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Comparative Study of Synthetic Fertilizers and Organic Manures on Some Mung bean (*Vigna radiata*(L.) Wilczek) Genotypes 2_Yield, Yield Component and Seed Quality Characters

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Abstract : In the light of recent scientific discoveries that let us understanding the role of management fertilization practices in maintain soil health and increasing productivity as well as seed quality of several crops, consequently we need to a change the agricultural strategy for achieving sustainable agriculture production, preserving soil fertility, producing healthy food free with chemical contamination, reduce pollution and increasing farmers return. Therefore, the present work was conducted in field experiment at Agriculture and Research Station, College of Food and Agriculture Sciences, Derab, King Saud University, Saudi Arabia, during 2014 and 2015 seasons, to evaluate the suitable fertilizers doses for sustaining high crop yield of mungbean and restore soil fertility. The treatments included two mungbean genotypes i.e., (Kawmy-1and VC- 2010) and five fertilization treatments *viz.,*recommended dose of NPK fertilizer 150: 150: 60 kg ha^{-1} (T1- control); organic manure 10 t ha^{-1}(T2); recommended dose of chemical fertilizer (NPK) + Biofertilizers (T3); organic manure 10 t ha^{-1} + bio fertilizer (T4) and organic manure 10 t ha^{-1} + 50 % of recommended dose of NPK fertilizer + bio fertilizer (T5). Results concluded that although reducing dose of synthetic fertilizers by 50 % and replaced by organic fertilizers (T5), could compensate the reduction of yield and yield component characters and achieve the highest seed yield and quality.
Key Words : Mung bean; Organic manures; Inorganic fertilizers; Bio-fertilizers; Compost.

1. Introduction

Food production and fertilizers application are inextricably linked. The annual global use of fertilizers will need to be doubled by the year 2030 from about 130 million tons in the 1990's, if the current per capita cereal production is to be maintained (Gilland, [1] and Brown et al. [2]). Total fertilizer use has largely increased over the past years (300 % from 1980 to 2003) but with major increase in urea as compared to the other fertilizers (FAO, [3]).

Low soils organic matter content especially in arid and semi-arid regions is believed to be a vital reason for low productivity of soils and huge use of chemical fertilizers as because the soil organic matter plays an important role on physical, chemical and biological properties of soil. Under such conditions, farmers of this region have no choice except to cultivate arid legume crops like mung bean with hope of some returns (Ali Mosood and RaoSrinivasa[4]),reported that mung bean is quite capable of sustain yield under harsh conditions due to physiological and morphological characters but need urgent attention by supplementation with some nutrients supplies for brining the quantum jump in the productivity, these is similar to that finding are found by (Khattak et al.[5]; Faroda and Sing,[6] andSingh and Tripathi[7]) .

Recent studies on management agricultural systems lowered the curtain on that bright feature is waiting to mungbean crop due to its ability to grow under varied conditions (irrigated and rained), any low water requirements and also has short duration season and high potential of producing higher seed yield according to genotypes and growing conditions. Seed is an excellent source of high quality protein is amounted about 25 per cent protein (Bilal, [8]; Ullah et al. [9] and Choudhary et al. [10]).In general, mungbean yield is quite low; the world average yield is about 0.4 t/ha while some selective varieties of South Asia are capable of producing seed yield 2.5 t/ha (Anonymous, [11]and AVRDC [12]).Although, mungbean plants able to fixed atmospheric nitrogen, excessive amounts of inorganic fertilizers is needed, (Sadeghipour,[13]). Yadav and Meena, [14]and Selim et al.[15] concluded that sole application of inorganic fertilizers in large quantities over a long period of time causes micronutrient deficiencies and the deficiencies of micronutrients have become major constrains of soil productivity, stability and sustainability of soil fertility.

Regardless of all previous comments, it is necessary to replace at least the half of chemical fertilizers with other cheaper and eco-friendly fertilizer such as organic manure in the form of integration with chemical fertilizers not only for increasing yield production, but also for improving and restore soil fertility. Nambiar and Abrol, [16], found that integrated use of chemical fertilizer with organic manure has been found to be quite promising not only in maintaining higher productivity but also in greater stability to crop production, as well as improvement in physical properties of soil, organic carbon and available nitrogen, phosphorus and potassium due to such material is a rich in source of N, P, K and micronutrients (Babulkar et al.[17]).

Sustain soil health is one of the most important factors for sustainable agriculture and maintain seed yield , therefore management nutrients programs through optimum supply of crop requirements is of great considering especially in condition of poor fertility soils , low seed yield and low return. Furthermore, intensive agriculture with very high nutrient turnover in soil-plant system coupled with low and imbalanced fertilizer use have resulted in decline of native soil fertility and created a serious threat to long-term sustainability of crop production (Anonymous, [11]).

Farmers are used to apply a large amount of fertilizers every year for each crop individually without any considering for the total amount applied whole year (Moller, [18] and Tejada et al.[19]).In another studies Choudhry, [20] and Noor et al. [21], reported that farmers are neglected or ignoring the use of organic manures and bio-fertilizers, these irresponsible practices created imbalanced soil nutrients which led to nutrients deficiency and paved the soil to the way of deterioration and hence will negatively reflect on plant growth, human health and livestock. In addition, farmers favored to applied synthetic fertilizers, they believe that chemical fertilizers containing major nutrients NPK in a large quantities and suitable form for plant absorption, but the real which are absent from them this large quantity may be more than plant requirements and a great part of these compounds are leaching with irrigation water without any benefits. Moreover, consumer nationally and internationally is prefers organic products because they are free of toxic residues and have concern for environment.

Organic materials contain a great amount of multi nutrients components that which able to supply plants with nutrient requirements for a long time and have ability to improve both yield production and quality, as well as maintaining soil health and soil characteristics (Moller, [18]and Tejada et al.[19]). Mandal et al. [22] and Rahman et al. [23]reported that, organic matter and total soil nitrogen contents were higher under the treatment of green manure in either sole application or integration with inorganic fertilizers. A great number of studies also show that organic farming system have great benefits ,it is lead to higher soil quality(both physical and chemical properties) and more biological activity , enhancing nutrient up take, preventing the leaching and other losses of soil nutrients which causes low productivity , and increasing in production costs and decreasing farmer income (Ashour et al. [24]; Selim[25];Siddique[26]; Choudhry, [20]; Kaur et al.[27]; Khan et al. [28]; Sönmez et al.[29]; selim et al.[30] ; Yolcu et al.[31]; Abbasi and Yousra[32]and RecepIrfan et al. [33]).

Several researches have confirmed that management crop nutrition is one of the most important ways to achieve the goals of improving crop production and sustain soil health over a longer time. Among these, Wijewardana,[34] and Azam et al. [35]reported that, the application of organic manure in combination with chemical fertilizer too many crops is more useful to obtain high yields than application of each sole. Additionally, the results of the experiments of Bloemberg et al. [36]; Kennedy et al.[37] and Abdullahi et al.[38], concluded that the application of synthetic fertilizers in combination with organic manures or biofertilizers has recently gained recognition in sustainable crop production. In the same concept, Mian et al.[39] ; Nasir and Qureshi,[40]; Khanam et al.[41];Alam et al.[42], Alam and Shah[43]; Alam et al.[44], recognizes that soils are the storehouse of the most important essential plant nutrients for plant requirements until the end of his life, and integrated use of organic manures and chemical fertilizer for a long time, can sustain soil health.

Although many studies evidenced the importance of integrated nutrient management and its role in reducing the dependence of costly inorganic fertilizers, regretfully practicably farmers and some agricultural researchers are not convinced that they can obtain economic yield without application a great amount of chemical fertilizer. Hence, the present investigation has beenundertakenunder Saudi Arabia conditions due to the lack of knowledge about recycling organic wastes in agriculture system and it is role in integration nutrient management as one of the important practices can be practically applied by farmers and successfully increase yield and gained higher return.

2. Materials and Methods:

A field experiments were carried out at Agriculture and Research Station, College of Food and Agriculture Sciences, Derab, King Saud University, Saudi Arabia, during 2014 and 2015 to evaluate the suitable fertilizers doses for sustaining soil productivity and maintain crop yields as well as seed quality of two mungbean genotypes. Initial soil samples (0 - 60 cm depth) were collected from five sites of the experimental field and dried in the air through passing a2-mm sieve and analyzed physically and chemically according to the methods described by Cottene et al.[45] and But, [46]. Results showed that soil texture was sandy clay loam (57.92 % sand,27.20 % silt, 0.46 O.M and 14.88 %clay) with high $CaCO_3$ (29.42 %),soil pH in 1:25 soil water was (7.86) , EC (3.88dSm^{-1}) in extracted soil paste (2:1), respectively. Whereas, Saturation percentage was 29.70%, Field capacity (%) 16.30 and Wilting point7.6%. Soil micronutrients continents in ppm were 3.27, 2.44, 6.07and 0.70for Fe, Mn, Zn and Cu, respectively. Water of irrigation was also analyzed according to the methods described by (APHA, [47]). Results is presented in Table, (1).

Table 1.Chemical properties of the irrigation water

pH	EC (dS/ m^{-1})	O.M %	Soluble Cations (meq /l^{-1})				Soluble Anions (meq/ l^{-1})			Macronutrients (ppm)		
			Ca	Mg	Na	K	HCO_3	Cl	SO_4^{--}	N	P	K
7.1	1.45	0.02	6.30	1.75	7.35	0.44	2.40	4.85	9.24	10.50	9.23	17.0

Agronomic management were followed as recommended *viz.,* plant material, field preparation sowing methods and seed rates as well as agronomic practices after sowing were followed for both seasons as recommended, all of these were presented in details in the first part of this study.

2.1. Data Recorded:

At harvest time , plants in two centeral rows in each sub -plots were randomly hand pulled, number of plants per squar meter were counted and all plants were completley air dried, then biological yield/hectare was determined and plants were thrashed for measuring seed yield per plot (g m^2) and then seed yield per hectare was calculated on the bases of seed yield/plot. Sub sample of ten plants was taken and sent to the laboratory to determining yield component characters*viz.,*number of pods $plant^{-1}$, number of seeds per pod, seed yield g $plant^{-1}$ and 100 seed weight. Yield parameters were also calculated i.e., harvest index (HI) and crop index (CI) were calculated using the formula suggested by Donald and Humblin[48] as follows:

$$HI = \frac{\text{Grain yield (kg ha}^{-1})}{\text{Biological yield (kg ha}^{-1})} \times 100$$

Biological yield = Grain yield + straw yield

$$CI = \frac{\text{(Grain yield (kg ha}^{-1})}{\text{(Straw yield (kg ha}^{-1})} \times 100$$

Seed quality was also considered; random sample of seed of both seasons was collected and pooled, dried and grounded. Total nitrogen was determined using microkjldahl as described byA.O.A.C.[49]. Total N values were multiplied by 6.25 to obtain protein percentage. Whereas, total carbohydrates were determined according to the method described by Dubois et al.[50]. Micronutrients were determined by the methods described by Chapman and Pratt[51], wet ash digestion and measured using atomic absorption apparatus.

3. Statisticall analyzes:

Data obtained of each season were subjected for statistically analyzed by the methods described by Gomez and Gomez [52].Means were compared by the New Least Significant Difference test (LSD) at 0.05 level of significance which was developed by Snedecor and Cochran[53].

Table2. Analysis of variance for the two growing seasons in the effect of integrated nutrient management on two mungbean genotypes.

2014 season

S.V.O	df.	MS					
		Pod per plan	Seed per pod	100-seed Weight,g	Seed Yield	Harvest index (%)	Biologic yield
Replication	2	0..62	0.32	0.009	33828.16**	2.6	402696.6
Cultivar	1	16.82**	4.92**	2.4**	437688.96**	0.90*	2849678.3**
Error a	2	0.55	0.29	0.02	4017.064	0.66	26967.9
Fert. Treatt.	4	10.18**	1.38*	1.41**	134606.20**	4.43*	1243795.8**
Fert. × C	4	2.10*	1.14*	1.01**	52137.08**	3.47*	296272.02**
Error b	16	0.38	0.34	2.01	2345.72	1.05	32213.82
C.V%		3.68	6.22	2.91	4	3	5.1

*: Significant at 0.05 level **: Significant at 0.01 level

Table.2. Contain **2015 season**

S.V.O	df.	MS					
		Pod per plan	Seed per pod	100-seed Weight, g	Seed Yield	Harvest index (%)	Biologic yield
Replication	2	0.85	0.53	0.006	42257.14**	24	412573.7
Cultivar	1	18.62 **	5.18**	2.6**	477523.19**	0.84*	3216887.5 **
Error a	2	0.38	0.22	0.03	4426.080	0.54	22485.7
Fert. Treat.	4	11.26**	2.42**	2.12**	144536.12**	5.66*	1332783.4**
Fert. × C	4	3.02*	1.22*	2.13**	61823.06**	4.32*	324687.22**
Error b	16	0.44	0.53	2.32	3256.23	1.16	36215.94
C.V%		3.94	6.46	2.94	3	3	5.6

*: Significant at 0.05 level **: Significant at 0.01 level

4. Results and Discussion

4.1. Yield and Yield Component parameters:

Mung bean crop is short duration season; therefore spend more half of his normal growing period in the building of growth vigor, whereas the remaining time is consumed in building the yield component characters, which are essential for formation and contributing seed yield and seed quality parameters. Therefore, the condition of soil health and the climatic conditions as well as agronomic farming practices are the most important input affecting in the final yield and quality and of course investments return. The first part of the study discussed the effect of integrated nutrient management practices on some growth attributed, whereas in this part of the study the discussion will be about the influence on seed yield and quality in two growing seasons as follows :

4.1.1. Number of plants/m^2:

Final grain yield production of mungbean is mainly depends on number of harvested plant per unit area. Results presented in Tables 3 and 4 show the mean performance and new LSD values of the significant differences between two mungbean genotypes tested under integrated nutrients management and their interactions in 2014 and 2015 seasons.

Significant differences in number of plants per unit area were observed due to varietal differences and application of various nutrient treatments as well as their interactions in the first and second seasons. Data indicates that the magnitude of differences between two genotypes were significant, Kawmy-1 genotype recorded the higher number of plants per square meter 29.6 and 31.4 compared to those recorded by VC2010 28.8 and 30.2 plants in the first and second seasons, respectively. Such superiority of this genotype is meaning that he has genetic constituents able him to better utilize the environmental condition and producing higher number of plants per unit area. In the same context, integrate nutrient management systems recorded the highest number of plant per square meter mounting to(35 and 31) plants^{m2}for the treatment of application of decay ingorganic compost 10 t ha^{-1} + 50 % of recommended dose of NPK fertilizer + Bio fertilizer (T5) followed by application of decaying organic compost 10 t ha^{-1} + Bio fertilizer (T4) in the first and second seasons ,respectively as compared to (25, 28 and 27 and plants^{m2}) for T3, T2 and T1,in the first and second seasons, respectively. In addition , the interactions were also significant, sowing either Kawmy-1 or VC2010 genotypes under the application of 50 % of the recommended dose in the presence of decaying organic manure 10 t ha^{-1} and bio fertilizer (T5) recorded the highest number of plants/m^2(36and 35) and (34 and 33), in the first and second seasons , respectively. These results were in line with those obtained by Karle et al.[54] and Masood and Mishra[55].

4.1.2. Number of pods plants^{-1}:

The data presented in (Table 3)also show that the difference in number of podsplant^{-1}between the two mungbean genotypes were statistically significant in both seasons. Kawmy-1 genotype recorded the higher number of pods per plant (32.23 and 31.24) as compared to VC2010 genotype (29.0 and 30.2) in the first and second seasons, respectively. Such increment may be owing toKawmy-1 has more genetic potential enabled him to best utilize the available nutrients in sufficient amount to produce more number of pods plant^{-1}. Similar results were also reported by Khan[56]. In the same table, it can be seen that plants received decaying of organic manure 10 t ha^{-1} + 50 % of recommended dose of NPK fertilizer + Bio fertilizer (T5) produced more number of pods per plant (33.60 and 35.16) in the first and second seasons, respectively. Such effect was expected early; since the same treatment produced healthy plants has more vegetative vigor, and produced largest reproductive sink and enough dry matter able to provide it with his requirements as mentioned in the first part (see first paper). Also it is noticeable that the minimum number of pods plant^{-1} (28.09 and 30.65) was observed in 2014 and 2015 seasons due to the application of recommended dose of chemical fertilizer (NPK) + Bio fertilizer in both seasons. Furthermore, the interaction was significant in both seasons; the lowest number of pods plant^{-1} (25.63 and 27.44) were produced in the treatment of inoculated variety VC 2010seeds with specific rhizobium and application the recommended dose of chemical fertilizers, while, the highest value of number of pods (37.70 and 37.90) were recorded in the interaction of sowing Kawmy-1 genotype and plant received of decaying organic manure 10 t ha^{-1} + 50 % of recommended dose of NPK fertilizer + Bio fertilizer (T5).The present findings are in agreement with those obtained by Mondal et al.[57],who reported that number of pods per plant is more sensitive under deficit conditions.

Table 3: Effect of interactions on seed yield and yield component characters of two mung bean genotypes grown under integrated nutrients management, in the first season and second season of 2014 and 2015.

Crop Index, (CI) %	Harvest Index,(HI) %	Biological yield ton/ha	Seed yield ton/ha	Seed yield g/m^2	100- seed Weight, g	No. of seeds /pod	No. of pod/plant	No. of $plant/m^2$	Treatment	
[First Season									Fert. Treat.	Varity
26.60	26.32	11.02	2.90	289.7	8.2	10.2	29.56	26	T1	V1
31.12	19.56	12.22	2.39	238.7	7.5	8.7	30.48	28	T2	
26.31	25.05	10.22	2.56	255.5	7.7	8.0	30.55	26	T3	
27.34	21.68	12.87	2.79	278.9	7.7	10.7	32.86	32	T4	
30.33	22.22	13.50	3.00	299.7	8.9	12.6	37.70	36	T5	
25.46	24.27	10.22	2.48	247.9	7.8	9.4	30.84	28	T1	V2
20.21	22.83	10.25	2.34	233.8	7.0	8.7	29.52	28	T2	
20.86	21.57	10.20	2.20	220.4	7.5	8.2	25.63	24	T3	
24.88	24.33	10.52	2.56	255.6	7.0	8.0	29.52	30	T4	
30.27	24.30	12.22	2.97	297.3	8.4	10.2	29.50	34	T5	
Second Season										
27.22	26.29	11.41	3.00	300.20	8.7	10.7	30.66	30	T1	V1
32.94	20.56	12.94	2.53	252.51	8.0	8.8	32.57	29	T2	
29.13	24.05	10.74	2.69	269.04	7.9	8.7	33.85	29	T3	
28.96	21.68	13.24	2.87	286.69	8.0	10.9	36.42	34	T4	
31.45	23.33	13.03	3.04	314.16	8.8	12.7	37.90	35	T5	
24.33	21.72	9.77	2.37	237.08	7.7	9.2	31.55	30	T1	V2
21.51	22.82	10.91	2.49	248.87	7.5	8.7	30.73	30	T2	
21.80	21.58	10.66	2.30	230.06	7.7	8.7	27.44	26	T3	
26.64	24.31	11.27	2.74	274.12	7.4	8.2	30.33	32	T4	
31.39	25.31	12.67	3.08	308.04	8.2	10.7	32.61	33	T5	
------	-----	0.80	0.14	12.62	0.46	1.42	1.05	0.9	LSD for V x frt. 1^{st} season	
-----	----	0.21	0.24	11.33	0.26	1.34	1.24	1.7	LSD for V x frt. 2^{sec} season	

* T1 Recommended dose of NPK fertilizer 150: 150: 60 kg ha^{-1} (control), **T2** Decaying organic compost 10 t ha^{-1} , T3 Recommended dose of chemical fertilizer (NPK) + Bio fertilizer **T4** Decaying organic compost 10 t ha^{-1} + Bio fertilizer, **T5** Decaying organic compost 10 t ha^{-1} + 50 % of recommended dose of NPK fertilizer + Bio fertilizer.

Table 4: Effect of integrated use of organic and synthetic fertilizers on seed yield and yield component characters of two mung bean genotypes grown under different fertilization treatments, in 2014 and 2015 seasons.

Crop Index, (CI) %	Harvest Index,(HI) %	Biological yield ton/ha	Seed yield ton/ha	Seed yield g/m^2	100- seed Weight, g	No. of seeds /pod	No. of pod/plant	No. of $plant/m^2$	Treatment	
First Season									Treatment	
26.03	24.81	11.24	2.62	261.8	7.4	9.05	30.20	27	T1	
25.67	21.51	10.62	2.47	243.3	7.0	9.45	30.00	28	T2	
23.59	23.29	11.21	2.38	238.0	7.1	8.10	28.09	25	T3	
26.11	21.02	11.70	2.67	267.3	7.4	9.35	29.69	31	T4	
30.30	23.87	12.86	2.99	298.5	8.3	11.40	33.60	35	T5	
28.34	20.99	11.97	2.73	272.5	7.94	10.04	32.23	29.6	V1	Variety
24.34	24.44	10.68	2.51	251.0	7.58	8.7	29.00	28.8	V2	
-----	-----	0.38	0.22	10.84	0.75	0.87	1.33	1.2	Treat.	LSD
-----	-----	1.22	0.10	20.71	0.24	1.22	2.24	0.8	Variety	for
Second Season										
25.78	24.01	11.93	2.69	268.64	8.2	10.0	31.11	29	T1	
27.23	21.69	10.59	2.51	250.69	7.8	8.4	31.65	30	T2	
25.47	23.32	10.70	2.50	249.55	7.8	8.7	30.65	27	T3	
27.80	23.00	12.26	2.80	280.41	7.7	9.6	31.93	33	T4	
31.42	23.82	12.85	3.06	306.09	8.6	11.7	35.16	35	T5	
29.94	23.98	12.27	2.83	282.57	8.28	10.36	34.24	31.4	V1	Variety
25.13	22.95	11.06	2.60	259.63	7.74	9.10	30.53	30.2	V2	
-----	-----	1.03	0.21	14.62	0.74	1.21	2.41	1.4	Treat.	LSD
-----	-----	1.33	0.20	10.38	0.41	1.12	2.16	1.0	Variety	for

*T1 Recommended dose of NPK fertilizer 150: 150: 60 kg ha^{-1} (control), **T2** Decaying organic compost 10 t ha^{-1} , T3 Recommended dose of chemical fertilizer (NPK) + Bio fertilizer **T4** Decaying organic compost 10 t ha^{-1} + Bio fertilizer, **T5** Decaying organic compost 10 t ha^{-1} + 50 % of recommended dose of NPK fertilizer + Bio fertilizer.

4.1.3. Number of seeds pod^{-1}:

Data presented in (Tables 3 and 4), clearly obvious that, there are significant difference in number of seeds per pod between the two genotypes.V1 (Kawmy-1) surpassed V2 (VC 2010) and recorded the higher number of seed per pod in both seasons (10.04 and 10.36), respectively, in the same table the data also clear that the highest number of seeds per pod was recorded in the interaction of sowing V1 genotype and application of decaying organic manure 10 t ha^{-1} + 50 % of recommended dose of NPK fertilizer + Bio fertilizer (T5). The present findings are in line with those obtained by many investigators in different crops;Hati et al. (2006)reported that application of farmyard manure and NPK (N P K+FYM) to soybean improved soil physical properties and also increased seed number and yield plant $^{-1}$ over the control and Shen and Shen (2001)found that organic material is a good source of plant nutrient and has a positive effect on improvement of the yield and yield components of mungbean. Furthermore, Zarei et al. (2011) reported that seed yield and yield component characters of soybean influenced by varieties and nutrient management.

4.1.4. 100- seed weight (seed index):

Seedindex is one of the important yield component characters contribute in final seed yield. It is a genetic character, thus there is big variances among different genotypes and somewhat affected by management agronomic practices. Under the present study, observation regarding seed index (1000-seed weight)presented in (Table 3 and4) show that, the difference between the two genotypes was significant. V1 (Kawmy-1) yielded higher seed index 7.94 and 8.28g as compared to V2 (VC 2010) yielded 7.58 and 7.74 gin first and second season, respectively. These results are in concurrence with those observed by Onder and Babaglu (2001) and Leila et al. [65]they reported that 1000-seedweight was significantly affected by varietal differences under different conditions. Regarding the effect of integrated nutrient management, data also show that significant differences due to fertilization treatments, although the half of recommended dose of chemical fertilizers were replaced by decaying organic manure 10 t ha^{-1}+Bio fertilizer(T5), recorded the highest weight of 100 seed 8.3and 8.6 gin the first and second seasons, respectively, whereas the complete dose of synthetic fertilizers sole (T1)recorded the weight of 100 seed 7.4 and 8.2 g in the first and second seasons, respectively. Such results may be due to presence of essential elements in available forms (organic and inorganic) in sufficient amount for a long time until harvest time, when applied decaying organic manure in combination with chemical fertilizer .These results are consistent with those obtained by Zhao et al.[63], who reported that farmyard manure combined with chemical fertilizers resulted in higher increases in maize yield and yield components. Data in the same table also showed that the interactions between the two factors of genotypes x integrated nutrient management were also significant, higher 100- seed weight 8.9 and 8.8 g was recorded by sowing Kawmy-1 and plants received of decaying organic manure 10 t ha^{-1} + 50 % of recommended dose of NPK fertilizer + Bio fertilizer (T5). Similar results were reported by Masood and Mishra,[55] and Karle et al.[54].

4.1.5.Seed yield g/m^2:

Generally, seed yield is highly variable and is Influenced by many factors *viz.,* genotypic variations among varieties and genotypes, soil types, climatic conditions (environmental factors) and management agronomic practices. Under the present study, the results of the analyses of variance for the two seasons, show that there are significant difference in grain yields (g/m^2) of tested two mungbean genotypes against different integrated nutrients management, at $P<0.05$ level. Kawmy-1 (V1) recorded higher seed yield per square meter (272.5 and 282.57 g/m^2), as compared to VC- 2010, (251.0and 259.63 g m^2) in the first and second seasons, respectively (Table4). Such superiority of Kawmy-1 (V1) variety was expected ,since the same effect was detected early, since the same treatment recorded higher values of number of plant/m^2 (29.6 and 29.0), number of pods per plant (32.23 and 31.4) , number of seeds per pod (10.04 and 10.36) and 100 seed weight (7.94 and 8.28 g) in the first and second seasons. Also data obtained revealed that cultivar x integrated nutrient management interactions caused significant effected on seed yield per square meter, sowing either V1 or V2 and application decaying organic manure 10 t ha^{-1} + 50 % of recommended dose of NPK fertilizer + Bio fertilizer (T5) produced highest grain yield amount to 299.7and 297.3 g/m^2 and 314.16 and 308.04 g/m^2 in the first and second seasons, respectively(Table 3). Similar results were also reported by Khan[56].

4.1.6.Seed yield ton/ha:

Data presented in (Table 3 and 4), showed that, there are significant difference between two mungbean genotypes, management fertilization treatments, as well as their interaction in seed yield ton^{-ha}. V1 (Kawmy-1), recorded significantly higher value of grain yield ton^{-ha}2.73 and 2.83 as compared to V2 (VC2010), which recorded 2.51 and 2.60 ton^{-ha} in the first and second seasons, respectively. Such effect was predicted due to higher positive effect of this genotype previously on most of yield component characters, the present findings are accordance those obtained by Masood and Mishra,[55] and Karle et al.[54], who reported that cultivars are differed in their response according to their genetic constituents. It is also noticeable that application of organic manures in combination with chemical fertilizers and seed inoculation with specific strains of bacteria recorded the highest seed yield 2.99 and 3.06 ton^{-ha}as compared to application of each sole 2.62 and 2.69 or 2.47 and 2.51 for T1 and T2 in the first and second seasons, respectively(Table 4). Similar results were also reported by Khan [56],Tairo and Ndakidemi[58], Makoi et al.[59] and Nyoki and Ndakidemi[60].They reported that Inoculation of legumes with proper rhizobium and supplementation with some nutrients especially phosphorus has been reported to increase the leaf chlorophyll content of legume crops and Consequently led to higher yields.Sabrina et al. [61] and Mirakalaei et al. [62]discovered that using compost at a rate of 10 t ha^{-1} in combination with chemical fertilizers are sufficient to obtain good growth and seed yield of several crops as compared to the control.

4.1.7. Biological yield

Among yield components characters, measuring biological yield is considered the most expressive one, it is indicating the ability of plant to utilize the available nutrients and accumulated higher dry matters in aerial organs and also expressing the potentiality of the plant during the all of his life before harvest, highest biological yield will produce highest yield. Variance analyzing between two mung bean genotypes grown under different management nutrients , outcomes presented in (Table 4) show significant differences between two cultivars, higher biological yield yielded in V1 cultivar (Kawmy-1) 11.97 and 12.27t ha^{-1}, and lower biological yield belonged to V2 cultivar (VC2010),which yielded 10.68and 11.06t ha^{-1}in the first and second seasons ,respectively. Such effect is consistent with results obtained previously in the present study, which indicated that Kawmy-1cultivar has more potential to transfer the available growth factors to produced higher plant vigor. Regarding the effect of management nutrients, data in the same context, clear that the lowest biological yield (10.62 and 10.59t ha^{-1}) was recorded under the sole application of recommended dose of synthetic fertilizers (NPK (T1), in the first and second seasons, respectively. While application of 50 % of the recommended dose of synthetic fertilizers + organic fertilizers and biofertilizer (T5); recorded the highest biological yield 12.86 and 12.85t ha^{-1}. Such results are worthy indicates that, although reducing dose of synthetic fertilizers by 50 % and replaced by half that organic fertilizers (T5), could compensate the reduction of biological yield and achieve the highest biological yield 12.86 and 12.85.Such result also indicates that integrated nutrients can provide plants with the essential nutrients requirements for long time until harvest time. Additionally, the interactions of genotype × fertilization treatments were significant at $P<0.05$ level (Table 3).Sowing Kawmy-1genotype under application of synthetic fertilizers by reducing dose 50 % in the presence of decaying organic manure 10 t ha^{-1} and bio fertilizer (T5), recorded the highest values of biological yield (13.50and12.67t ha^{-1}) in the first and second seasons, respectively. The present findings are confirmed those obtained by (Ashour et al.1992; Khan [56];Selim et al.[30] and Selim and Refay, [68]).

4.1.8. Harvest index:

Harvest index is a criterion which determines the differences in metabolic activity and the ability to turn the outputs of photosynthesis to an economic yield. Results obtained from variance analyzing showed that cultivars, management fertilization treatments and their interactions had significant effect on harvest index at $P<0.05$ level (table 3 and 4). Details show that differences between both cultivars weresignificant,Kawmy-1genotype yielded least harvest index 20.99 % as compared to (VC2010) 24.44 %, in the first season, whereas the picture was changed in the second season, (Kawmy-1) surpassed (VC2010) and recorded the highest harvest index 23.38 % compared to 22.95% for (VC2010). Gebey, 2006 and Leila et al. 2012, reported that cultivars showed significant different responses under different conditions. Also due attention to data presented in (Table 4),harvest index means comparing by new LSD showed significant differences among fertilization treatments. Reduction in harvest index in both seasons for the plants received decaying organic compost 10 t ha^{-1} + Bio fertilizer (T4) 21.02 % and 21.51 %,and also plant which received sole application of decaying organic compost 10 t ha^{-1}(T2)recorded 21.69% and 23.00 % in the first and second seasons, respectively as compared to plants received organic manure 10 t ha^{-1} + 50 % of recommended dose of NPK fertilizer + bio fertilizer (T5) that achieved harvest index amount to 23.87%-23.82% . Logically, the reduction in harvest index is due to limiting plant growth, less accumulated dry matter, which caused reduction in biological yield and finally reflected in seed yield, which is due to aborting flowers and falling in pod formation and also number of seeds per pod. It is well known that application of chemical fertilizers are quick soluble and easier moving in water irrigation to the root zone than organic matter and will be faster for plant absorption and also it is effect will be faster. Similar results was also reported by Zhao et al.[63], they reported that farmyard manure combined with chemical fertilizer management resulted in higher increases in harvest index. In the other hand these findings are contrary with those of Iqbal et al.[64]and Zamir[67]. They reported that non-significant effect on H.I % of mungbean under different fertilization treatments.

4.1.9. Crop index:

Crop index is indicating the accumulation of the dry matters for the plant organs during his life till harvesting time. Analyzes of variance of the data obtained in both seasons showed that crop index % was affected by varietal differences, management nutrients and their interactions. Means presented in Tables (3 and 4) show that,Kawmy-1 genotype recorded (CI) % 28.34and 29.94 compared to (VC2010), which recorded 24.34 % and 25.13% in the first and second seasons, respectively. Results further revealed that treatments which had the highest values of (CI) 30.30 % and 31.42 % in the first and second seasons is belong to the treatment of application of chemical fertilizers or organic manure 10 t ha^{-1} + 50 % of recommended dose of NPK fertilizer + bio fertilizer (T5). Results further revealed that crop index were also exhibited response to combination application of organic manure and the reduce dose of synthetic fertilizers with bio fertilizer, the interactions of any of both genotypes and application of chemical fertilizers or organic manure 10 t ha^{-1} + 50 % of recommended dose of NPK fertilizer + bio fertilizer (T5), 31.45% and 31.39 %.

4.2.Seed quality traits:

4.2.1. Effect on protein %, Total Nitrogen Percentage and total carbohydrates%:

4.2.1.1Protein Percentage (%):

Protein percentage is one of the most important parameters affecting the nutritional value of seeds. Statistically the data presented in (Table 6) of combined data of two seasons, evident that the maximum protein percentage (29.16 %) was produced in the interaction of sowing (Kawmy-1) under the application of decaying organic compost 10 t ha^{-1} + 50 % of recommended dose of NPK fertilizer + Bio fertilizer (T5), followed by sowing (Kawmy-1) and application recommended dose of chemical fertilizer (NPK) + Bio fertilizer(T3) recorded seed protein percentage mounting to28. 30 % .Furthermore, the data in the same table also clear that the treatment of application decaying organic manure 10 t ha^{-1} in combination with 50 % of recommended dose of NPK and biofertilizers is the promising agronomic practices, affected on seed protein percentage on both genotypes(Table6). These results are also confirmed the fact that, highest protein percentage is closely related with the highest nitrogen percentage 4.67 % 4.53% and 4.51%, respectively. These findings are in line with the results of Ahmed (2004), who found that plants received biogin increased protein percentage and also recorded the highest levels of NPK as compared to those received sole application of chemical fertilizers. In the same context Zhao et al. [63] reported that farmyard manure combined with chemical fertilizer resulted in higher increases in available N and consequently protein percentage.

4.2.1.1. Total Carbohydrates Percentage (%):

Data in the same table also reveal that, total carbohydrate percentage was affected by varietal differences and management fertilization practices as well as their interactions. The highest total carbohydrate percentage 54.06%was produced by sowing V1 genotype and plants received the recommended dose of chemical fertilizers (T1), followed by the treatments of T1 and T3 recorded the same values of total carbohydrate percentage 53.30%and the treatment of application decaying organic compost 10 t ha^{-1} + 50 % of recommended dose of NPK fertilizer + Bio fertilizer (T5) registered carbohydrate percentage 52.75%, the interaction of (V1xT5) registered carbohydrate percentage mounting to 52.55%.Whereas, minimum total carbohydrate percentage of 48.09% was recorded in application decaying organic compost 10 t ha^{-1} + Bio fertilizer (T4) to mungbean plants of V2 genotype. A similar trend was obtained by (Yadav and Warsi; 1988, Afiah and Mohamed, 2000).

4.2.2. Effect on micronutrients content (µg/100g):

Micronutrients uptake i.e., Fe, Zn,Mn, Cu µg/100g presented in (Table 6)show the mean performance and new LSD of the significant cases of varietal differences, nutrient management and their interaction. Variation in general seemed to be quite high response to nutrient management treatments particularly, treatments contained synthetic by half recommended dose and organic compost at the rate of 10 t ha^{-1} + Bio fertilizer (T5) followed the application of recommended dose of chemical fertilizers (T1). Selim et al.[15] came to the same conclusion.

Table 5. Seed quality of mung bean genotypes grown under different fertilization treatments (combined data of two seasons).

Micronutrient (µg/100g)				Total N (%)	Total Carbohydrates %	Protein %	Treatment *	
Cu	Mn	Zn	Fe				Fert. Treat.	Varity
76.5	143.4	449.5	4671.9	4.11	54.06	25.70	T1	V1
59.7	105.8	294.6	2794.4	3.94	51.22	24.62	T2	
67.0	146.5	494.5	2088.5	4.53	51.88	28.30	T3	
51.4	110.3	265.4	2864.5	4.09	48.52	25.54	T4	
71.5	131.0	471.5	3389.0	4.67	52.55	29.16	T5	
65.2	127.4	395.1	3161.7	4.27	51.65	26.66	General mean	
70.0	144.0	487.0	3537.0	4.06	52.54	25.40	T1	V2
62.7	100.5	278.6	2442.6	3.91	51.24	24.44	T2	
67.0	101.6	440.8	3848.5	4.27	52.29	26.67	T3	
58.0	99.5	238.5	2617.5	4.02	48.09	25.10	T4	
69.8	145.6	372.0	2652.0	4.34	51.54	27.10	T5	
65.5	118.2	363.4	3019.5	4.12	51.14	25.74	General mean	
79.8	143.7	468.3	4104.5	4.09	53.30	25.55	T1	
61.2	103.2	286.6	2618.5	3.93	51.23	24.53	T2	
67.0	109.1	467.7	2968.5	4.40	53.30	27.49	T3	
54.7	104.9	252.0	2741.0	4.06	48.31	25.32	T4	
61.5	118.3	421.8	3020.5	4.51	52.75	28.13	T5	
							LSD for:	
	7.2	28.9	112.6	0.12	0.10	0.55	V	
	3.7	14.6	107.6	0.10	1.24	0.48	T	
	4.3	10.6	122.5	0.20	1.15	0.39	V x t	

* **T1** Recommended dose of NPK fertilizer 150: 150: 60 kg ha^{-1} (control)**, T2** Decaying organic compost 10 t ha^{-1} , T3 Recommended dose of chemical fertilizer (NPK) + Bio fertilizer **T4** Decaying organic compost 10 t ha^{-1} + Bio fertilizer, **T5** Decaying organic compost 10 t ha^{-1} + 50 % of recommended dose of NPK fertilizer + Bio fertilizer.

5. Conclusion:

The present study has shown that mungbean has a high potential and produce high seed yield and quality besides the possibility of gaining large amount of biomass as byproduct estimated to 5t ha^{-1} up to 10 t ha^{-1}per seasons, has properties high quality forage for livestock. Additionally, results also appears that, for getting higher yield of mungbean, must be selected high yielding genotype along with suitable integrated nutrients practices.

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