Biological Forum – An International Journal 14(3): 1089-1095(2022)

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Effect of Integrated Nutrient Management Practices on Quality, Soil Fertility after Harvest, Nutrient content and their uptake of Maize (*Zea mays* L.) in Maize-clusterbean Cropping Sequence

Desai N.B.[1*], Mevada K.D.[2] and Ganvit K.J.[3]
[1]Ph.D. Scholar, Department of Agronomy, B. A. College of Agriculture, A.A.U., Anand (Gujarat), India.
[2]Professor (Agronomy), Gujarat Natural Farming and Organic Agricultural University, Anand (Gujarat), India.
[3]M.Sc. (Agri.), Gujarat Natural Farming and Organic Agricultural University, Anand (Gujarat), India.

(Corresponding author: Desai N.B.)*
(Received 26 June 2022, Accepted 08 August, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: A field experiment entitled "Effect of integrated nutrient management practices on quality, soil fertility after harvest, nutrient content and their uptake of maize (*Zea mays* L.) in maize-clusterbean cropping sequence" was conducted at College Agronomy Farm, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat during the years 2019-20 and 2020-21. The field experiment consisted of integrated nutrient management treatments *viz.*, 100% RDF, 75% RDF + 25% RDN through FYM, 50% RDF + 50% RDN through FYM, 75% RDF + 25% RDN through vermicompost, 50% RDF + 50% RDN through vermicompost, 100% RDF + NPK Consortium, 75% RDF + 25% RDN through FYM + NPK Consortium, 50% RDF + 50% RDN through FYM + NPK Consortium, 75% RDF + 25% RDN through vermicompost + NPK Consortium, 50% RDF + 50% RDN through vermicompost + NPK Consortium, 50% RDF + 25% RDN through FYM + 25% RDN through vermicompost and 50% RDN through FYM + 50% RDN through vermicompost + NPK Consortium to maize in *rabi* season and replicated four times in randomized block design. Based on two years of pooled results, the protein content, protein yield, oil content, N content as well as N, P and K uptake by grain and stover of maize was recorded significantly higher values with respect to the treatment T_9 (75% RDF + 25% RDN through vermicompost + NPK Consortium) while, P and K content in both grain and stover was found to be non significant. However, the treatment T_{12} (50% RDN through FYM + 50% RDN through vermicompost + NPK Consortium) recorded lower values with respect to N, P and K content and uptake by both grain and stover. Significantly higher available N and microbial count in the soil after harvest of maize was recorded in the treatment consisting of 50% RDN through FYM + 50% RDN through vermicompost + NPK Consortium (T_{12}) during both the years whereas, INM treatments failed to exert their significant influence on available P_2O_5 and K_2O in the soil after harvest of maize.

Keywords: Maize, RDF, RDN, FYM, vermicompost, NPK Consortium, content, uptake.

INTRODUCTION

Maize (*Zea mays* L.) is one of the most versatile emerging crops having wider adaptability under varied agro-climatic conditions. Globally, maize is known as the "queen of cereals" because it has the highest genetic yield potential among cereals. Maize or corn is the third most important cereal crop after rice and wheat in India. Globally it is highly valued for its multifarious use as food, feed, fodder and raw material for the large number of industrial products. Worldwide it occupies an area of about 184 million ha covering 160 countries providing around 36 percent of the global food grain production. In India maize has emerged as the third most important cereal crop, after rice and wheat, occupying an area of 9.60 million ha with the production of 27.15 million tones, having average productivity of about 2.8 tones/ha whereas, in Gujarat, 0.44 million ha area is covered with a production of 0.68 million tones having productivity of 1659 kg/ha (Anonymous, 2020), which is quite below the national and world average.

Nutrient management is an important factor in achieving the potential yield in maize production systems (Singh *et al.*, 2021). Integrated nutrient management includes the intelligent use of organic, inorganic and biological resources to sustain optimum yields, improve or maintain the soil's physical and chemical properties as well as microbial properties and provide crop nutrition packages that are technically sound, economically attractive, practically feasible and environmentally safe (Tandon, 1995). As a result, the current trend is to investigate the option of supplementing fertilizers with organic manures and biofertilizers. Many nutrients are supplied to plants by vermicompost and FYM like carbon containing-compounds provide food for soil flora and fauna

(Mohammadi *et al.*, 2017; Rao *et al.*, 2020). It also increases aeration and promotes healthy root development by providing sufficient pores in the rhizosphere. Biofertilizers are a relatively inexpensive source of nitrogen for crop production and they help to improve soil fertility by accelerating biological nitrogen fixation from the atmosphere, solubilizing insoluble nutrients in the soil, stimulating plant growth and development, maintaining soil reaction and improving the physico chemical properties of the soil and thereby making nutrients easily available to the plants.

MATERIAL AND METHODS

A field experiment was carried out on "Effect of integrated nutrient management practices on quality, soil fertility after harvest, nutrient content and their uptake of maize (*Zea mays* L.) in maize-clusterbean cropping sequence" at College Agronomy Farm, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat during the year 2019-20 and 2020-21. The soil of the experimental field was loamy sand in texture, alkaline in nature (8.19 pH) with low soluble salts (0.17 dS/m) and available nitrogen (177.25 kg/ha), medium in organic carbon (0.29%) and available phosphorus (43.53 kg/ha) and high in available potassium (284.81 kg/ha). Twelve integrated nutrient management treatments comprising of 100% RDF, 75% RDF + 25% RDN through FYM, 50% RDF + 50% RDN through FYM, 75% RDF + 25% RDN through vermicompost, 50% RDF + 50% RDN through vermicompost, 100% RDF + NPK Consortium, 75% RDF + 25% RDN through FYM + NPK Consortium, 50% RDF + 50% RDN through FYM + NPK Consortium, 75% RDF + 25% RDN through vermicompost + NPK Consortium, 50% RDF + 50% RDN through vermicompost + NPK Consortium, 50% RDF + 25% RDN through FYM + 25% RDN through vermicompost and 50% RDN through FYM + 50% RDN through vermicompost + NPK Consortium were studied under Randomized Block Design (RBD). The maize variety GAYMH 3 (Gujarat Anand Yellow Maize Hybrid 3) was taken for the experiment. The recommended dose of nutrients *i.e.*, 150: 60: 00 NPK kg/ha were applied through fertilizers uniformly in the furrows as per the treatments, wherein, 50% of the recommended dose of nitrogen (RDN) and 100% recommended dose of phosphorus were applied as basal, whereas remaining 50% RDN was applied in two equal splits at 30 and 60 DAS. The nitrogen was applied through urea and phosphorus was applied through single super phosphate. Bio-fertilizers (NPK Consortium) treatment was given to the seeds before sowing as per treatment. The maize crop was sown at 60 cm x 20 cm spacing in the experimental plot. The observations on protein content, protein yield, oil content, N, P and K content (%), N, P and K uptake (kg/ha), Available N, P_2O_5 and K_2O (kg/ha), soil microbial count after harvest of maize was recorded. The protein content in the seed was calculated by multiplying the nitrogen content of the seed (%) with the conversion factor of 6.25. The protein yield (kg/ha) was computed from the data of percent protein and seed yield (kg/ha) using following the formula:

$$\text{Protein yield (kg/ha)} = \frac{\text{Protein content (\%)} \times \text{Seed yield (kg/ha)}}{100}$$

The oil content of maize seed was determined by Nuclear Magnetic Resonance (NMR) technique suggested by Tiwari *et al.* (1974). Plant samples of grains and stover of maize were collected at harvest form each net plot during both the years and were ground in a willey mill to pass through 40 mesh sieve. The ground material was collected in butter paper bags and later used for chemical analysis. Nitrogen, phosphorus and potassium content from grain and stover were estimated using standard procedures given by Jackson (1973). The nutrient uptake kg/ha of the grain and stover of the maize crop was calculated by the following formula:

$$\text{Uptake by grain/stover(kg/ha)} = \frac{\text{Nutrient content in grain/stover(\%)} \times \text{Grain/stover yield (kg/ha)}}{100}$$

The composite soil samples were drawn from 0-22.5 cm depth before starting experimentation while after harvest soil samples were taken separately from each net plot for each crop during both years. The soil samples were dried under shade, ground and then sieved through a 2 mm size sieve. The initial soil samples were analyzed for different physicochemical properties. The soil samples collected after the harvest of maize were used to determine available nitrogen, phosphorus, potassium and microbial count. Available nitrogen was determined by the Alkaline Potassium Permagnate method described by Subbiah and Asija (1956). Available phosphorus is determined by Olsen's method using 0.5 M $NaHCO_3$ (Olsen *et al.*, 1954). Available potassium is determined by using Neutral Normal Ammonium Acetate (pH 7.0) method described by Jackson (1973) by using Flame Photometer. For microbial count soil samples were analyzed for counting microbial colony forming units by serial dilution techniques.

RESULTS AND DISCUSSION

The data pertaining to protein content, protein yield and oil content as influenced by different treatments are presented in Table 1. Significantly higher protein content and protein yield were recorded under the treatment T_9 (75% RDF + 25% RDN through vermicompost + NPK Consortium) which were comparable with all the treatments, barring treatments T_1, T_4, T_6 and T_7. An increase in protein content in seed might be due to the fact that higher nitrogen content in the seed is directly associated with higher availability of nitrogen to plants. Higher nitrogen in seeds is directly responsible for higher protein content because it is a primary component of amino acids which constitute the basis of protein content. The results are in close conformity with those of Mohammadi *et al.* (2015); Verma and Bindra (2019); Kadhavane *et al.* (2021). Similarly, significantly higher oil content in the seed of maize was recorded under the same treatment of 75%

RDF + 25% RDN through vermicompost + NPK Consortium (T_9).

The data pertaining to content and uptake by grain and stover of maize are presented in Tables 2 and 3. The results revealed that the N content in grain and stover of maize was found to be significant. While, P and K content was found to be nonsignificant during both the years and in pooled analysis but the higher values of N, P and K content were observed in treatment T_9 (75% RDF + 25% RDN through vermicompost + NPK Consortium). Similarly, uptake of N, P and K by grain and stover were significantly influenced by various INM treatments and the higher values of all nutrients were found with treatment T_9 (75% RDF + 25% RDN through vermicompost + NPK Consortium). Lower values of N, P and K content and uptake of N, P and K by grain and stover were found under the treatment T_{12} (50% RDN through FYM + 50% RDN through vermicompost + NPK Consortium).

Table 1: Influence of different integrated nutrient management practices on protein content, protein yield and oil content of maize (pooled over two years).

Treatment		Protein content (%)	Protein yield (kg/ha)	Oil content (%)
T_1: 100% RDF		10.44	581.58	4.35
T_2: 75% RDF + 25% RDN through FYM		10.29	558.20	4.31
T_3: 50% RDF + 50% RDN through FYM		8.76	392.72	4.24
T_4: 75% RDF + 25% RDN through vermicompost		10.54	599.69	4.38
T_5: 50% RDF + 50% RDN through vermicompost		9.77	469.03	4.29
T_6: 100% RDF + NPK Consortium		10.39	581.17	4.36
T_7: 75% RDF + 25% RDN through FYM + NPK Consortium		10.33	567.11	4.34
T_8: 50% RDF + 50% RDN through FYM + NPK Consortium		9.17	431.47	4.26
T_9: 75% RDF + 25% RDN through vermicompost + NPK Consortium		10.69	614.24	4.41
T_{10}: 50% RDF + 50% RDN through vermicompost + NPK Consortium		9.92	486.98	4.31
T_{11}: 50% RDF + 25% RDN through FYM + 25% RDN through vermicompost		9.44	445.10	4.27
T_{12}: 50% RDN through FYM + 50% RDN through vermicompost + NPK Consortium		8.62	368.09	4.24
SEm ±	Y	0.050	7.378	0.010
	T	0.133	18.07	0.024
	Y × T	0.173	25.56	0.034
CD (P=0.05)	Y	NS	NS	NS
	T	0.38	51.03	0.068
	Y × T	NS	NS	NS
CV %		3.81	10.06	1.58

The results presented in (Tables 2 and 3) were observed that the nutrient content and uptake improved through the integration of biofertilizer, organic and inorganic sources. Among the various INM treatments investigated, treatment T_9 (75% RDF + 25% RDN through vermicompost + NPK Consortium) was found to be effective in improving the nutrient content. The higher N, P and K content in grain and stover may be due to the addition of both organic and inorganic sources, which resulted in the formation of clay-humus complexes in the soil, which promotes lower and prolonged availability to the crop. However, common phosphorous application and from organic sources such as vermicompost improved the available N, P_2O_5 and K_2O of the soil and thus, higher availability of nutrients to the plant and enhanced root and early vegetative growth which increases photosynthetic activity in the plant as evident from the improvement of growth attributes recorded higher availability of metabolites from root to shoot and especially in the reproductive structure of maize resulting in higher N, P and K content by crop.

Similarly, treatment T_9 was found to be effective in nutrient uptake as compared to other INM treatments. The uptake of nutrients by the crop is a function of nutrient content and yield/biomass produced. When organic manures are combined with chemical fertilizers, the pattern of nutrient release changes. Normally, they release nutrients at a slower rate at first, but when fertilizers like urea are applied, the C:N ratio decreases resulting in faster mineralization of nutrients from organic manures. Hence, the greater amount of nutrients are available for uptake by the crop. Probably, due better nourishment of crops resulted in higher crop biomass production leading to higher uptake of N, P and K. The results are in close conformity with the findings of Mohammadi *et al.* (2015); Bharath *et al.* (2017); Rathod *et al.* (2019); Subbaiah and Ram (2019); Verma and Bindra (2019); Srinivasulu *et al.* (2020).

Table 2: N, P and K content in grain and stover of maize as influenced by different integrated nutrient management treatments (pooled over two years).

Treatments		N content (%)		P content (%)		K content (%)	
		Grain	Stover	Grain	Stover	Grain	Stover
T_1: 100% RDF		1.671	0.526	0.290	0.170	0.477	1.148
T_2: 75% RDF + 25% RDN through FYM		1.647	0.518	0.288	0.167	0.472	1.138
T_3: 50% RDF + 50% RDN through FYM		1.402	0.497	0.262	0.155	0.452	1.111
T_4: 75% RDF + 25% RDN through vermicompost		1.687	0.535	0.294	0.176	0.482	1.154
T_5: 50% RDF + 50% RDN through vermicompost		1.564	0.511	0.274	0.163	0.466	1.126
T_6: 100% RDF + NPK Consortium		1.662	0.533	0.292	0.173	0.479	1.152
T_7: 75% RDF + 25% RDN through FYM + NPK Consortium		1.652	0.526	0.290	0.168	0.474	1.143
T_8: 50% RDF + 50% RDN through FYM + NPK Consortium		1.467	0.501	0.266	0.159	0.457	1.115
T_9: 75% RDF + 25% RDN through vermicompost + NPK Consortium		1.711	0.547	0.298	0.179	0.483	1.160
T_{10}: 50% RDF + 50% RDN through vermicompost + NPK Consortium		1.588	0.515	0.286	0.164	0.468	1.132
T_{11}: 50% RDF + 25% RDN through FYM + 25% RDN through vermicompost		1.511	0.505	0.273	0.161	0.461	1.119
T_{12}: 50% RDN through FYM + 50% RDN through vermicompost + NPK Consortium		1.380	0.482	0.258	0.153	0.451	1.107
SEm ±	Y	0.008	0.003	0.003	0.0024	0.004	0.006
	T	0.021	0.008	0.012	0.0070	0.008	0.011
	Y × T	0.028	0.012	0.012	0.0062	0.013	0.020
CD (P=0.05)	Y	NS	NS	NS	NS	NS	NS
	T	0.061	0.023	NS	NS	NS	NS
	Y × T	NS	NS	NS	NS	NS	NS
CV %		3.81	4.39	11.59	11.94	4.86	2.87

Table 3: Effect of different integrated nutrient management treatments on N, P and K uptake by grain and stover of maize (pooled over two years).

Treatments		N uptake (kg/ha)		P uptake (kg/ha)		K uptake (kg/ha)	
		Grain	Stover	Grain	Stover	Grain	Stover
T_1: 100% RDF		93.05	42.55	16.17	13.70	26.55	92.97
T_2: 75% RDF + 25% RDN through FYM		89.31	40.26	15.66	13.05	25.56	88.48
T_3: 50% RDF + 50% RDN through FYM		62.84	31.23	11.73	9.73	20.23	69.77
T_4: 75% RDF + 25% RDN through vermicompost		95.95	40.54	16.71	13.40	27.43	87.44
T_5: 50% RDF + 50% RDN through vermicompost		75.05	34.58	13.14	11.10	22.46	76.33
T_6: 100% RDF + NPK Consortium		92.99	43.15	16.35	14.05	26.76	93.56
T_7: 75% RDF + 25% RDN through FYM + NPK Consortium		90.74	40.57	15.92	12.97	26.00	88.23
T_8: 50% RDF + 50% RDN through FYM + NPK Consortium		69.04	33.59	12.54	10.71	21.50	74.74
T_9: 75% RDF + 25% RDN through vermicompost + NPK Consortium		98.28	46.72	17.24	15.22	27.79	98.91
T_{10}: 50% RDF + 50% RDN through vermicompost + NPK Consortium		77.92	36.10	13.97	11.51	23.03	78.89
T_{11}: 50% RDF + 25% RDN through FYM + 25% RDN through vermicompost		71.22	34.32	12.95	10.96	21.77	76.20
T_{12}: 50% RDN through FYM + 50% RDN through vermicompost + NPK Consortium		58.89	29.18	11.00	9.30	19.28	67.08
SEm ±	Y	1.175	0.468	0.278	0.208	0.395	1.109
	T	2.882	1.571	0.835	0.780	0.870	3.148
	Y × T	4.069	1.620	0.962	0.722	1.368	3.841
CD (P=0.05)	Y	NS	NS	NS	NS	NS	NS
	T	8.30	4.52	2.403	2.245	2.50	9.05
	Y × T	NS	NS	NS	NS	NS	NS
CV %		10.03	11.77	16.34	18.17	10.24	10.76

The data on available soil nutrient status after the harvest of maize as influenced by different INM treatments are presented in Table 4 and revealed that different INM treatments have a significant influence on available soil nutrient status after the harvest of maize in both years. The available nitrogen in soil was significantly influenced by different INM treatments applied to maize and revealed that the application of 50% RDN through FYM + 50% RDN through vermicompost + NPK Consortium (T_{12}) recorded significantly higher values with respect to available nitrogen in soil but it remained statistically at par with treatments T_2, T_3, T_8 and T_{11} during the year 2019-20 and T_2, T_3, T_7, T_8 and T_{11} during the year 2020-21. The available phosphorous and potassium in the soil after harvest of maize found nonsignificant but numerically higher values of available phosphorous and potassium found with the application of 50% RDN through FYM + 50% RDN through vermicompost + NPK Consortium. Although, lower values were obtained under the treatment T_6 (100% RDF + NPK Consortium) during both the years in case of available nitrogen while, in the case of available phosphorous and potassium lower values were obtained with application treatment T_1 (100% RDF). From the above results (Table 4), it indicates that the different INM treatments marked their significant influence on available N, P_2O_5 and K_2O status in the soil after the harvest of maize during both the years of experimentation. All treatments of INM were found comparatively good and appreciably improved soil available N, P_2O_5 and K_2O status over its initial status. This might be possible due to the slow release of nutrients through organic sources which could not match the pace of nutrient uptake by the plants so they remained in the soil. Whereas, with the integration of organic sources with inorganic sources along with the NPK consortium would have synchronized demand and supply mechanism which was reflected in higher content and uptake of nutrients from treatments with integrated nutrient management. Use of FYM and vermicompost might have attributed to the mineralization of nitrogen in the soil and high enzyme activities in the soil amended with organic manures might have increased the transformation of nutrients to available form. Role of FYM and vermicompost in releasing nitrogen and improving nitrogen availability in soil. These results are similar to those obtained by Tetarwal *et al.* (2011); Kalhapure *et al.* (2013); Rathod *et al.* (2019).

Table 4: Available N, P and K in the soil after harvest of maize as influenced by different integrated nutrient management treatments.

Treatments		Available N (kg/ha)		Available P (kg/ha)		Available K (kg/ha)	
		2019-20	2020-21	2019-20	2020-21	2019-20	2020-21
T_1: 100% RDF		153.23	155.67	34.73	35.08	248.44	250.83
T_2: 75% RDF + 25% RDN through FYM		161.01	163.90	36.19	36.87	252.38	254.71
T_3: 50% RDF + 50% RDN through FYM		165.65	168.38	37.01	37.28	255.56	257.82
T_4: 75% RDF + 25% RDN through vermicompost		155.32	157.76	35.21	35.92	249.61	251.87
T_5: 50% RDF + 50% RDN through vermicompost		157.97	159.98	35.56	36.29	250.83	253.05
T_6: 100% RDF + NPK Consortium		152.17	153.98	34.81	35.65	247.85	249.40
T_7: 75% RDF + 25% RDN through FYM + NPK Consortium		160.06	162.75	36.01	36.68	252.13	254.71
T_8: 50% RDF + 50% RDN through FYM + NPK Consortium		165.29	166.62	36.62	37.04	254.34	256.63
T_9: 75% RDF + 25% RDN through vermicompost + NPK Consortium		154.59	154.93	35.05	35.72	249.47	251.71
T_{10}: 50% RDF + 50% RDN through vermicompost + NPK Consortium		156.28	158.99	35.34	36.25	250.35	252.48
T_{11}: 50% RDF + 25% RDN through FYM + 25% RDN through vermicompost		162.99	165.05	36.59	37.02	253.79	256.09
T_{12}: 50% RDN through FYM + 50% RDN through vermicompost + NPK Consortium		167.55	169.69	37.25	37.98	255.89	257.97
SEm ±	Y						
	T	2.543	2.687	0.889	0.820	3.466	3.558
	Y × T						
CD (P=0.05)	Y						
	T	7.32	7.73	NS	NS	NS	NS
	Y × T						
CV %		3.19	3.33	4.96	4.50	2.75	2.80
Initial value		177.25		43.53		284.81	

The mean data on the microbial count in the soil during the years 2019-20, 2020-21 and on pooled basis as influenced by integrated nutrient management treatments are furnished in Table 5. The result indicated that application of 50% RDN through FYM + 50% RDN through Vermicompost + NPK Consortium (T_{12}) had higher microbial count (93.40×10^7 CFU/g, 94.50×10^7 CFU/g and 93.95×10^7 CFU/g during the years 2019-20, 2020-21 and Pooled analysis, respectively). However, it remained statistically at par with all the treatments except treatments T_7, T_8 and T_{10} during both years. While in the case of pooled analysis it remained statistically at par with treatments T_{10}. There might be balanced soil air and moisture conditions (Vapsa conditions) with lowered bulk density enhanced microbial activities were only organic manure (FYM & vermicompost) where added along with NPK consortium forming humus; a basic food material for microbes. In contrast to it, significantly lower microbial count in soil was recorded with the application of 100% RDF (T_1). In absence of organic manure, the bulk density of the soil might be increased and there might be a lower pores for favorable microbial activities. This might be the reason for lower microbial content under 100% RDF (T_1).

Table 5: Microbial count after harvest of maize as influenced by different treatments.

Treatments		Microbial count ($\times 10^7$ CFU/g)		
		2019-20	**2020-21**	**Pooled**
T_1: 100% RDF		8.709 (51.14×10^7)	8.714 (51.72×10^7)	8.711 (51.43×10^7)
T_2: 75% RDF + 25% RDN through FYM		8.793 (62.08×10^7)	8.787 (61.20×10^7)	8.790 (61.64×10^7)
T_3: 50% RDF + 50% RDN through FYM		8.837 (68.68×10^7)	8.847 (70.33×10^7)	8.842 (69.50×10^7)
T_4: 75% RDF + 25% RDN through vermicompost		8.762 (57.76×10^7)	8.768 (58.67×10^7)	8.765 (58.22×10^7)
T_5: 50% RDF + 50% RDN through vermicompost		8.811 (64.77×10^7)	8.822 (66.31×10^7)	8.816 (65.54×10^7)
T_6: 100% RDF + NPK Consortium		8.732 (53.97×10^7)	8.736 (54.45×10^7)	8.734 (54.21×10^7)
T_7: 75% RDF + 25% RDN through FYM + NPK consortium		8.929 (84.83×10^7)	8.932 (85.56×10^7)	8.930 (85.20×10^7)
T_8: 50% RDF + 50% RDN through FYM + NPK consortium		8.963 (91.85×10^7)	8.966 (92.52×10^7)	8.965 (92.18×10^7)
T_9: 75% RDF + 25% RDN through vermicompost + NPK consortium		8.897 (78.93×10^7)	8.913 (81.75×10^7)	8.905 (80.34×10^7)
T_{10}: 50% RDF + 50% RDN through vermicompost + NPK consortium		8.949 (88.93×10^7)	8.953 (89.75×10^7)	8.951 (89.34×10^7)
T_{11}: 50% RDF + 25% RDN through FYM + 25% RDN through vermicompost		8.875 (74.96×10^7)	8.878 (75.57×10^7)	8.877 (75.26×10^7)
T_{12}: 50% RDN through FYM + 50% RDN through vermicompost + NPK Consortium		8.970 (93.40×10^7)	8.975 (94.50×10^7)	8.973 (93.95×10^7)
SEm ±	Y			0.943
	T	3.473	3.445	2.493
	Y × T			3.267
CD (P=0.05)	Y			NS
	T	9.99	9.91	7.17
	Y × T			NS
CV %		9.59	9.32	9.65

Note: logarithmic transformation. Values in parentheses are the original values

CONCLUSION

Based on two years of pooled results, it can be concluded that maize should be fertilized with 75% RDF + 25% RDN through vermicompost + NPK Consortium for getting higher nutrient uptake, quality of crop and to maintain the chemical and microbial properties of soil in maize-clusterbean cropping sequence.

FUTURE SCOPE

1. Experiments will be conducted at different AICRP centers with the integrated use of organic manure and biofertilizers along with inorganic fertilizers for region-wise recommendation.
2. The key components of this approach are described; the roles and responsibilities of various, including extension workers and agricultural institution are delineated and recommendations for improving the management of plant nutrients and soil fertility are presented.

REFERENCES

Anonymous (2020). Ministry of Agriculture, Directorate of economics and statistics. Available athttp.//www.agricoop.nic.in

Bharath, T., Vidyasagar, G. E., Rao, V. P., Reddy, S. N. and Madhavi, A. (2017). Residual effect of organic manures and fertilizer levels to preceding maize on the nutrient uptakes of succeeding groundnut. *International Journal of Pure and Applied Bioscience*, *5*(4): 409-417.

Jackson, M. L. (1973). Soil Chemical Analysis. Prentice Hall of India Pvt. Ltd.

Kadhavane, S. R., Karanjikar, P. N., Lokhande, N. R. and Mirkad, S. B. (2021). Yield, yield attributes and protein quality of sweet corn (*Zea mays* L. *saccharata* Sturt.) as influenced by integrated nutrient management. *International Journal of Chemical Studies*, *9*(1): 180-182.

Kalhapure, A. H., Shete, B. T. and Dhonde, M. B. (2013). Integrated nutrient management in maize (*Zea mays* L.) for increasing production with sustainability. *International Journal of Agriculture and Food Science Technology*, *4*(3): 195-206.

Mohammadi, N., Pankhaniya, R. M. and Joshi, M. P. (2015). Effect of inorganic fertilizer, vermicompost and bio-fertilizer on quality, content and uptake of nutrients in sweet corn (*Zea mays* L. var. *saccharata*). *International Journal of Science and Research*, *6*(5): 670-675.

Olsen, S. R., Cole, C. V., Watanabe, F. S. and Dean, L. A. (1954). Estimation of available phosphorus in soils by extraction with sodium bicarbonate. Circulation from USDA. 939.

Rao, B. M., Mishra, G. C., Maitra, S. and Adhikari, R. (2020). Effect of integrated nutrient management on yield and economics in summer sweet corn (*Zea mays* L. *saccharata*). *International Journal of Agriculture, Environment and Biotechnology*, *13*(1): 23-26.

Rathod, A. M., Patel, P. M., Patel, H. K. and Ranva, M. (2019). Nitrogen management through organic and inorganic sources in popcorn (*Zea mays* L. *everta*). *International Journal of Chemical Studies*, *7*(4): 1655-1658.

Singh, S., Singh, H., Kumar, P., Singh, V., Kumar, S. and Singh, R. (2021). Effect of NPK levels with bio-fertilizers on productivity of maize (*Zea mays* L.). *International Journal of Chemical Studies*, *9*(1): 1476-1479.

Srinivasulu, D. V., Prabhakara, R. G, Chandrika, V. and Venkataravana, N. G. V. (2020). Nutrient uptake as influenced by live mulching and nitrogen management practices in maize-groundnut sequence. *International Journal of Chemical Studies*, *8*(4): 2712-2717.

Subbaiah, P. V. and Sairam, A. (2019). Effect of integrated use of organic and inorganic sources of nutrients and biofertilizers on growth and nutrient content of maize (*Zea mays* L.). *International Journal of Current Microbiology and Applied Sciences*, *8*(7): 1106-1116.

Subbiah, B. V. and Asija, G. L. (1956). A rapid procedure for determination of available nitrogen in soils. *Current Science*, *25*: 259-260.

Tandon, (1995). Major nutritional constraints to crop production and the soil fertility management studies in different Agro Climatic Regions of Asia. In: Proc. Int. Potash Inst. Colloq. Potassium in Asia: Balanced fertilization to increase and sustain agriculture production. Chiang Mai Thailand IPL. Basel, pp. 43-72.

Tetarwal, J. P., Ram, B. and Meena, D. S. (2011). Effect of integrated nutrient management on productivity, profitability, nutrient uptake and soil fertility in rain-fed maize (*Zea mays* L.). *Indian Journal of Agronomy*, *56*(4): 373-376.

Tiwari, P. N., Gamber, P. N. and Rajan, T. N. (1974). Rapid and non-destructive determination of oil in oilseeds. *Journal of Oil and Chemical Science*, *51*, 1049.

Verma, K. and Bindra, A. D. (2019). Impact of integrated nutrient management on nutrient content, nutrient uptake, protein content and grain yield in maize (*Zea mays* L.)-wheat (*Triticum aestivum* L.) cropping system in an acid alfisol. *International Journal of Current Microbiology and Applied Sciences*, *8*(6): 899-917.

How to cite this article: Desai N.B., Mevada K.D. and Ganvit K.J. (2022). Effect of Integrated Nutrient Management Practices on Quality, Soil Fertility after Harvest, Nutrient content and their uptake of Maize (*Zea mays* L.) in Maize-clusterbean Cropping Sequence. *Biological Forum – An International Journal, 14*(3): 1089-1095.