successful cultivation for oilseed, pulses, cereals and horticultural crops with fisheries and poultry farming. The net irrigated area and rained area is 162.151 ha, 120.491 ha and 70.892 ha respectively. The gross cropped area 272.285 ha, net sown area 191.383 ha, area sown more than once 81.441 ha and cropping intensity is 142.6 percent is also valuable. Rainfed agriculture is the traditional farming practice followed in the region. The crops cultivated under rainfed conditions are gram, rapeseed and mustard, in *rabi* season, while wheat, barely, mustard and gram tomato and sugarcane are cultivated under irrigated condition and sesame, bajra and arhar and mung bean are cultivated under *kharif* season.

The soil samples were collected randomly from the selected sites using soil auger, khurpa and spade. Description of soil sampling site was presented in Table1. The soil samples were collected by cutting a V shaped slice to the proper depth of about 15 cm. Then the centre of the sample was cut, lifted with the help of knife and was collected in a plastic bag to carry to the laboratory. After the collection of the gross samples, precaution was taken to avoid further chemical reactions. The soil samples were dried for 24 to 48 hour in shade. Large soil aggregates were crushed by wooden mortar into smaller one and were further reduced by grinding. Grinding provides a maximum surface area for physical and chemical reactions and reduces the heterogeneity. Grinding was followed by sieving with 2.0 mm sieve and samples were preserved in plastic bags.

The soil sample were analyzed for the chemical properties *i.e.* soil pH, electrical conductivity, organic carbon, available nutrient (N, P, K, S, Mg, Ca) content of soil. Procedures followed in macronutrients analysis of soils were depicted in Table 2.

**Table No 1: Description of sampling site**

| S. No. | Sample no | Farmer's Name | Cropping pattern |
|---|---|---|---|
| 1 | S1 | Ram Nath | Sorghum-gram |
| 2 | S2 | JalendharYadav | Rice-Wheat |
| 3 | S3 | Ram Kishan Singh | Bajra- Wheat |
| 4 | S4 | NankuMaurya | Sorghum-gram |
| 5 | S5 | Rahul Singh | Rice-Wheat |
| 6 | S6 | Dve Kumar | Rice-Wheat |
| 7 | S7 | LakxmanYadav | Bajra- Wheat |
| 8 | S8 | ArunDixit Lal | Rice- Mustard |
| 9 | S9 | Rajaram | Rice-Wheat |
| 10 | S10 | Prema Devi | Bajra- Wheat |
| 11 | S11 | Vikash Chandra | Rice-Wheat |
| 12 | S12 | CandanVerma | Rice –mustard |
| 13 | S13 | Ajeetkumar | Rice-Wheat |
| 14 | S14 | Vikash Chandra | Bajra- Wheat |
| 15 | S15 | Vikram Singh | Sorghum-gram |
| 16 | S16 | Guru DevYadav | Rice-Wheat |
| 17 | S17 | Sudhansu Kumar | Rice-Wheat |
| 18 | S18 | Rajneesh Singh | Bajra- Wheat |
| 19 | S19 | Ramesh Singh | Rice- Mustard |
| 20 | S20 | Digvijay Singh | Rice-Wheat |
| 21 | S21 | Ram Krishna | Bajra- Wheat |
| 22 | S22 | Jeetlaal | Rice-Wheat |
| 23 | S23 | Shyam Kumar | Rice –mustard |
| 24 | S24 | Vijay Singh | Rice-Wheat |

| | | | |
|---|---|---|---|
| 25 | S25 | NandlalYadav | Bajra- Wheat |
| 26 | S26 | Sri Gagpal Singh | Sorghum-gram |
| 27 | S27 | Sri Rajesh Kumar | Rice-Wheat |
| 28 | S28 | Sri Mahendra Sharma | Rice-Wheat |
| 29 | S29 | Sri BanvariLal | Bajra- Wheat |
| 30 | S30 | Sri Kamala Prashad | Rice- Mustard |
| 31 | S31 | Ramhit Shankar | Rice-Wheat |
| 32 | S32 | VisnuPrashad | Bajra- Wheat |
| 33 | S33 | SanjayYadav | Rice-Wheat |
| 34 | S34 | Sri KaluramNayak | Rice-mustard |
| 35 | S35 | Sri SatishSingh | Rice-Wheat |
| 36 | S36 | Mahendralal | Bajra- Wheat |
| 37 | S37 | Sri HasrajYadav | Sorghum-gram |
| 38 | S38 | SukhuDev | Rice-Wheat |
| 39 | S39 | Anand Kumar | Rice-Wheat |
| 40 | S40 | Vivek Pal | Bajra- Wheat |
| 41 | S41 | BhagvanPrashad | Rice- Mustard |
| 42 | S42 | Mohd. Alam | Rice-Wheat |
| 43 | S43 | WiasvanathYadav | Bajra- Wheat |
| 44 | S44 | Ajay Singh | Rice-Wheat |
| 45 | S45 | AshishMaurya | Rice –mustard |
| 46 | S46 | Sri SurendarLal | Rice-Wheat |
| 47 | S47 | Sri RamchandYadav | Bajra- Wheat |
| 48 | S48 | Pramod Kumar | Sorghum-gram |
| 49 | S49 | MatabadalGautam | Rice-Wheat |
| 50 | S50 | Shankar Gautam | Rice-Wheat |

**Fig 1: Location of Mujehera village in Kone block of Mirzapur district (Uttar Pradesh)**

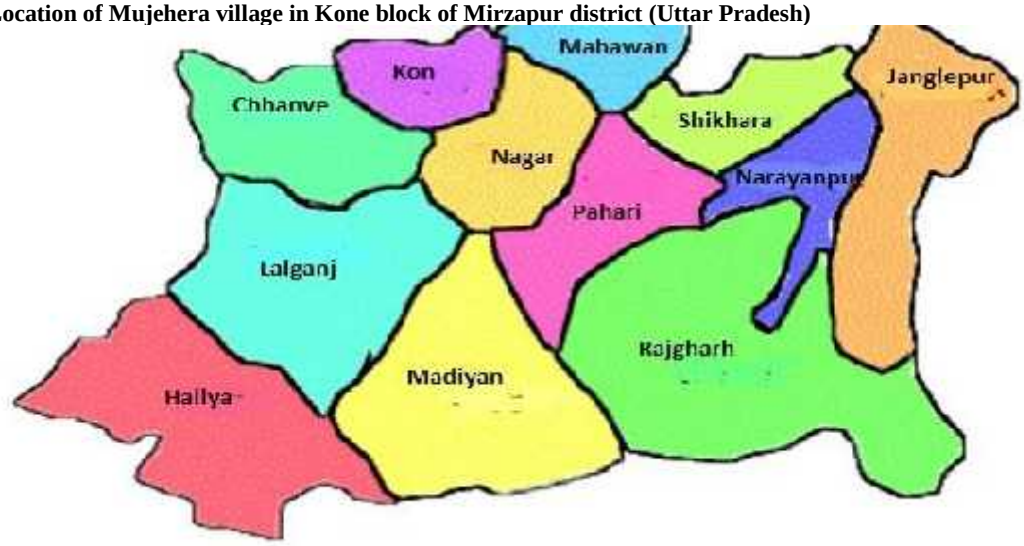


**Table 2: Procedure used for pH, EC, organic carbon and chemical analysis of soil**

| Chemical properties | Method applied |
|---|---|
| pH | by pH meter [1] |
| EC(dsm-1) | EC bridge [1] |
| Organic carbon (%) | Wet oxidation method [2] |
| Available Nitrogen (kg/ha) | Alkaline KMnO4 method [3] |
| Available Phosphorus (kg/ha) | Olsen's method [4] |
| Available Potassium(kg/ha) | Ammonium Acetate method [5] |
| Available Sulphur (kg/ha) | Calcium chloride method [6] |
| Available Calcium and Magnesium (meq/100g) | By EDTA Method [7] |

**Nutrients Index:** The characterization of the soils of the individual blocks as a whole in to the three fertility classes was done according to the nutrient index values calculated from the soil test summaries giving their percentage distribution into low, medium and high categories. The nutrient index was given by-Nutrient index = [% in high category x 3 + % in medium category x 2 + % in low category x 1] / 100.

In this percent assessment a nutrient index less than 1.5 denotes low category and that falls between 1.5 and 2.5 represents the medium fertility class. Value of 2.5 and above (maxi 3.00) signifies a high fertility class in respect of

the particular nutrient. Data obtained from all the observation were statistically analyzed. Correlation between various parameters, Range, Mean and Standard Deviation of all parameter in soils were calculated. The relationship between relevant soil properties and available cationic micronutrient of soils was calculated by using standard statistical methods.

**Results and Discussion**

**pH, EC, Organic Carbon Content of the Soil:** The data on pH, EC and organic carbon are presented in table-3.The data shows that the pH of these soils ranged from 6.5 to 8.4 with average value of 7.6. The lowest pH (6.5) found in S6, S10, S26, S30, S37 (rice-wheat, bajra-wheat, sorghum-gram, rice-mustard, sorghum-gram) soils while highest pH (8.4) was observed in S5,S11,S25,S31,S38 (rice-wheat, rice-wheat, bajra-wheat, rice-wheat, rice-wheat) soil samples. About 26% soil samples were neutral (6.5 to 7.5) and remaining 74% soil samples was slightly alkaline (above of 7.5pH) in reaction. More than three-fourth of soil samples was slightly alkaline and few soil samples are neutral in reaction. The electrical conductivity of soils ranged from 0.63 to 0.98 $dSm^{-1}$ with an average value of 0.77$dSm^{-1}$. The lowest (0.63) EC is found in S1 (sorghum-gram) field, while highest EC (0.98) is found in S17 (rice-wheat) soil sample. EC of all the soils are less than 1$dSm^{-1}$, therefore all crops may be cultivated in soils of Mujehra village. The investigation further suggests that salt accumulation is not a problem in these soils for proper growth and development of crops. The organic carbon content varied from 0.24 to 0.48 with a mean value 0.38, the lowest value 0.24 of organic carbon content was observed in S40 (bajra-wheat) field, the highest value of organic carbon is found in S8,S21,S34,S47 (rice–mustard, bajra-wheat, rice-mustard, bajra-wheat) fields.

All soil samples were found low in organic carbon. Thus low organic carbon content showed that cropping pattern had no influence on organic carbon content of the soil. The high temperature prevailing in the area is responsible for rapid decomposition of organic carbon.

**Table .3: Sample wise data on pH, EC and Organic Carbon**

| Sr. No. | Cropping pattern | pH | EC dSm-1 | OC (%) |
|---|---|---|---|---|
| S1 | Sorghum-gram | 7.9 | 0.63 | 0.38 |
| S2 | Rice-Wheat | 8.2 | 0.82 | 0.41 |
| S3 | Bajra- Wheat | 8.1 | 0.69 | 0.42 |
| S4 | Sorghum-gram | 7.7 | 0.79 | 0.39 |
| S5 | Rice-Wheat | 8.4 | 0.85 | 0.42 |
| S6 | Rice-Wheat | 6.5 | 0.92 | 0.29 |
| S7 | Bajra- Wheat | 7.1 | 0.68 | 0.35 |
| S8 | Rice- Mustard | 8.2 | 0.72 | 0.48 |
| S9 | Rice-Wheat | 8.2 | 0.79 | 0.42 |
| S10 | Bajra- Wheat | 6.5 | 0.82 | 0.28 |
| S11 | Rice-Wheat | 8.4 | 0.74 | 0.42 |
| S12 | Rice -mustard | 7.6 | 0.79 | 0.42 |
| S13 | Rice-Wheat | 6.9 | 0.64 | 0.47 |
| S14 | Bajra- Wheat | 7.9 | 0.69 | 0.38 |
| S15 | Sorghum-gram | 8.3 | 0.71 | 0.33 |
| S16 | Rice-Wheat | 6.6 | 0.89 | 0.25 |
| S17 | Rice-Wheat | 7.8 | 0.98 | 0.35 |
| S18 | Bajra- Wheat | 8.2 | 0.91 | 0.42 |
| S19 | Rice- Mustard | 6.6 | 0.84 | 0.29 |
| S20 | Rice-Wheat | 6.7 | 0.78 | 0.39 |
| S21 | Bajra- Wheat | 7.9 | 0.69 | 0.48 |
| S22 | Rice-Wheat | 8.2 | 0.69 | 0.38 |
| S23 | Rice -mustard | 8.1 | 0.79 | 0.28 |
| S24 | Rice-Wheat | 7.7 | 0.85 | 0.31 |
| S25 | Bajra- Wheat | 8.4 | 0.92 | 0.42 |
| S26 | Sorghum-gram | 6.5 | 0.68 | 0.47 |
| S27 | Rice-Wheat | 7.7 | 0.72 | 0.38 |
| S28 | Rice-Wheat | 8.2 | 0.79 | 0.41 |
| S29 | Bajra- Wheat | 8.2 | 0.82 | 0.4 |
| S30 | Rice- Mustard | 6.5 | 0.74 | 0.35 |
| S31 | Rice-Wheat | 8.4 | 0.79 | 0.42 |
| S32 | Bajra- Wheat | 7.6 | 0.64 | 0.29 |
| S33 | Rice-Wheat | 6.9 | 0.69 | 0.39 |

**Status of available N, P and K in Soil:** Available nitrogen content of soils ranged from 160 to 211 Kg ha-1 with a mean value of 168.52 kg ha-1(Table 4). The lowest (160 kg ha-1) available nitrogen content was observed in soil sample S16 (rice-wheat) The highest (211 kg ha-1) available nitrogen content was observed in soil samples S8, S21, S34, S47 (rice- mustard, bajara-wheat, rice- mustard, bajara-wheat). All soil samples collected from Mujehra village found in low range. Cropping pattern did not show any effect on available nitrogen content of soil. The available phosphorous content of soils varied from 8.10 to 12.20 kg ha-1 with a mean value of 5.35 kg ha-1(Table 4). The highest available phosphorous observed in S8, S20, S35, S43 (rice-mustard, rice-wheat, rice-wheat, bajra-wheat), while lowest available phosphorous observed in S17, S32, S40 (rice-wheat, bajra-wheat, bajra-wheat) All the soil samples were found low in phosphorous availability. It may be due to low rainfall and low organic matter content. The potassium content of soils was ranged from 120 to 140 kg $ha^{-1}$ with a mean value of 131.34 kg $ha^{-1}$(Table 4). The highest available potassium observed in S5,S8,S14,S24, S27,S33,S40,S43, S47 (rice-wheat, rice-mustard, bajra-wheat, rice-wheat, rice-wheat, rice-wheat, rice-wheat, bajra-wheat, bajra-wheat) while lowest available potassium observed in S4, S13, S23, S32, S39 (sorghum-gram, rice-wheat, rice- mustard, bajra-wheat, rice-wheat). Medium potassium content in all soil samples was observed. It may be due to low availability of potassium bearing minerals in soils.

**Table 4 :Range, Mean, S.D. of available N,P,K in Soil**

| Nutrients | **Range** | **Mean** | **S.D** |
|---|---|---|---|
| Available N(kg ha-1) | 105-211 | 168.52 | 28.08 |
| Available P(kg ha-1) | 3.0-7.20 | 5.35 | 1.43 |
| Available K(kg ha-1) | 120-140 | 131.34 | 6.41 |

**Status of Available Secondary Macronutrients *viz*. S, Ca and Mg in Soils:** The data on status of available S exchangeable Ca2+and Mg2+ in soils of Mujehra village in Kon block of Mirzapur district were presented in table 5. The available sulphur content in soils of Mujehra village of Mirzapur ranged from 6.10 to 8.20 kg/ha with an average value of 7.20 kg/ha. The highest available sulphur content (8.20) is observed in S9, S22, S28, S45 (rice-wheat, rice-wheat, rice-wheat, rice-mustard)**,** while the lowest available sulphur content (6.10 kg/ ha-1) is observed in S14, S33 (bajra-wheat, rice-wheat). All samples of Mujehra village were low in sulphur content. It may be due to low organic matter content, application of fertilizers lacking sulphur may be one reason of low sulphur in soils of Mujehra village.

The data revealed that the exchangeable calcium content of these soils ranged from 3.60 to 5.80 C mol (P+) kg-1 with an average value of 4.68 C mol (P+) kg-1. The exchangeable Ca content was observed highest (5.80 Cmol (P+) kg ha-1 in soil samples S12, S21, S36 (rice-mustard, bajra-wheat, bajra-wheat), while the lowest exchangeable Ca content (3.60 Cmol (P+) kg ha-1 was observed in soil samples S10, S19, S34 S48 (bajra-wheat, rice-mustard, rice-mustard, sorghum-gram). About 62% of soil samples were found higher in exchangeable calcium, while 38% soil samples were found medium in exchangeable calcium. It may be due to use of lime in the soil of area.

The exchangeable Mg2+ content in soils of Mujehra village of Mirzapur varied from 2.11 to 2.40 Cmol (P+) kg-1 with a mean value of 2.29 C mol (P+) kg .The medium value of exchangeable Mg2+ (2.11-2.40) Cmol (P+) kg-1 content was observed in all soil sample. Similar result was observed [8] in Golaghat district of Assam, India. The highest exchangeable Mg content (2.40 Cmol (P+) kg ha-1 was observed in soil sample S39 (rice-wheat) while the lowest exchangeable Mg content (2.11 Cmol (P+) kg ha-1 was observed in soil samples S5, S16, S34 (rice-wheat, rice-wheat rice-mustard). All soil samples were in medium-ranged (1.5-4.5meq/100g). All soil samples are sufficient in exchangeable Mg2+ in soils of Mujehra village.

**Table 5: Status of available secondary macronutrients viz. S, Ca and Mg in soils of Mujehra village of Mirzapur**

| **Soil characteristics** | **Range** | **Mean** | **S.D** |
|---|---|---|---|
| Available S (kg ha-1) | 6.10-8.20 | 7.20 | 0.58 |
| Available Ca (Cmol (P+) Kg-1) | 3.60-5.80 | 4.68 | 0.68 |
| Available Mg (Cmol (P+) kg-1 ) | 2.11-2.40 | 2.29 | 0.10 |

**Nutrient Index of Soils of Mujehra Village of Mirzapur:** The Nutrient index value of available macronutrient (N, P and K), available secondary nutrients (S, Ca and Mg) in soils of Mujehra village of Mirzapur were given below in table 6. The nutrient index value for soil of Mujehra

village of Mirzapur were low for nitrogen and low for hosphorus, medium for potassium, and low for sulpher. The nutrient index value worked out for nitrogen, phosphorus, potassium and sulphur are 1.0, 1.0, 2.0 and 1.0 respectively, against the nutrient index value <1.5 for low, 1.5 to 2.5 for medium and >2.5 for high fertility status of area. Nutrient Index value for calcium, magnesium, and sulphur were 2.62, 2.0.0 and 1.0 respectively.

**Table 6: Nutrient Index values of Mujehra village of Mirzapur**

| S. No. | Available Nutrient | NIV | Category |
|---|---|---|---|
| 1 | Nitrogen | 1.0 | Low |
| 2 | Phosphorus | 1.0 | Low |
| 3 | Potassium | 2.0 | Medium |
| 4 | Calcium | 2.62 | High |
| 5 | Mg | 2.0 | Medium |
| 6 | Sulphur | 1.0 | Low |

**Table 7:Correlation between pH, EC, organic carbon properties and available nutrients in the soil of Mujehra village of Mirzapur**

| pH | EC | OC | N | P | K | Ca | Mg | S |
|---|---|---|---|---|---|---|---|---|
| pH | - | - | - | - | - | - | - | - |
| EC | 0.039 | - | - | - | - | - | - | - |
| OC | 0.344* | -0.262 | - | - | - | - | - | - |
| N | 0.350* | -0.265 | 0.999** | - | - | - | - | - |
| P | 0.046 | 0.044 | 0.107 | 0.115 | - | - | - | - |
| K | -0.009 | 0.061 | 0.012 | 0.019 | 0.171 | - | - | - |
| Ca | -0.035 | 0.011 | -0.079 | -0.086 | -0.023 | -0.090 | - | - |
| Mg | 0.025 | 0.266 | 0.118 | 0.115 | 0.085 | -0.240 | 0.025 | - |
| S | 0.039 | -0.005 | 0.045 | 0.080 | 0.151 | -0.222 | 0.165 | 0.156 |

**Correlation among the Macronutrients and Soil Properties:** The data on correlation between soil properties and available nutrients in soil of Mujehra village of Mirzapur was presented in table 7. The soil pH (r=0.350*) was found positively significant correlated with available nitrogen. The close relationship between available nitrogen and organic carbon (r = 0.999**) may be due to association of nitrogen with organic matter, adsorption of N with organic matter and adsorption of ammonical N by humus complex in soil. EC had positive significant correlation with pH (r=0.039) and negative correlation with nitrogen (r= -0.265).

Available phosphorus showed positively relationship with organic carbon (r=0.107) and EC (r=0.044). Similar result was observed [9] in Ambajogai Tahsil of Beed District. A significant and positive correlation was found between available K(r=0.012) with organic carbon (Table 4.6). Ambajogai Tahsil of Beed District also reported similar relationship [9].

Available K show significant negative correlation with pH (r=-0.009). Available sulphur in these soil show significant positive relationship with pH (r=0.039). Available sulphur in these soil showed positive significant correlation with organic carbon (r=0.045), positive correlation (r=0.051) of organic carbon and available sulphur was also found out [10].

The exchangeable calcium in these soil were positive correlated with EC (r=0.011).The relationship of organic carbon with EC (r=-0.262) had negative correlation. The exchangeable magnesium in this soil was positive correlation with EC (r=0.266), whereas, it was positive correlation with pH (r=0.025).

**Conclusion:** It may be concluded that, the soils of Mujehra village of Mirzapur district are neutral and slightly alkaline in reaction. Low organic carbon was observed in all soils of Mujehera village. Available N (160-211 kg ha-1) and P (8.10-12.20) were low in the soils while K content in soil was reported medium (120-140 kg ha-1). Calcium is found sufficient in soil of Mujehra village. Soils were found medium in Mg content, low in sulphur content in the soils was observed in soils.

Soils of Mujehra village are low in N, P and organic carbon and medium in K. Therefore it is suggested that farmers of Mujehra village should apply fertilizers based on soil testing for getting higher yields of crops.

**References**

1. Sparks, D.L. (1996). Methods of soil analysis. Part 3- Chemical Methods. *American Society of Agronomy, Inc., Soil Science Society of America, Inc.* Madison Wisconsin, USA.
2. Walkley, A. and Black, I. A. (1934). An examination of Degtjareff method for determining soil organic matter and aproposed modification of the chromic acid titration method. *Soil Sci.*, 37:29-37.
3. Subbiah, B. and Asija, G.L. (1956). Alkaline permanganate method of available nitrogen determination. *Current Science,* 25, 259.

4. Olsen, S. R., Cole, C. V., Watnable, F. S. and Dean L.A. (1954). Estimation of available phosphorus in soils by extraction with sodium bicarbonate. USDA Circular, 939: 1-19. *Gov. Printing Office Washington D.*C. 103 Publication.
5. Hanway, J.J. and Heidel, H. (1952). Soil analysis methods as used in Iowa State College, Soil Testing Laboratory. *Iowa State College Bull*, 57, 1-131.
6. Chesnin, L. and Yien, C. H. (1950). Turbidimetric determination of available sulfate. *Soil ScienceSociety America Proceedings,* 15 : 149-151.
7. Cheng, K. L. and Bray R. H. (1951). Determination of calcium and magnesium in soil and plant material. *Soil Science*, 72(6): 449-488.
8. Bhupen K. Baruah, Bhanita Das, Ansarul Haque, Chitrani Medhi, Abani K Misra. (2011). Sequential extraction of common metals (Na, K, Ca and Mg) from surface soil, *j. Chem. Pharm. Res.*, 3(5):565-573.
9. Dhamak, A. L., Meshram, N. A. and Waikar, S. L. (2014). Evaluation of nitrogen fractionation in relation to physico-chemical properties of soil in Ambajogai Tahsil of Beed district. *Journal of Agriculture and Veterinary Science*, 7: 2319-2380.
10. Meena, H. B. and Giri, J. D. (2010). Nutrient availability in soils as affected by physiography in Chittorgarh district, Rajasthan. *Agropedology*, 20(1): 85-87.