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Impact of Nutrient Management on Plant Nutrient Content and Nutrient Uptake of Wheat (*Triticum aestivum* L.) under Degraded Land of Chambal Ravine

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ABSTRACT

A field experiment was conducted during the rabi season of 2013-14 and 2014-15 on sandy clay loam soil to evaluate the effect of nutrient management in wheat (Triticum aestivum L.) at Aisah (Ambah) Tehsil, district Morena, on Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya farm situated in the ravines of Chambal river. The crop cultivar MP-1203 of wheat was grown with 120:60:40 kg ha^{-1} (NPK) recommended dose of fertilizers under nutrient management practices viz., seven treatments Farmer Practices (T_1), 100% RDF (T_2), 150% RDF (T_3), STCR Based NPK Application (T_4), 50% RDF+5 tone FYM + PSB+ all deficient Micro Nutrient (T_5), 75% RDF+2.5 ton FYM/ha+ PSB+ $ZnSO_4$@ 25 kg ha^{-1} (T_6), Organics Practices FYM @10tone ha^{-1}+PSB+Azotobactor (T_7), in randomized block design, replicated three times. Significantly higher values of N, P and K content at 45 DAS, 70 DAS, 90 DAS, harvest stage, seed and Straw, was registered with application of 75% RDF+2.5 ton FYM ha^{-1}+PSB+$ZnSO_4$@ 25 kg ha^{-1} (T_6). However, it was statistically at par with T_3 and they were significantly superior over remaining fertility treatments. The total Nitrogen, Phosphorous and Potassium uptake (kg ha-^{1}), were observed in the range of 46.88 to 129.39, 4.38 to 21.68 and 30.96 to 79.74 kg ha^{-1}, respectively under different INM practices. The application of 75% RDF+2.5 ton FYM h^{a-1}+PSB+$ZnS_{O4@}$ 25 kg ha^{-1} (T_6), showed maximum total N, P and K uptake by wheat, which was significantly higher over remaining fertility treatments except T_3 and T_5 during both the years. The straw yield (4454.27 kg ha-^{1}) and seed yield (3984.45 kg ha-^{1}) of wheat was found highest in 75% RDF+2.5 ton FYM/ha+ PSB+ $ZnSO_4$@ 25 kg ha^{-1} (T_6) practices followed by 150% RDF and STCR Based NPK Application (T_4), Thus, the study demonstrated that the 75% RDF+2.5 ton FYM ha^{-1}+ PSB+ $ZnSO_4$@ 25 kg ha^{-1} (T_6).

Key words: *Chambal ravine, Nutrient Management, Nutrient Uptake and Wheat*

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the world's leading cereal crop cultivated over an area of about 651 million tons making it the third most-produced cereal after maize and rice. India achieved remarkable progress in wheat production during the last four decades.

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India is production of wheat estimated is 88.94 million tons during 2014-15. Nitrogen, phosphorus and potassium as major nutrients, sulphur, calcium and magnesium as the secondary, zinc and boron are the micronutrients which play an important role in the yield and quality of wheat. The ability of the plants to produce more yields is dependent on the availability of adequate plant nutrients because cultivation of high yielding varieties of crop coupled with intensive cropping system has depleted the soil fertility, resulting in multi nutrient deficiencies in soil-plant system. Under such situation, use of only one or two primary nutrients will not be sufficient for maintaining the long term sustainability of crop production. Moreover use of balanced fertilization is a key component of the crop production technology. Productivity of wheat or any other crop can only be improved by integration of inorganic, organic and bio-fertilizer application. Influence of Integrated Nutrient Management and Irrigation on Soil and Plant Nutrient Concentration of Summer Sunflower finding by[27] and integrated nutrient management on growth and yield of wheat[11].

Soil and water are vital natural resources for human survival. Growing world population and increasing standard of living are placing tremendous pressure on these resources. In addition to these, many environmental hazards, causing land degradation is of utmost impertinence as it has direct bearing on decline in productivity on arable non–arable land. It is estimated that about 80% of the current degradation on agricultural land in the world is caused by soil erosion due to water finding by Angima *et al* [2.] Hydrological disaster coupled with high erosion rate has serious social, economic and environmental implications Pimentel[24]. One of the major negative on site effects of soil erosion is the loss of soil fertility status leading to decline in productivity. It is estimated that India suffers an annual loss of 13.4 million tons in the production of major cereals, oilseeds and pulses crops due to water erosion, and equivalalent to about 2.51 billion Indian rupees[28]. Ravine a small valley usually carved by running water, especially the narrow excavated valley of a mountain stream. Etymology - French, “mountain torrent.” By Bates and Jackson[6]. National Commission on Agriculture (1976) estimated that India has 3.67 million hectares of ravine lands constituting 1.12% of total geographical area of India or world. Once even a small ravine is formed, every rainfall makes it bigger by creating holes in the front as well as the corners. Centre decants, thousands of hectares of fertile land along the banks of rivers like Yamuna, Chambal, Mahi and their tributaries have been ruined by ravine formation in Uttar Pradesh, Madhya Pradesh, Rajasthan and Gujarat. But the rapid spread of ravines is a recent phenomenon, more so in Chambal due to its typical nature of formation which is always deep (>10 m) even right at its start. Out of 328.0 million ha geographical area of the country, nearly 147.75 million ha. is subjected to various types of degrees of degradation. Of this about 93.68 million ha is severely eroded by Maji *et al*[17]. Out of estimated 20.06 lakh ha area under ravines in the country, about 6.83 lakh ha is in Madhya Pradesh. And out of that, nearly 5.7 lakh ha is in Chambal and Gwalior divisions of the state, indicating that the Chambal basin suffers most severely from the problem of land degradation due to ravine formation. The Government of Madhya Pradesh has tried to check this soil erosion and expansion of ravines by the means of watershed development and by aerial-seeding for plants like Prosopis Juliflora, and Jatropha in the ravines. But the rugged terrain is still stubborn and once a dacoit sanctuary, these ravines now play host to tourists with a flavour for adventure. There are a considerable extent of area affected by ravines, mostly along the banks of river Chambal, Kalisindh and their tributaries. Out of the 7.2 lakh ha of Chambal command area, about 2.2 lakh ha land has been converted into ravines. Ravine is described as a “Cancer of the Land” and is the severest form of erosion. In fact the table lands of this area are highly productive under better managed conditions. The climate and quality of soil and water are good. The area is free from major insect pest and diseases of the crops. Thus, if properly managed these ravines can also be converted into lush green areas providing better food, fodder, fuel wood and fibre resulting into better socio economic environment to the people of the ravines. The changing scenario in agriculture and escalating land prices may induce to villagers/ farmers to utilize the waste land around their vicinity for crop production and some of farmers are doing agriculture in the revines but without scientific basis which may further home land. The input cost incurred to level the ravine land (Rs.50, 000 to 1,00,000 /ha) is very less as compared to cost of agricultural land in vicinity areas. So little effort from outside may further encourage .Them to manage these wasteland. The ravenous land are most fragile in nature and need special care for profiling the upper layer like conservation practices, nutrient management, cropping sequences and justified land use for its potential production. In resent past some attempts were mode to level a best of ravine area by using machine and to stabilize the ravine crops are by cultivated.

MATERIALS AND METHODS

A field experiment was conducted during *rabi* season 2013-2014 & 2014-2015, on research farm of Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya (R.V.S.K.V.V.), Gwalior, docoited at Aisah (Tehsil- Ambah), district Morena, of situated in Grid zone lying in between 26° 41' 02.60" N latitude and 78° 06' 30.20″ E longitude with an altitude of 163 meters from mean sea level (MSL). Generally rainfed farming is practiced in the area. The research was conducted on an area of 5671 m^2 in permanently maintained plots, having fairly uniform topography with gentle slope and adequate drainage. The region experiences subtropical climate where hot winds during summer flow for a greater part of the day and during night temperatures remain high. The hottest months are May and June (mercury touches 48°C), and the temperature drops considerably in last week of June. The winter commences in October and the months of December and January are the coldest, Minimum temperature some time touches to the freezing point at night. Winter rains are erratic and irregular. The average annual rainfall of the Chambal division is 891.4 mm and a major portion is received in July, August and September. The weather remains sultry and humid in most of the months of the year. Soil experimental site belongs to alluvial soil with high amount of sand and is classified as Inceptisol at soil order of USDA classification. Soil sample was dig from the depth of 0-15cm layers. The soils were collected layer wise and analyzed for physical, chemical and biological properties. The result showed that soil is alkaline in nature, non saline and sandy in texture, with low in organic carbon and low to very low in nitrogen content and phosphorus content. There was no consistency in potassium content and sulfur content neither in different layers nor at locations and content varied from low to high. Total nitrogen content in plant samples at 45, 70, 90 days after sowing and at harvest stage of wheat crop was determined by the Kjeldahl method. Total phosphorous content in plant sample of wheat at different growth stages *viz;* 45, 70, 90 days after sowing and at harvest, phosphorous content were determined by digesting sample in di-acid (NHO_3 : $HClO_4$, 9:4 ratio) followed by estimation of extract by vanadomolybdate yellow colour method by Jackson[12]. Potassium in the acid digest of plant sample was determined by using flame photometer. Nutrient uptake (kg ha^{-1}) =Nutrient Content (%) X Yield (kg ha^{-1})/100.

RESULTS AND DISCUSSION

Total Nutrient uptake by the Wheat crop: The total Nitrogen, Phosphorous and Potassium uptake (kg $ha\text{-}^{1}$) by wheat as influenced by different treatments of fertility levels are presented in Table - 1.On the basis of two years pooled data, total N, P and K uptake by wheat, were observed in the range of 46.88 to 129.39, 4.38 to 21.68 and 30.96 to 79.84 kg $ha\text{-}^{1}$, respectively under different INM practices. Application of 75% RDF+2.5 ton FYM ha^{-1}+PSB+$ZnSO_4$@ 25 kg ha^{-1} (T_6), showed maximum total N, P and K uptake by wheat, which was significantly higher over remaining fertility treatments except T_3 and T_5 during both the years. Significantly lower Total N, P and K uptake by wheat was recorded with treatment T_1 (farmer practices) over all other fertility treatments during both the years. Similar trends were found on basis of two years pooled data. Application of 150% of recommended NPK. Total NPK uptake in rice–wheat system also increased significantly with increase in fertility levels with greatest magnitude by supplying 150% of recommended NPK. Overall, nutrient recycling through incorporation of crop residues and Sesbania green manuring along with inorganics greatly improved the crop productivity, nutrient uptake, and biofertility indicators of soil health with substantial influence on SMBC, CO_2 evolution, and dehydrogenase and phosphatase enzyme activities as mentioned by Paul *et al.* (2014)[23]. Result reveals that the application of different INM packages and water regimes markedly influenced the concentration of nutrients in seeds as well as in stover, and uptake of nutrients by sunflower plants, after harvest. Likewise, residual major soil nutrients (organic C, organic matter and total N, and available P and K) were also influenced greatly due to different nutrient management practices and moisture levels, in which highest values of concentration and uptake as well as residual major soil nutrients exhibited with the application of vermicompost + chemical fertilizers irrigated at IW:CPE ratio 1.0.the similar results were also reported by Puste *et al.*[27]. Chesti *et al.*[8] in a experiment found that application of 100% NPK + 10 t FYM ha^{-1} was superior as compared to the grain yield of 4.41 t ha^{-1} and total NPK uptake (95.7, 18.1 and 111 kg ha^{-1}, respectively) with the 100% NPK alone by Wheat yield and nitrogen uptake showed significant increase when grown after pulses due to impact of different nutrient management practices and cropping systems by (Mubarak and *Singh*[21] and Bahadur *et al*[4]. Application of 50% N through FYM + 50% through chemical fertilizers was significantly higher than that under 100% chemical fertilizers applied to both the crops and was on par with 25% N through FYM and 75% through inorganic source. Maximum N, P and K uptake values were recorded when 50% N was substituted by FYM in maize (114.6, 23.9 and 125.5 kg ha^{-1}) and wheat (99.7, 18.1 and 89.8 kg ha^{-1}) and maize-wheat system (214.3, 42.0 and 215.3 kg ha^{-1}) followed by 25% N through FYM and remaining through inorganic source and minimum in control. The productivity, nutrient uptake and per cent response increased with the increase in the fertilizer level but the reverse trend was noted in case of agronomic efficiency and apparent N recovery per cent. Reported by Prasad *et al*[26], Ping *et al*[25], Paul *et al* [23], Almaliev *et al.*[1], Jat *et al.*[13] and Kara *et al*[14].

Nitrogen content in plant: The study of the data on N content at 45 DAS, 70 DAS and 90 DAS revealed that the N content at each stage of wheat crop was affected significantly due to different fertility levels during both the years as well as on pooled basis was presented in Table 2. Amongst fertility levels, the maximum N content at all stage of crop was observed from the treatment 75% RDF+2.5 ton FYM ha^{-1}+PSB+$ZnSO_4$@ 25 kg ha^{-1} (T_6) during both the years, which was significantly higher as compared to rest of other treatments except T_3, and T_5. Control treatment gave the lowest N content at 45 DAS as well as at 70 DAS and at 90 DAS. And no significant data at harvest stage seed and straw of nitrogen content during both the years during 2014 – 15. Similarly, based on two years pooled data, significantly higher values of N content at 45 DAS (3.08%), at 70 DAS (2.13%) and at 90 DAS (1.45%), was registered with application of 75% RDF+2.5 ton FYM ha^{-1}+PSB+$ZnSO_4$@ 25 kg ha^{-1} (T_6). However, it was statistically at par with T_3 and they were significantly superior over remaining fertility treatments. The lowest N content at 45 DAS, at 70 DAS and at 90 DAS was recorded with farmer practices. The findings of Dahiya *et al* [10] and Singh *et al.*[31] confirms that addition of

10 t FYM ha^{-1} in soil improved the concentration of nitrogen in wheat crop at various stages of growth in both the crop seasons. Increased nitrogen content with the application of FYM may be ascribed to increased root system and higher absorbing capacity and increased available N status of soil due to FYM application. FYM itself contains nitrogen and upon its decomposition produced many organic acids which in turn make it soluble and thus increases N availability. These results are in close conformity with An increase in nitrogen content was also observed due to 10 t FYM ha^{-1} + *Azotobacter* + PSB inoculation in wheat crop. This increase in nitrogen content might be due to increase in bacterial activity in the presence of organic matter which enhanced nitrogen availability to plants which is very much in agreement with the findings of Kumar [16], Konde and Desai[15] and Badgiri and Bindu[3] who showed a general increase in nitrogen content in dry matter by *Azotobacter* + PSB inoculation. The chemical fertilizers (100 and 150% NPK) also increased nitrogen content in both crop seasons. This increase in nitrogen content may be ascribed to greater availability of nitrogen in soil due to its application. Inoculation of seeds treated with *Azotobacter* + PSB along with chemical fertilizers (75 and 100% NPK) further increased the nitrogen content during both crop seasons. Sharma *et al.*[29] also reported similar results. Nitrogen content was enhanced significantly due to chemical fertilizers (75 and 100% NPK) applied along with 2.5 t FYM ha^{-1} over T_2, T_3 and T_4 treatments. The chemical fertilizers (100% NPK) along with 2.5 t FYM ha^{-1} and *Azotobacter* + PSB inoculation had higher values of nitrogen content. The maximum values of nitrogen content in wheat crop at various stages of growth were recorded with nutrient management (75% RDF+2.5 ton FYM ha^{-1}+PSB+$ZnSO_4$@ 25 kg ha^{-1}) which was followed by 150% RDF. This increase may be attributed to increased microbial activity under the INM treatments, which favoured N mineralization. The increase in available N status due to organic manure with *Azotobacter* + PSB application would also be due to the multiplication of soil microbes leading to enhanced conversion of organically bound N into inorganic forms and rapid mineralization which is responsible for higher N content in wheat biomass. Chesti *et al.*[9] and Bahadur *et al.*[5] also reported the similar findings under INM treatments.

Phosphorous content in plant: The maximum P content at 45 DAS, 70 DAS, at 90 DAS, harvest stage seed and straw was estimated (Table-3), from the treatment 75% RDF+2.5 ton FYM ha^{-1}+PSB+$ZnSO_4$@ 25 kg ha^{-1} (T_6), during both the years, which was significantly higher compared to rest of other treatments except $T_{3,}$ and T_5. Farmer practices estimated the lowest P content at 45 DAS, 70 DAS, at 90 DAS, harvest stage seed as well as straw during both the years except T_2 and T_7 during 2014 – 15. Similarly, based on two years pooled data, significantly higher values of P content at 45 DAS (0.44%), at 70 DAS (0.42%), at 90 DAS (0.27%), harvest stage seed (0.45%) and Straw (0.09%) was registered with application of 75% RDF+2.5 ton FYM ha^{-1}+PSB+$ZnSO_4$@ 25 kg ha^{-1} (T_6). However, it was statistically at par with T_3 and they were significantly superior over remaining fertility treatments. The lowest P content at 45 DAS, 70 DAS, at 90 DAS, harvest stage seed and Straw was recorded with farmer practices. Again, the concentration of phosphorus in plants at harvest stages increased significantly with the application of 10 t FYM ha^{-1}.The increase in phosphorus content may be due to enhanced root growth and increased availability of phosphorus in soil. These results are in close conformity with the findings of Singh *et al*[31] and Dahiya *et al*[10] Phosphorus content in wheat crop at different stages of growth was also improved with 10 t FYM ha^{-1} + *Azotobacter* + PSB inoculation over treatment T_2. This increase in phosphorus content might be due to bacterial activity in the presence of organic matter which enhanced phosphorus availability to plants. Kumar [16] reported that the phosphorus content increased significantly by *Azotobacter* inoculation over uninoculated control. The phosphorus content also increased significantly by increasing levels (100 % NPK) of fertilizers over T_1, T_2, T_3 and T_4 treatments, respectively in both crop seasons. This increase in phosphorus content is due to the addition of phosphatic fertilizer. The combined application of NPK (75 and 100%) along with 2.5 t FYM ha^{-1} to the soil significantly increased the phosphorus content over T_1, T_2,T_3 and T_4 treatments. This favourable effect of organic matter on phosphorus availability to plants is due to its solubilizing effect on fixed forms of phosphorus in soil. Similar results were also reported by Tekchand and Tomar[32]. The NPK (75 and 100%) treated soil coupled with bio fertilizer (*Azotobacter* + PSB) resulted in increase in phosphorus content over T_1, T_2, T_3 and T_4 treatments, respectively during both crop seasons. Inoculation of seeds treated with *Azotobacter* + PSB in combination with 2.5 t FYM ha^{-1} and NPK (75 and 100%) gave higher concentration of phosphorus in both the years of study. These results are in close conformity with the findings of Kumar[16]. The application of 100% NPK + 2t FYM + *Azotobacter* + PSB recorded significantly higher P content in wheat grain, straw and by total biomass, could be ascribed to their solubilizing effect on the native insoluble P fraction through release of various organic acids, thus resulting into a significant improvement in available P as well as P content in plant biomass. These findings are in close agreement with the findings of Chesti *et al*[9].

Potassium content in plant: The study of the data on K content at 45 DAS, 70 DAS, 90 DAS and at harvest of wheat revealed that the K content at all the stages was affected significantly due to different fertility levels during both the years as well as on pooled basis presented in Table 4. The maximum K content at 45 DAS, at 70 DAS, at 90 DAS, harvest stage, seed and Straw of wheat was observed from the treatment 75% RDF+2.5 ton FYM ha^{-1}+PSB+$ZnSO_4$@ 25 kg ha^{-1} (T_6), during both the years, which was significantly higher compared to rest of other treatments except T_3, and T_5. Farmer practices gave the lowest K content at 45 DAS, at 70 DAS, at 90 DAS, harvest stage, seed and Straw of wheat during both the years except T_2 and T_7 during 2014 – 15. Similarly, based on two years pooled data, significantly higher values of K content at 45 DAS (2.69%), 70 DAS (2.72%), 90 DAS (2.60%), harvest stage seed (0.55%) and straw (1.56%) was registered with application of 75% RDF+2.5 ton FYM ha^{-1}+PSB+$ZnSO_4$@ 25 kg ha^{-1} (T_6). However, it was statistically at par with T_3 and they were significantly superior over remaining fertility treatments. The lowest K content at 45 DAS, 70 DAS, 90 DAS, harvest stage seed and straw was recorded with farmer practices. Application of 10 t FYM ha^{-1} enhanced potassium concentration significantly over T_1 (control) treatment in both the years of study. This increase in potassium content might be due to a favourable influence of organic matter on potassium absorption by wheat crop. Similar results were also reported by Dahiya *et al*[10]. The concentration of potassium was further improved with combined application of 10 t FYM ha^{-1} + *Azotobacter* + PSB inoculation over 10 t FYM ha^{-1} alone in wheat crop. This increase in potassium content might be due to bacterial activity in the presence of organic matter which increased potassium availability to wheat plants. Kumar[16] also reported that the K content increased by *Azotobacter* inoculation over uninoculated control. The levels of NPK (100%) enhanced the potassium content significantly over T_1, T_2, T_3 and T_4. Addition of chemical fertilizers (75 and 100% NPK) in combination with 2.5 t FYM ha^{-1} influenced significantly the potassium content in wheat crop. Potassium content also increased when NPK (75 and 100%) levels were applied along with *Azotobacter* + PSB noculation. But the magnitude of increase in potassium content in wheat crop due to 2.5 t FYM ha^{-1} coupled with NPK (75 and 100%) levels was higher than that obtained with *Azotobacter* + PSB inoculation. Integrated use of bio-fertilizer (*Azotobacter* + PSB) in combination of 2.5 t

FYM ha^{-1} and NPK (75 and 100%) levels further influenced the concentration of potassium in wheat plant at various stages of growth during both crop seasons. The highest level of NPK (150%) failed in increasing potassium content significantly as compared to other treatments except 100% RDF + 2.5 t FYM ha^{-1} + *Azotobacter* + PSB in both crop seasons. The maximum value of K content in wheat crop was obtained with integrated nutrient management (100% NPK + 2.5 t FYM ha^{-1} + *Azotobacter* + PSB in both crop seasons. The increase of K content under 100% NPK + 2t FYM + *Azotobacter* + PSB might be due to addition of organic matter and microbes reduced K fixation and release of K due to interaction of organic matter with clay, besides the direct K addition to the pool of soil. It may also be due to the decomposition of organic matter accompanied by the release of appreciable quantities of CO_2, which when dissolved in water, forms carbonic acid, which is capable to decomposing certain primary minerals and release of nutrients, which is finally responsible for better absorption resulting in higher K content in plant biomass. The similar finding was also reported by Chesti *et al*[9]. Mehdi *et al*[19] also reported that the nutrient content improved by adopting the integrated nutrient management.

Grain and Straw Yield: The grains and straw yield (kg ha-[1]) were recorded treatment wise and Table 5 reveals that inorganic and organic practices significantly increased grain and straw yield over farmer practices during both the years. Significantly higher (4225 and 3744 kg ha-[1]), (4561 and 4347 kg ha-[1] grain and straw yield in 2013 – 14 and 2014 - 15 were recorded under application of 75% RDF+2.5 ton FYM ha^{-1}+ PSB+ $ZnSO_4$@ 25 kg ha^{-1}, which was statistically identical to 150% RDF (3427 to 3343 kg ha-[1]) and (4012 to 3991 kg ha-[1]) grain and straw yield in 2013-14 and 2014-15, respectively) and superior over other inorganic and organic treatments during both the years. However, treatment (T_4) NPK application on the STCR basis, (T_5) 50% RDF+5 ton FYM +PSB+ Zn So_4 25 kg ha-[1], and (T_7) FYM @10 ton/ha+ PSB+ Azotobactor conjoint application of inorganic with organic were at par but were Superior over control during both the years. The lowest value of this parameter 1940 kg ha-[1] and 2244 kg ha-[1] in 2013-14 and 1889 kg ha-[1] and 2245 kg ha-[1] in 2014-15 were noted under farmer practices plot. The residual soil fertility improved considerably with the combined application of inorganic fertilizer and organics. It was concluded that integration of organics *Rhizobium*, PSB & FYM) with inorganics led to 50% saving of inorganic fertilizer without scarifying the yield of sunnhemp-rice cropping sequence and improved soil fertility status. Tripathi *et al*[33], Effect of nutrient management in wheat on yield of and nutrient uptake by wheat and soil properties. After three years conjoint use of 10 t FYM ha^{-1} with 100% NPK significantly improved the organic carbon and available N, P and K contents over the chemical fertilizers alone. Integrated nutrient management (100% NPK + 10 t FYM ha^{-1}) maximized yields of wheat crop and improved the soil fertility in the intermediate zone of Jammu and Kashmir. Chesti *et al*[8] and (Mauriya *et al*[18] Similarly, recommended dose of inorganic fertilizer (F_{100}) gave significantly higher yield of wheat grain and straw by Naik *et al*[22], Milkha and Aulakh[20], Singh *et al*[30] Application of organic manure (FYM) integrated with recommended dose of fertilizers and biofertilizers (PSB + BGA/*Azotobacter*) further increased the yield and yield attributing characters of rice and wheat which was similar to 125% recommended dose of fertilizers. by Bahadur *et al*[4], Fertilizers constitute an integral part of improved crop production technology. Proper amount of fertilizer application is considered a key to the higher crop production, Yadav *et al*[34], Over-application of nitrogen (N) in North Central China is primary reasons for yield restriction and low nutrient use efficiencies by Ping *et al* [25] . The effect of fertilizers indicated that grain and straw yields of wheat were increased more prominently with the addition of 150 kg N, 60 kg P2O5, 50 kg K2O and 5 t of FYM ha^{-1}. By Bhaduri and Gautam[7], Mubarak and Singh[21]. Integrated nutrient management system for maize-wheat cropping system in an Alfisol. Grain yield of maize, wheat and the system under 50% N through FYM + 50% through chemical fertilizers was significantly higher than that under 100% chemical fertilizers applied to both the crops and was on par with 25% N through FYM and 75% through inorganic source by Prasad *et al*[26]. Effect of nutrient management practices (NM) on growth and yield of wheat (*Triticum aestivum* L.). The experiment consists of eleven treatments viz., T_1-100% recommended dose of fertilizer (RDF) i.e. 120 : 26.4 : 50 N : P : K kg ha-^{1}, T_2- 100% RDF+Vermicompost @ It ha-^{1}, T_3-100% RDF+Vermicompost @ It ha-^{1} + Phosphate Solubilizing bacteria (PSB), T_4-100% RDF+PSB, T_5-75% RDF+ vermicompost @ 1t ha^{-1}, T_6- 75% RDF+vermicompost @ 1t ha-^{1} + PSB, T_7-50% RDF+Vermicompost @ 1t ha^{-1}; T_8-50% RDF+Vermicompost @ 1t ha^{-1}; + PSB, T_9-Vermicompost @ 1t ha^{-1}; + PSB, T_{10}-Vermicompo@st 1t ha^{-1} and T_{11}-absolute control. The results revealed that the application of 100% recommended dose of fertilizers (RDF) i.e. 120:26:4:50 N:P:K kg ha-'+ vermicompost @ 1t ha-^{1} + phosphate solubilizing bacteria (PSB) and 75% RDF + vermicompost @1t ha-^{1}+ PSB produced higher yield attributes and grain yield than the other treatments. The higher yield led to higher NPK uptake by wheat. Further, the available NPK content of soil also increased in above NM treatment over control. The highest benefit: cost ratio (2.73) was obtained from the application of 75% RDF + vermicompost @1t hd1+ PSB. by Devi *et al*[11]. Revealed that the yield and yield contributing characters of wheat showed positive response with an increase in nitrogen levels up to 160 kg N ha^{-1}. The highest grain yield (3.32 t ha^{-1}) was obtained from 160 kg N ha^{-1}, whereas the lowest (1.51t ha^{-1}) was recorded from 0 kg N ha^{-1}. Application of 200 kg N ha^{-1} decreased grain yield. The variety Shatabdi produced the highest grain yield (3.63 t ha^{-1}) and Protiva produced the lowest grain yield (3.12 t ha^{-1}).

Table 1: Effect of nutrient management practices on total Nitrogen, Phosphorous and Potassium uptake (kg ha^{-1})

Treatments	N uptake (kg ha^{-1})			P uptake (kg ha^{-1})			K uptake (kg ha^{-1})		
	2013-14	2014-15	Pooled	2013-14	2014-15	Pooled	2013-14	2014-15	Pooled
T_1	51.59	42.17	46.88	5.59	3.16	4.38	31.53	30.40	30.96
T_2	108.95	84.98	96.96	15.57	13.18	14.38	52.81	58.78	55.80
T_3	117.09	91.98	104.54	16.08	15.20	15.64	62.36	67.72	65.04
T_4	84.16	71.67	77.91	9.85	10.57	10.21	44.27	51.98	48.13
T_5	95.76	73.85	84.80	12.07	10.66	11.37	48.25	52.84	50.55
T_6	147.19	111.59	129.39	25.48	17.88	21.68	85.53	73.95	79.74
T_7	70.03	57.56	63.80	10.96	9.67	10.31	33.19	37.36	35.27
SEm±	4.59	3.26	3.26	0.95	1.18	0.89	1.80	2.65	2.06
CD(0.05)	14.16	10.05	9.52	2.94	3.62	2.61	5.54	8.17	6.02

Table 2: Effect of nutrient management practices on nitrogen content (%) at 45, 70, 90 DAS, and at harvest stage (Grain and Straw) of wheat

Treatments	45 DAS			70 DAS			90 DAS			Grains			Straw		
	2013-14	2014-15	Pooled	2013-14	2014-15	Pooled	2013-14	2014-15	Pooled	2013-14	2014-15	Pooled	2013-14	2014-15	Pooled
T_1	2.70	1.98	2.34	2.06	1.23	1.65	1.43	0.48	0.96	2.08	1.74	1.91	0.50	0.42	0.45
T_2	3.50	2.33	2.92	2.26	1.65	1.95	1.67	0.78	1.23	2.28	1.83	2.05	0.58	0.63	0.60
T_3	3.52	2.42	2.96	2.19	1.71	1.94	1.82	0.96	1.39	2.42	1.95	2.18	0.85	0.66	0.76
T_4	3.41	2.02	2.72	2.10	1.30	1.70	1.62	0.78	1.19	2.39	2.00	2.19	0.78	0.58	0.68
T_5	3.32	2.08	2.70	2.45	1.53	1.99	1.78	0.85	1.32	2.40	1.87	2.14	0.82	0.64	0.73
T_6	3.61	2.54	3.09	2.45	1.71	2.08	1.91	0.99	1.45	2.44	2.14	2.29	0.96	0.73	0.85
T_7	2.83	2.07	2.45	2.34	1.35	1.84	1.54	0.70	1.11	2.13	1.99	2.07	0.74	0.48	0.61
S.Em.±	0.09	0.10	0.07	0.09	0.12	0.07	0.08	0.08	0.05	0.05	0.14	0.08	0.12	0.12	0.09
C.D.(0.05)	**0.30**	**0.32**	**0.22**	**0.27**	**NS**	**0.21**	**0.25**	**0.26**	**0.17**	**0.15**	**NS**	**NS**	**NS**	**NS**	**NS**

Table 3: Effect of nutrient management practices on phosphorous content (%) at 45, 70, 90 DAS and at harvest stage (Grain and Straw) of wheat

Treatments	45 DAS			70 DAS			90 DAS			Grains			Straw		
	13-14	14-15	Pooled	13-14	14-15	Pooled	13-14	14-15	Pooled	13-14	14-15	Pooled	13-14	14-15	Pooled
T_1	0.27	0.28	0.27	0.2	0.19	0.19	0.13	0.16	0.14	0.25	0.13	0.19	0.04	0.04	0.04
T_2	0.34	0.39	0.37	0.31	0.24	0.27	0.16	0.21	0.19	0.3	0.32	0.31	0.03	0.03	0.04
T_3	0.35	0.39	0.38	0.32	0.26	0.30	0.20	0.21	0.21	0.39	0.37	0.37	0.07	0.07	0.07
T_4	0.33	0.39	0.36	0.24	0.23	0.24	0.20	0.18	0.20	0.4	0.34	0.37	0.06	0.07	0.07
T_5	0.35	0.41	0.38	0.31	0.24	0.28	0.17	0.21	0.19	0.37	0.30	0.33	0.04	0.06	0.05
T_6	0.38	0.5	0.44	0.34	0.49	0.42	0.28	0.26	0.27	0.52	0.38	0.45	0.08	0.09	0.08
T_7	0.28	0.37	0.32	0.21	0.21	0.21	0.14	0.2	0.17	0.41	0.35	0.38	0.03	0.07	0.05
SEm±	0.02	0.03	0.02	0.03	0.03	0.02	0.03	0.02	0.02	0.04	0.04	0.03	0.01	0.02	0.01
CD(0.05)	**0.07**	**0.11**	**0.05**	**0.08**	**0.09**	**0.05**	**0.08**	**NS**	**NS**	**0.12**	**0.13**	**0.08**	**0.02**	**NS**	**NS**

Table 4: Effect of nutrient management practices on potassium content (%) at 45, 70, 90 DAS, and at harvesting stage (Grain and Straw) of wheat

Treatments	45 DAS			70 DAS			90 DAS			Grain			Straw		
	13-14	14-15	Pooled	13-14	14-15	Pooled	13-14	14-15	Pooled	13-14	14-15	Pooled	13-14	14-15	Pooled
T 1	1.09	3.32	2.21	1.31	2.44	1.88	0.89	2.06	1.48	0.41	0.42	0.41	0.90	1.01	0.95
T 2	1.21	3.57	2.38	1.50	3.07	2.28	1.30	2.6	1.95	0.44	0.48	0.46	1.05	1.31	1.18
T 3	1.37	3.74	2.56	1.56	3.45	2.50	1.35	3.13	2.25	0.48	0.50	0.49	1.15	1.36	1.25
T 4	1.36	3.47	2.41	1.37	3.19	2.28	1.30	2.43	1.86	0.43	0.44	0.43	1.10	1.23	1.16
T 5	1.33	3.65	2.49	1.36	3.39	2.37	1.32	2.76	2.03	0.46	0.48	0.46	1.13	1.31	1.22
T 6	1.41	3.99	2.7	1.65	3.78	2.72	1.38	3.48	2.43	0.56	0.54	0.56	1.28	1.39	1.33
T 7	1.32	3.37	2.34	1.5	2.56	2.03	1.06	2.33	1.70	0.44	0.41	0.43	0.92	1.16	1.04
SEm±	0.05	0.13	0.07	0.05	0.28	0.14	0.05	0.28	0.15	0.02	0.03	0.02	0.03	0.11	0.06
CD(0.05)	**0.16**	**0.4**	**0.24**	**0.16**	**0.84**	**0.43**	**0.15**	**0.86**	**0.47**	**0.06**	**NS**	**0.05**	**0.1**	**NS**	**0.19**

Table 5: Effect of different treatment on grain and straw yield (kg ha-[1]) of wheat during the two years of study

Treatments	Grain Yield (kg ha^{-1})			Straw Yield (kg ha^{-1})		
	2013-14	2014-15	Pooled	2013-14	2014-15	Pooled
T_1	1940	1889	1915	2244	2245	2245
T_2	3424	3188	3306	3479	3644	3561
T_3	3427	3343	3385	4012	3991	4002
T_4	2934	2910	2922	2974	2911	2942
T_5	2951	2921	2936	3045	2981	3013
T_6	4225	3744	3984	4561	4347	4454
T_7	2429	2310	2369	2449	2377	2413
SEm±	16.47	26.78	39.37	43.83	53.73	39.98
C.D. (p=0.05)	**50.75**	**82.53**	**114.91**	**135.1**	**165.58**	**116.68**

CONCLUSION

It may be concluded that fertility treatment has greater impact on nutrient uptake and nitrogen, phosphorous and potassium content at different stage of wheat crop. As such, grain yield and straw yield of wheat crop were influenced significantly in 75% RDF+2.5 ton FYM ha^{-1}+ PSB+ $ZnSO_4$@ 25 kg ha^{-1} practices.

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