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Impact of Organic and and Mineral Fertilization on Onion Yield, Quality, Storability, some Soil Properties and its Fertility

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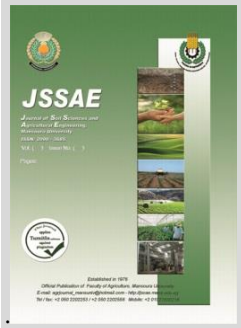

ABSTRACT

This investigation was carried out at the farm of Sids Agricultural Research Station, ARC, in Beni Suef Governorate in two successive seasons study the effect of different levels of organic manure and NPK application on quality, quantity and storability of onion (*Allium cipa* L) as well as some physio-chemical soil properties at harvest stage. A split plot design was used in the experiment, where the main plots were located with organic manure (0.0, 24.0 and 48.0 t ha^{-1}) represent without, half and full recommended rates of FYM and the sub plots were represent the NPK fertilizers (0.0, half and full recommended rates). The full recommended NPK rates were 288/75/115 N, P_2O_5 and K_2O kg ha^{-1} Results show that increasing organic manure levels improved all studied soil properties and fertility after onion harvest, i.e., soil reaction, organic matter, bulk density, soil available N, P and K, except soil salinity which positively responded to FYM application. Also, organic manure application enhanced the onion dry matter, total dissolved solids (TDS), plant height and number of leaves/plant at 90 and 110 days, bulb weight, total yield, culls yield and marketable yield. Increasing NPK levels had positive effect on soil fertility, plant height, number of leaves/plant, bulb weight total yield, culls yield. Whereas dry matter %, T.D.S%, marketable yield and storability responded to NPK levels only at half recommended rate of NPK. Combined high level of organic manure with half recommended rate of NPK gave the best vegetative growth, yield and storability of onion plants.

Keywords: Onion, FYM, NPK fertilizers, soil properties, yields and storability.

INTRODUCTION

Onion (*Allium cepa* L.) is considered to be an important crop world wide, followed tomato in its economic importance. Onion contains carbohydrates, vitamins, minerals, antioxidants, and essential oils (Sekara et al. 2017). It is consumed for their good flavor and their ability to improve the other foods flavor. Furthermore, onion having several health benefits, e.g. minimizing the risk of obesity, heart disease, cancer, diabetes. Gharib et al (2016) reported that onion are heavy absorbable of nutrients, especially macronutrients than other crops, which mainly due to it have heavy roots group and its long growing during the season, they added that onions need N, P and K in large quantities, hence deficiency of any of them resulted in significant reduction in onion growth.

Nitrogen, phosphorus and potassium are essential macronutrients, which are often yield limiting in plant production. It are needed by plants in larger amounts when compared with other nutrients. Due to the shallow root in depth of onion and the variation of N, P and K content in soil, the onion plant is generally responded to macronutrients application (Geisseler et al, 2022). Adequate macronutrients application resulted in highest yield, while excess N, P and K application increases the risk of nutrient leaching as well as increasing the production costs and can reduce the quality and quantity of onion yield (Geisseler et al, 2022). Many authors reported the positive effect of macronutrients on improving onion yield, such as Yoldas et al (2020), Andishmand and Nori (2021) and Singh et al (2022).

Organic fertilizer is an important factor for the sustainability of soil fertility and crop production. Recently, organic manure is used in organic farming, which is preferred for the environmental awareness and healthy life (Eleroglu and Korkmaz, 2016). Organic fertilizer such as farmyard manure improves the physical, chemical and biological soil properties that in turn enhanced the plant growth (Ceylan et al, 2020). It consider a good source of nutrients due to its decomposition, consequently lead to higher nutrients absorption by plant resulted to higher yield. Organic manure have a promotive effect on root growth, in turn encouraged plant growth and microorganisms population (Kidanu, 2017). Yoldas et al (2020) reported that organic manure have significant effects on the soil and the succeeding crop. Many workers cleared that application of FYM fertilizer improved quality and quantity of onion plant such as Yoldas et al (2020), Andishmand and Noori (2021), Bashandy and Sarhan (2021) and Singh et al (2022). Furthermore, Ahmed (2009), Ahmed (2017), Galal et al (2017) and Ceylan et al (2020) stated that organic manure have beneficial effect on soil properties.

The aim of this work is to evaluate the effect of NPK fertilization and organic manure application on:-

1- Soil physical properties (pH, EC, O.M and BD).
2- Soil fertility (soil available N,P and K).
3- Vegetative growth (plant height and number of leaves/plant).
4- Bulb quality (dry matter % and T.D.S %).
5- Onion productivity (bulbs weight, total yield, culls yield and marketable yield).
6- Onion storability.

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MATERIALS AND METHODS

Two field experiments were conducted at Sids Agric. Res. Station of ARC in Beni Suef Governorate (Middle Egypt). The experiment site was latitude 24° 04- N, longitude 31° 06- E and 30-40 m above the mean sea level at 2020/2021 and 2021/2022 to investigate the response of quality, quantity and storability of onion (*Allium cipa* L.) as well as some physical and chemical properties of soil after onion harvest to organic manure and macronutrients application. Some physical and chemical properties of the experimental soil before planting were determined according to A.O.A.C (1995) and listed in Table(1).

The chemical composition of used organic manure (FYM) are listed in Table 2 according A.O.A.C (1995).

Table 1. The initial properties of the experimental soil.

Soil properties	2020/2021	2021/2022
Particle size distribution		
clay %	52.37	54.11
Silt %	22.61	20.41
Sand %	25.72	25.48
Texture grade	Clay	Clay
pH (in 1:2.5 soil- water suspension)	8.00	7.92
EC, dSm^{-1} (soil paste)	1.26	1.15
Organic matter (mg kg^{-1})	17.9	19.2
Available N (mg kg^{-1})	25.6	26.7
Available P (mg kg^{-1})	15.1	14.9
Available K (mg kg^{-1})	167	185
Bulk density (g cm^{-3})	1.16	1.20
Total porosity (%)	54.06	55.24
Field capacity (%)	44.38	42.44
Available water (%)	23.27	22.39
Wilting point (%)	21.11	20.05

Table 2. Some chemical composition of used FYM:

Chemical composition	2020/2021	2021/2022
pH (1:10 FYM- water suspension)	7.32	7.69
EC, dSm^{-1} (1:10 FYM- water extraction)	6.25	5.81
Organic carbon (mg kg^{-1})	157.13	164.56
Organic matter (mg kg^{-1})	91.06	95.44
Total nitrogen (mg kg^{-1})	8.25	9.37
Total phosphorus (mg kg^{-1})	2.41	2.66
Total potassium (mg kg^{-1})	11.55	11.90
C/N ratio	1:19	1:18

The experimental design was split plot, where FYM treatments, i.e. 0.0, 24.0 and 48.0 t ha^{-1} were located in main plot and NPK treatments (0.0, ½ recommended rate and recommended rate) were arranged in the sub plot. The recommended rate of NPK are 288/75/115 N, P_2O_5 and K_2O ha^{-1}, respectively. The FYM and phosphorus (as superphosphate, 15.5 P_2O_5) were added before planting, during land preparation, while nitrogen and potassium were added as ammonium nitrate (33.5% N) and potassium sulphate (48% K_2O), respectively in two equal doses, before first and second irrigation.

At age of about two months, the seedling (Giza-cv) were transplanted at the experimental site and sown at the second week of September in plots (6*7 m). The spacing between plants was 10 cm and 20 cm between rows.

At 90 and 110 days, ten representative plants were randomly taken from each plot to measure plant height (cm), number of leaves/plant, bulb weight (g). At harvest, when 50% of plant leaves fell down, the plants in each plot were harvested and cured in the field four about ten days, then the roots and shoots were removed. The total, marketable and culls yields were determined and expressed as ton ha^{-1}. Also, about 150 bulbs were collected and stored under room conditions and weight to determine the losses % after 2,4 and 6 months to estimate the effect of treatments on the storability.

The data were collected and statistically analysis according to **Snedecor and Cochran (1980)**. The least significant differences (L.S.D) at 5% level was used to compare between treatment means.

RESULTS AND DISCUSSION

Soil properties

Some physical and chemical soil properties after onion harvest, i.e, soil reaction, soil conductivity and bulk density are given in Table (3). The data indicate that both pH and bulk density values were decreased as affected by organic manure application, while EC and O.M % value were increased. The effective of FYM on these characters were increased by increasing its levels. The positive effect of FYM on decreasing soil pH may be FYM contain sufficient amounts of organic acids which released to the soil during its mineralization (Ahmed, 2009).

Table 3. Effect of integrated mineral and organic fertilizers on some physico-chemical soil properties after harvest.

FYM	NPK	First season				Second season			
		pH	EC dsm^{-1}	O.M (%)	B.D (g cm^{-3})	pH	EC dsm^{-1}	O.M (%)	B.D (g cm^{-3})
0.0	0.0	8.11	1.26	1.75	1.16	8.17	1.15	1.92	1.21
	1/2RR	8.12	1.25	1.77	1.15	8.15	1.16	1.90	1.21
	RR	8.11	1.25	1.75	1.16	8.16	1.15	1.91	1.21
mean		8.11	1.25	176	1.16	8.16	1.15	1.91	1.21
½ RR	0.0	8.01	1.38	1.90	1.13	8.11	1.27	1.97	1.18
	1/2RR	8.00	1.39	1.91	1.13	8.10	1.26	1.97	1.19
	RR	8.00	1.38	1.91	1.14	8.10	1.26	1.99	1.19
mean		8.00	1.38	1.91	1.13	8.10	1.26	1.98	1.19
RR	0.0	7.92	1.47	1.98	1.11	7.96	1.40	2.08	1.15
	1/2RR	7.92	1.48	1.99	1.12	7.97	1.40	2.09	1.16
	RR	7.93	1.48	1.97	1.11	7.97	1.40	2.09	1.16
mean		7.92	1.48	1.98	1.11	7.97	1.40	2.09	1.16
Mean of NPK	0.0	8.01	1.37	1.88	1.13	8.08	1.27	1.99	1.18
	1/2RR	8.01	1.37	1.89	1.13	8.07	1.27	1.99	1.19
	RR	8.01	1.37	1.88	1.14	8.08	1.27	2.00	1.19
L.S.D at 0.05		0.03	0.05	0.06	0.01	0.04	0.05	0.05	0.01
A		NS	NS	NS	NS	NS	NS	NS	NS
B		NS	NS	NS	NS	NS	NS	NS	NS
AB		NS	NS	NS	NS	NS	NS	NS	NS

RR of FYM = 48 Mg ha^{-1} RR of NPK = 288 kg N / 75 kg P2O5 / 116 kg K2O ha^{-1}

In addition, Abbady et al (2021) mentioned that organic manure is a soil acidify in material, therefore during its decomposition, some organic acids release resulted decreasing in soil reaction. He added that the CO_2 formed during FYM decompose dissolved in soil moisture forming H_2CO_3 acid, which in turn caused further decreasing of soil

pH. The enhancement of organic matter content may be attributed to the formation of organic compounds during organic manure mineralization (Taha, 2007). Khalil et al (2011) declared that the beneficial effect of organic manure on bulk density may be due to its effect on increasing the volume of micro pore space, beside decreased the soil particle density. On contrary, the negative effect of FYM on soil salinity may be due to the high of salinity content of used FYM (Table,1). These results are similar to those obtained by Galal et al (2017) for soil pH ; Ahmed (2009) for soil salinity, Taha and Abd Elhamed (2021) for soil organic content and Habib et al (2009) for bulk density.

Concerning the effect of NPK application, the data reveal that all studied soil physical properties did not affect by NPK fertilization. As for the interaction effect, the results clearly show that the studied soil properties did not respond to the interaction between the two factors.

Soil fertility

Data of the effect of organic and inorganic application on soil fertility after onion plants harvested, in term of soil available N, P and K are given in Table 4.

Table 4. Effect of integrated mineral and organic fertilizers on soil available N, P and K (ug g^{-1})

FYM	NPK	First season			Second season		
		N	P	K	N	P	K
0.0	0.0	25.9	15.7	165.9	27.1	15.1	180.7
	1/2RR	27.2	17.1	168.3	29.5	17.3	184.1
	RR	29.1	19.0	171.0	32.0	19.5	187.3
mean		20.7	17.3	168.4	29.5	17.3	184.0
½ RR	0.0	30.2	17.3	170.3	33.3	17.6	193.3
	1/2RR	33.0	19.4	173.7	35.7	19.3	195.7
	RR	35.6	22.0	176.1	37.1	21.9	198.2
mean		32.9	19.6	173.4	35.4	19.6	195.7
RR	0.0	36.1	19.1	175.3	39.0	19.3	197.7
	1/2RR	39.9	22.0	178.0	40.7	21.8	199.8
	RR	44.1	24.6	181.3	42.8	24.2	202.2
mean		40.0	21.9	178.2	40.8	21.8	199.9
Mean of NPK	0.0	30.73	17.37	170.50	33.13	17.33	190.57
	1/2RR	33.37	19.50	173.33	35.30	19.47	193.20
	RR	36.27	21.87	176.13	37.30	21.87	195.90
L.S.D at 0.05							
A		2.17	1.17	2.70	3.42	1.25	3.96
B		1.05	0.61	1.74	1.11	0.72	1.85
AB		NS	NS	NS	NS	NS	NS

RR of FYM = 48 Mg ha^{-1} RR of NPK = 288 kg N / 75 kg P2O5 / 116 kg K2O ha^{-1}

The data reveal that FYM application was significantly increased N, P and K availability. Comparing with no manure treatment added 48 Mg ha^{-1} FYM increased soil available N, P and K by about 93.2, 28.1 and 7.4%, respectively in the first season. Similar trends were obtained in the second season. It can be notice that the effective of FYM on enhancing N, P and K availability was increased as its levels increased. The promotive effect of FYM on nutrient availability may be due to FYM contain a relatively high amounts of N, P and K (Table 2) which released to soil during its decomposition (Mekail et al, 2006). In addition, Yasser (2016) pointed out that organic manure addition led to improve the microbial activity in soil, in turn accelerated the organic manure mineralization and supply the soil with nutrients, beside these microorganisms produce chelating and complexing compounds that prevent phosphorus fixation in the soil (Korndant Melo, 2009). These results agree with those obtained by Elsayed et al (2008), Etesamiet et al (2017).

With regard to the effect of NPK fertilization, the results reveal that soil available N, P and K after onion harvested were positively increased by added NPK fertilizers. Also, the data show that the NPK availably were increased as the levels of NPK increased. The increment of N, P and K due to added the recommended rate of NPK fertilizers reached to 18.0, 25.9 and 3.3 % over without macronutrients application, respectively in the first season. Same trends were obtained in the second seasons. The beneficial effect of mineral fertilizers on nutrients avaibility may be due to mineral fertilizers increased plant growth, especially the root system, which in turn improved the microbial activity in the soil after its decomposition, consequently enhanced the nutrients solubility (Duponnois et al, 2005).

As for the interaction, the results show that nutrients availability did not respond the interaction between organic and mineral treatments. In general, the highest values of soil available N, P and K were recorded under combined the recommend rate of both organic and mineral fertilizers. On the other hand, the plants without FYM and NPK fertilizers exhibited the lowest nutrient availability.

Vegetative growth:

The data in Table (5) represent the effect of mineral and organic fertilizers and their interaction on some vegetative growth of onion, namely, plant height and number of leaves/plant at 90 and 110 days.

Table 5. Effect of integrated mineral and organic fertilizers on onion vegetative growth at 90 and 120 days.

FYM	NPK	First season				Second season			
		Plant Height (cm)		No of leaves/ plant		Plant height (cm)		No of leaves/ plant	
		90 days	110 days	90 days	110 days	90 days	110 days	90 days	110 days
0.0	0.0	48.62	51.41	4.25	4.92	46.76	49.53	4.02	4.19
	1/2RR	55.91	59.90	5.16	6.10	54.09	57.34	5.05	5.12
	RR	59.60	62.75	6.31	7.20	57.53	60.16	6.13	6.29
mean		54.71	58.02	5.24	6.07	52.79	55.68	5.07	5.20
½ RR	0.0	55.64	59.66	5.20	6.17	53.81	57.93	5.10	5.21
	1/2RR	59.56	63.17	6.37	8.02	57.95	60.32	6.21	6.33
	RR	59.78	63.52	6.40	8.09	57.91	60.51	6.24	6.35
mean		58.33	62.12	5.99	7.43	56.56	59.59	5.85	5.96
RR	0.0	59.81	63.34	6.25	8.10	58.14	60.83	6.20	6.31
	1/2RR	62.50	65.71	7.15	8.93	60.25	63.44	6.87	6.93
	RR	62.85	65.75	7.19	8.92	60.40	63.51	6.85	6.92
mean		61.72	64.93	6.86	8.65	59.60	62.59	6.64	6.72
Mean of NPK	0.0	54.69	58.14	5.23	6.40	52.90	56.10	5.11	5.24
	1/2RR	59.32	62.93	6.23	7.68	57.43	60.37	6.04	6.13
	RR	60.74	64.01	6.63	8.07	58.61	61.39	6.41	6.52
L.S.D at 0.05									
A		2.39	2.67	0.34	0.31	2.16	2.80	0.32	0.34
B		2.01	2.27	0.37	0.38	2.15	2.63	0.35	0.40
AB		2.73	2.77	0.41	0.43	2.55	2.96	0.40	0.42

RR of FYM = 48 Mg ha^{-1} RR of NPK = 288 kg N / 75 kg P2O5 / 116 kg K2O ha^{-1}

As for main effect of FYM, the data reveal that both plant height and number of leaves/plant whether at 90 or 110 days were significantly responded to FYM application. Increasing FYM resulted in increasing its effect. The relative increasing of plant height at 90 or 110 days and number of leaves/plant at 90 or 110 days reached to 12.8, 11.9, 30.9 and 42.5 % over without manuring, respectively in the first season. The corresponding increasing in the second season were 12.9, 12.4, 30.0 and 29.2%. The positive effect of FYM on onion growth parameters is mainly due to organic manure improved soil properties and its fertility as discussed before (Table 3 and 4), consequently increased the nutrient availability resulted in enhancing cell divition and elongation (Mahmoud et al 2017 and Gerefael et al 2020). These finding are in line with those obtained by Kumar et al (2019) and Bashandy and Sarhan (2021).

With respect to the main effect of mineral fertilizers, the data show that increasing the NPK levels were significantly increased the abovementioned parameters in both seasons, where fertilized onion plant with the recommended rates of N, P and K fertilizers resulted in highest values of plant height and number of leaves/plant. The positive effect on onion growth could be explain by the inorganic fertilizer supply nutrient in concentrated form for plant use (Salami and Omotoso, 2018). Furthermore, Gererufael et al (2020) pointed out that inorganic fertilizers enhanced the photosynthetic rate in plant, consequently increased cell division and elongation. These results are in harmony with those obtained by Abdulrazzag (2002) and Andishmand and Noori (2021).

The data of the interaction reveal that vegetative growth of onion were significantly responded to the interaction between inorganic and organic fertilizers, where increasing NPK levels from half to full recommended rate did not affect onion growth parameters under the high level of FYM. In general, the highest values of plant height and number of leaves/plant were exerted under combined the recommended rate of FYM with half or full recommended NPK rates, while the treatment of without application of FYM and NPK fertilizers recoded the lowest ones.

Bulb quality

Bulb quality in term of bulb dry matter% and total soluble solids% consider one of the most important parameters of onion crop during its marketed. The data in Table (6) show the effect of organic and inorganic fertilizers on bulb quality. The results show that bulb quality was significantly responded to increasing FYM levels up to full recommended rate in both seasons, but the difference between the effect of half and full recommended rates did not reach to the significance value. The positive effect of FYM on quality of onion may be due to FYM contain sufficient amount of nutrients which released during organic manure decomposition, also FYM improved the physicochemical soil properties, consequality improved onion quality (Yadav, 2006). In addition Doklega (2017) pointed out that the beneficial effect of organic manure on growth parameters resulted in improved photosynthesis activity, in turn increased carbohydrates formation, and total soluble solids. These results agree with those obtained by Shah et al (2019) and Bashandy and Sarhan (2021).

As for the effect of NPK fertilizers, the data show that increasing NPK levels from zero to half recommended rates was significantly increased both onion dry matter % and T.S.S %, and then decreased as raised NPK levels up to 100 % recommended rates. This means that NPK at half recommended rates is the best dose for onion quality. These results are in harmony to those obtained by Bekele (2018).

Table 6. Effect of integrated mineral and organic fertilizers on dry matter (%) and T.S.S at 90 days

FYM	NPK	First season		Second season	
		Dry matter (%)	T.S.S (%)	Dry matter (%)	T.S.S (%)
0.0	0.0	13.89	13.32	13.62	13.20
	1/2RR	14.08	13.63	13.89	13.54
	RR	13.95	13.40	13.62	13.42
mean		13.97	13.45	13.71	13.39
½ RR	0.0	14.11	13.65	13.91	13.50
	1/2RR	14.39	13.95	14.02	13.80
	RR	14.18	13.72	13.95	13.62
mean		14.22	13.77	13.96	13.64
RR	0.0	14.25	13.68	13.92	13.54
	1/2RR	14.35	13.90	13.99	13.76
	RR	14.28	13.80	13.87	13.68
mean		14.29	13.79	13.92	13.66
Mean of NPK	0.0	14.08	13.55	13.82	13.41
	1/2RR	14.27	13.83	13.97	13.70
	RR	14.14	13.64	13.81	13.57
L.S.D at 0.05					
A		0.12	0.08	0.11	0.08
B		0.11	0.12	0.11	0.14
AB		NS	NS	NS	NS

RR of FYM = 48 Mg ha^{-1} RR of NPK = 288 kg N / 75 kg P_2O_5 / 116 kg K_2O ha^{-1}

The data of the interaction reveal that both onion quality did not affect by the interaction between organic and inorganic application. Statistically the best onion quality were obtained when fertilized onion plant with half does of recommended rates of both FYM and NPK fertilizers. On the other hand, the plants not supplied with FYM and NPK fertilizers yielded the lowest values of onion quality.

Onion productivity:

Onion productivity parameters, i.e., bulb weight, total yield, culls yield and marketable yield as influenced by application of FYM and NPK fertilizers are presented in Table (7). The data show that all studied onion productivity were significantly affected by FYM application. The maximum bulb weight (102.41 g), total yield (42.53 t ha^{-1}), culls yield (6.15 t ha^{-1}) and marketable yield (36.38 t ha^{-1}) were obtained when applied the full recommended FYM rate. While the minimum values were 89.01 g, 36.6 t ha^{-1}, 5.33 t ha^{-1} and 31.27 t ha^{-1}, in the abovementioned order. In this concern, Datt (2003) pointed out that the positive effect of organic manure on onion productivity is mainly due to FYM improved physio-chemical soil properties and supply the plants by more nutrients as well as increased biological properties. Also, Mahala et al (2018) inducated that the positive effect of organic manure may be due to FYM help to increase the nutrients availability and improve physical and chemical properties. Yoldas et al (2019) and Al-Amri and Alabdaly (2021) reported similar results in their work.

Regarding the effect of NPK fertilizers, the data show that increasing NPK levels were significantly increased all studied onion productivity. It can be observed that the differences between added half and full recommended NPK rates did not significant. Fertilized onion plants with 100% recommended NPK rates produced highest values of bulb

weight (99.53 g), total yield (41.09 t ha^{-1}), culls yield (5.99 t ha^{-1}) and marketable yield (35.09 t ha^{-1}) in the first season. Some trends were obtained in the second season. The increasing of onion productivity due to NPK application can be explained by the positive effect of N, P andK fertilizers on vegetative growth of onion as discussed before (Table 5). These results are similar to those obtained by Yoldas et al (2020) and Andishmand and Noori (2021).

Table 7. Effect of integrated mineral and organic fertilizers on onion productivity at harvest

FYM	NPK	First season				Second season			
		Bulb Weight(g)	Total yield(t ha^{-1})	Culls yield(t ha^{-1})	Marketable yield(t ha^{-1})	Bulb Weight(g)	Total yield(t ha^{-1})	Culls yield(t ha^{-1})	Marketable yield(t ha^{-1})
	0.0	79.51	32.62	4.70	27.92	75.36	30.91	4.46	26.45
0.0	1/2RR	91.33	37.68	5.51	32.17	87.25	35.86	5.23	30.63
	RR	96.18	39.49	5.78	33.71	92.60	38.13	5.57	32.56
mean		89.01	36.60	5.33	31.27	85.07	34.97	5.09	29.88
	0.0	92.02	37.77	5.52	32.25	88.36	36.21	5.26	30.95
½ RR	1/2RR	97.37	39.68	5.86	33.82	93.31	38.29	5.61	32.68
	RR	97.45	39.79	5.88	33.91	93.51	38.36	5.53	32.83
mean		95.61	39.08	5.75	33.33	91.73	37.62	5.47	32.15
	0.0	97.41	39.68	5.84	33.84	93.42	38.31	5.56	32.75
RR	1/2RR	104.84	43.93	6.29	37.64	101.15	41.50	6.02	35.48
	RR	104.96	43.98	6.32	37.66	101.19	41.57	6.04	35.53
mean		102.41	42.53	6.15	36.38	98.59	40.46	5.87	34.59
	0.0	89.65	36.69	5.35	31.34	85.71	35.14	5.09	30.05
Mean of NPK	1/2RR	97.85	40.43	5.89	34.54	93.90	38.55	5.62	32.93
	RR	99.53	41.09	5.99	35.09	95.77	39.35	5.71	33.64
L.S.D at 0.05									
A		2.37	1.53	0.26	1.02	2.16	1.33	0.26	0.93
B		1.04	1.14	0.29	1.27	1.00	1.14	0.27	1.10
AB		2.63	1.76	NS	1.35	2.57	1.68	NS	1.31

RR of FYM = 48 Mg ha^{-1} RR of NPK = 288 kg N / 75 kg P2O5 / 116 kg K2O ha^{-1}

The results reveal that onion productivity responded to the interaction between organic and inorganic fertilizers, except culls yield. In general, statistically the highest values of bulb weight, total yield and marketable yield were recorded under the treatment of combined full recommended rate of FYM + half recommended NPK rates. While, the treatment of no both FYM and NPK exhibited the lowest ones. Our results agree with the finding of Bhati et al (2018).

Storability:

Storability of onion expressed as the percentage of total weight loss of bulbs for different periods through its storage is illustrated in Table (8). The data show that there were significant differences in loss weight percentage due to organic manure levels. The plants received FYM at full recommended rate gave the highest weight loss%. While added half recommended rate of FYM reduced weight loss by about 8.77, 16,50 and 17.50% at 2,4 and 6 months when compared to that under 100% recommended rate of FYM, respectively in the first season. similar results were obtained in the second season. This means that added 50% of FYM is the best treatment for onion storability. These results are in line with those obtained by Kale (2010).

Table 8.Effect of integrated mineral and organic fertilizers on onion weight loss % after 2, 4 and 6 months (onion storability).

FYM	NPK	First season			Second season		
		After 2 months	After 4 months	After 6 months	After 2 months	After 4 months	After 6 Months
	0.0	7.27	14.07	22.24	7.66	14.66	25.05
0.0	1/2RR	8.34	14.97	23.66	8.73	15.68	26.74
	RR	8.75	15.92	25.14	9.14	16.50	28.11
mean		8.12	14.99	23.68	8.51	15.61	26.63
	0.0	6.94	11.36	17.94	7.33	11.22	19.08
½ RR	1/2RR	7.95	15.66	24.74	8.34	16.41	27.98
	RR	8.83	13.16	20.79	9.22	13.61	23.08
mean		7.91	13.39	21.16	8.30	13.75	23.38
	0.0	8.29	16.11	25.46	8.67	16.73	26.44
RR	1/2RR	8.61	15.68	24.78	9.00	16.29	25.74
	RR	9.10	16.31	25.77	9.49	16.89	26.69
mean		8.67	16.03	25.34	9.05	16.64	26.29
Mean	0.0	7.50	13.85	21.88	7.89	14.20	23.52
of	1/2RR	8.30	15.44	24.39	8.69	16.13	26.82
NPK	RR	8.89	15.13	23.90	9.28	15.67	25.96
L.S.D at 0.05							
A		0.36	1.12	1.05	0.39	1.01	1.27
B		0.71	1.26	1.26	0.82	1.13	1.38
AB		NS	NS	1.43	NS	NS	1.60

RR of FYM = 48 Mg ha^{-1} RR of NPK = 288 kg N / 75 kg P2O5 / 116 kg K2O ha^{-1}

As for NPK fertilization, the obtained results illustrated that NPK application had significant effect on onion storability in both seasons only when compared with no NPK fertilization, where added NPK whether at half or full recommended rate were increased onion weight loss % at the different periods. It can be notice that the differences between

the effect of the two studied rates on weight loss % is not significant. On the other hand, the onion plants without inorganic fertilizers exhibited the lowest weight loss %. Similar results were obtained by Obiadalla-Ali (2016).

The interaction between FYM and NPK fertilizer had no significant effect on onion storability at the different studied duration in both seasons, except at 6 months. In general, the lowest weight loss percentage were recorded under the treatment of half recommended rate without NPK application, while the plants supplied with full recommended rates of both organic and inorganic fertilizers exerted the highest value of weight loss %.

CONCLUSION

Optimal results were achieved with 48.0 t ha-1 of Farm Yard Manure (FYM) and half the recommended rate of NPK, demonstrating improved soil parameters, enhanced onion quality, and increased yields. The synergy between organic manure and NPK application proved crucial for achieving the best vegetative growth, yield, and storability of onions. Farmers are recommended to incorporate organic manure into their cultivation practices, adhere to balanced NPK fertilization, carefully monitor soil salinity, and consider the synergistic combination for optimal results. These findings contribute valuable insights for sustainable onion cultivation, encouraging a holistic approach that balances soil health and crop productivity. Continued research in related areas is also advocated for comprehensive agricultural optimization.

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تأثير التسميد العضوي والمعدني علي إنتاجية وجودة الصل وقدرته التخزينية وبعض خصائص التربة وخصوبتها

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الملخص

أجريت تجربتان حقليتان بالمزرعة البحثية بمحطة البحوث الزراعية بسدس/مركز البحوث الزراعية/بني سويف في موسمين متتاليين لدراسة تأثير مستويات مختلفة من التسميد العضوي والمعدني علي جودة وإنتاجية محصول البصل وقدرته التخزينية وخواص التربة وخصوبتها بعد الحصاد. وقد استخدم تصميم القطع المنشقة في التجربة حيث وضعت معاملات التسميد العضوي (0 ، 50% ، 100 % ، 100 % من الموصي به) في القطع الرئيسية. كما وضعت معاملات التسميد النيتروجيني والفوسفاتي والبوتاسي (0.0 ، 50% ، 100%) في القطع المنشقة. وكانت أهم النتائج كما يلي:-- أدي زيادة التسميد العضوي الي تحسين صفات التربة وخصوبتها ، ماعدا نسبة الأملاح التي زادت بزيادة التسميد العضوي.- أدي زيادة التسميد العضوي الي زيادة المادة الجافة ونسبة المواد الصلبة الذائبة وأرتفاع النبات وعدد الأوراق للنبات عند 90 ، و110 يوم ووزن البصلة والمحصول الكلي والمحصول الغير صالح للتسويق والمحصول الصالح للتسويق.- أدي زيادة التسميد المعدني الي زيادة خصوبة التربة عند الحصاد وزيادة طول النبات وعدد أوراق النبات ووزن البصلة والمحصول الكلي والمحصول الغير صالح للتسويق.- زادت المادة الجافة والنسبة المئوية للمادة الصلبة والمحصول القابل للتسوق والقدرة التخزينية بزيادة التسميد المعدني حتي 50 % من الموصي به ، بينما لم تتأثر معنويا بالزيادة الي 100 % من الموصي به .- أدي تعويض 50% من أسمدة النيتروجين والفوسفور والبوتاسيوم الكيميائية بأضافة 100% من السماد البلدي بالحصول علي أعلي جودة ومحصول وقدرة تخزينية للبصل مع تحسن خواص التربة بعد الحصاد.