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EFFECT OF INTEGRATED INORGANIC AND ORGANIC NITROGEN FERTILIZER ON QUANTITY AND QUALITY OF POTATOES PLANT GROWN ON NEW RECLAIMED SANDY SOIL.

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ABSTRACT

The integrated use of organic and inorganic fertilizers on the yield of potatoes was evaluated in a field experiment at newly reclaimed sandy soil at El-Kattaba Region El-Monofia Governorate-Egypt, during two successive years (growing seasons of winter 2011/2012 and 2012/2013). The organic sources used were farmyard manure, poultry manure and compost. These were integrated in different proportions with mineral nitrogenous fertilizer as ammonium nitrate to supply 120 kg $Nfed^{-1}$ N. All the organic fertilizers were applied at planting time and mineral fertilizer (ammonium nitrate) was applied as divided into 4 doses, the 1^{st} dose was added after planting by 15 days and the other doses applied every 15 days. The results showed that integrated use in different proportion increased the plant height, number of stems, total chlorophyll, nitrogen concentration in potato tubers and protein content, but mineral nitrogen fertilizer individually gave higher values compared with the integrated organic and mineral nitrogen fertilizers. However, the maximum and minimum values of potato yield and nitrate content in potato tuber were obtained by application of poultry manure combined with mineral nitrogen fertilizer and organic nitrogen individually, respectively.Organic matter OF content in soil was increased in all treatments compared with sole mineral nitrogen fertilizer and contrary, the values of bulk density BD decreased generally. Therefore,the combined use of organic manure with inorganic fertilizer application was recognized as the most suitable way for ensuring high quantity and quality crop yield and reducing the harmful effects of using nitrogenous chemical fertilizers, but also for sustaining soil fertility status.

Keywords: Integrated, organic, inorganic nitrogen, potato plant, sandy soil

INTRODUCTION

The most widely consumed of all vegetables, potatoes are a nutritious, low-calorie source of carbohydrates, potassium, and vitamin C, and their skins are high in fibre. Potato (*Solanumtubrosum.)* as a member of the family solanaceae is one of the most important food crops all over the world including Egypt. It ranks the first export and the second vegetable crop in acreage. Commercial production of potatoes in Egypt is concentrated in the Nile Delta and Middle Egypt. In this desert environment significant diurnal temperature variations allow tuberization even when day temperatures are quite high .Potatoes are cropped continuously in Egypt from August to June.

The most newly reclaimed soils in both east and west desert of Egypt, range in texture from sandy to sandy calcareous soils. Potatoes are plants with a long vegetation period; therefore they assimilate nutrients from organic and mineral fertilizers rather intensively. Content of dry matter, starch, proteins, sugar in potato tubers can increase or decrease, depending on the mineral fertilizer forms and rates as well as their correlation. The most important factors in fertilizing potatoes are proper relations between different nutritional elements, since they influence potato vegetation period and maturity stage of potato tubers. Potato has a high N requirement, but its recovery of fertilizer N is often quite low. In recent years, there has been a steady increase in the use of nitrogen fertilizer to achieve maximum potato production. The abundance and low cost of N fertilizer has encouraged the use of high fertilization rates in attempts to obtain maximum tuber yields (Carter and Bosma, 1974). However, Hlaysova *at.al*.,(1970) reported that nitrate increases -in the tubers with increasing N fertilization rates. Although nitrites are the toxic principle which may be formed prior to ingestion or during digestion and absorption of food, nitrates may be considered as the index or precursor to the amount of nitrite which may be formed. There is considerable concern that use of these high nitrate containing vegetables could cause methemoglobinemia, especially in infants. If foods contain high levels of nitrate, the potential hazard may be increased. Consequently, the nitrate levels should be kept as low as possible while near maximum yields are maintained. So the sound of applying the integrated inorganic and organic Nitrogen fertilizer is interesting in this paper.

The soils in Egypt are very poor in their organic matter content which fluctuates between 2.5 – 0.1 % due to the arid climate conditions and high decomposition rate of organic matter.

The effect of organic manure on plant behaviour is not just a matter of nutrients supply; organic materials influence the physical, chemical and biological characteristics of soil which in turn influence development of plants. Because of the high fertilizer prices and transport costs in the farm, there is a need to supplement a part of N needs of potato with organic fertilizer. Delate and Camberdella (2004) reported that Organic manures including FYM (farmyard manure) and PM (poultry manure) may be used for the crop production as a substitute of the chemical fertilizers. Ayoola and Adeniyan (2006) reported that nutrient from mineral fertilizers enhance the establishment of crop while organic manure promotes yield when both fertilizers were combined. The combined use of organic manure and inorganic fertilizer could narrow down the negative nutrient balance substantially in many cropping systems.Therefore, the main objectives of the present study are to study integrated of organic and inorganic nitrogen fertilizers on quantity and quality of potatoes plant grown on new reclaimed sandy soil and on some physical and chemical properties of the experimental soil .

MATERIALS AND METHODS

Two field experiments were conducted at newly reclaimed sandy soil in El-Kattaba Region, El-Monofia Governorate, Egypt, during two winter seasons of 2011/2012 and 2012/2013 to study the effect of nitrogen sources [(organic fertilizers and mineral fertilizer (Ammonium nitrate, 33.5%)) and types of organic fertilizers [(farmyard manure (FYM), chicken manure (CH) and compost (Comp)] on some growth characters of potato plant and some properties of soil fertility. The following materials and methods were applied.

Materials:

Soil Sample:

Two field experiments were conducted at soil sandy textured. Some physical and chemical properties of soil used are showing in Table 1.

As shown in the Table1 soil is considered a sandy in texture that was low in available nitrogen and high in both available phosphorus, and potassium.

Table 1: Some physical and chemical properties of the soil before growing seasons.

Experiment year	Soil depth	Soil characters										
		B.D g/cm^{-3}	EC dsm^{-1}	pH	Total N%	O.M %	Available K mg/kg	Available P mg/kg	Available(ppm)			Soil Texture
									Zn	Fe	Mn	
2011-2012	0-30	1.71	7.65	7.8	0.039	0.32	88.5	4.5	0.98	3.1	2.1	Loamy sand
2012-2013	0-30	1.70	7.60	7.79	0.050	0.47	88.9	4.9	1.10	4.2	2.3	Loamy sand

Seed Tubers:

To achieve the purpose of present study, potatoes (*Diamount cv*.) was chosen to this study.

Table 2: Chemical properties of organic fertilizer types.

O F	pH 1:2.5	E.C dsm^{-1} 1:10	O F %	Total N %	Total K%	Available P ppm	C/N ratio	Fe ppm	Zn ppm	Mn ppm
FYM	11.80	9.9	61.97	2.55	2.22	180.70	14.14	42.95	30.55	46.30
CHnb	7.14	3.7	62.03	3.14	2.65	342.30	11.50	27.80	55.90	63.15
Comp.	7.54	2.5	59.33	2.16	1.17	187.25	16.00	31.20	19.70	53.50

Treatments:

The present experiments included 15 treatments that were five rates of nitrogen sources multiply in 3 types of organic manures as follows:

I: The integrated ratio of nitrogen sources:

1. 100% mineral Nitrogen .
2. 75% mineral N+ 25% organic N.
3. 50% mineral N+ 50% organic N.
4. 25% mineral N+ 75% organic N.
5. 100% organic N.

Types of organic fertilizers:

1. Farmyard manure (FYM).

2. Chicken manure (CH).
3. Compost (Comp).

In all treatments N, P and K were applied at rates of 150, 60, and 96 kg/fed, respectively.

To achieve these amounts in the treatment of 100% mineral nitrogen, N, P and K were applied in the form of 450 kg ammonium nitrate (33.5% N) 400 kg/fed calcium super-phosphate (15.5% P_2O_5) and 200 kg/fed potassium sulphate (48.0% K_2O) , while ammonium nitrate was used at rates of 337.5, 225 and 112.5 kg/fed for the treatments of 75, 50 and 25% mineral nitrogen, respectively. On the other hand to achieve 100, 75, 50, and 25% of organic nitrogen different the amounts of different organic fertilizers were applied as shown in Table 2. To let P and K constant (60 kg P_2O_5 and 96 K_2O kg/fed) in all organic treatments, different amounts of rock phosphate and feldspar were applied according to chemical analysis of each organic fertilizer type, which is shown in Table3

Table 3: Amounts of different organic fertilizers (ton/fed) to achieve different rates (100, 75, 50 and 25%) of organic nitrogen.

Rate of organic N	Types of organic fertilizers		
	Farm Yard Mnure	Chicken	Compost
100%	6	4.8	6.9
75%	4.5	3.6	5.2
50%	3	2.4	3.5
25%	1.5	1.2	1.7

Methodes

Experimental Design:

This experiment was carried out as split plot with three replications. The main plot was the different rates of inorganic and organic nitrogen sources and the subplots were the types of organic fertilizers (farmyard manure, chicken manure and compost).

Soil preparation:

Each plot was homogeneously mixed with the topsoil to approximate 30 cm depth before cultivation. The plot area was 30 m^2 (5 m in width and 6m in length) with 12 rows in each plot.

2.3. Planting and Harvesting:

Potato tuber pieces were planted at 25 cm distance in 10 cm depth and at the rate of 1300 kg fed^{-1} during the third week of November for both two years (winter seasons) 2011/2012 and 2012/2013.

Application of fertilizers:

The rate of each fertilizer was applied as the following: The rates of nitrogen fertilizers were divided into 4 doses, the 1^{st}dose was added 15 days after planting and the other doses were applied every15 days. Calcium super-phosphate, rock phosphate and feldspar were applied before planting and irrigation. Potassium sulphate was applied a as a one dose with the third irrigation.

Irrigation:

Potatoes were irrigated with drip irrigation.

Soil analysis before planting and after harvest:

Mechanical analysis was determined according to the international pipette method as described by Piper (1950).

Soil pH was determined in the saturated soil paste using a GIlenkamp pH meter. [United States Salinity Laboratory Staff (Richards, 1954)].

The electrical conductivity (EC) was measured by electrical conductivity meter in saturation extracts of soil in dS/m [United States Salinity Laboratory Staff (Richards, 1954)].

Bulk density was determined by using paraffin wax method (Dewis and Freitas, 1970) and Real density was determined using pycnometer method (Black *et al.*, 1965).

Organic matter (OF) was determined by the determination of total carbon (C %) according to Walkley and Black method as described by Hesse (1971) and multiplying the result by 1.724to obtain OF.

Plant Measurements and Analysis:

Plant Measurements:

After 70 days from planting date, 3 plants were randomly chosen from each plant and taken for determination total chlorophyll of leaves using a Minolta SPAD chlorophyll meter (Yadava, 1986). The reading of chlorophyll meter was taken on 2nd leaf from the top of plant.

Five plants from each plot were chosen randomly in both seasons after 90 days from planting e to study the following characteristics of plant growth.

Plant height (cm).

Number of stems per plant.

Potatoes were harvested after 110 days from planting date and tubers yield were calculated as (t/fed).

Tuber chemical contents at harvest:

At harvest, total nitrogen, total protein, total nitrate, and total carbohydrates were determined in potato tubers using the following methods:

Total nitrogen (%) was determined by Kjeldahl method as aforementioned (Hesse, 1971).

Total protein (%) was calculated according to Ranganna (1977) using conversion factor. ($\text{Protein}(\%) = \text{Nitrogen}(\%) \times 6.25$)

Total Nitrate was mesured by the method of Hlaysova *et al.* (1970).

Total carbohydrate content (%) was determined according to Herbet *et al.* (1971).

Statistical Analysis:

The statistical analysis of the obtained data was done according to the method described by Gomez and Gomez (1984) and LSD was used to compare the means of treatments values.

RESULTS AND DISCUSSION

Effect of nitrogen sources and types of organic fertilizers on plant height (cm) of potato after 90 days from planting

Effect of rates of nitrogen sources

Applying 100%nitrogenas mineral significantly ascertained the highest means values of plant height whichwere48.7 and 46.6 in the 1st and 2nd season, respectively (Table 4). This results may be due to the ammonium nitrate is ready to absorbed by root while organic nitrogen sources passed by decompositions state. On the other hand, concerning the effect of different rates of organic and in organic nitrogen sources**,** data in Table 4 reveal that the ratio of 25% of combined with 75 % MF application significantly increased plant height as compared with the other combinations of organic and in organic nitrogen sources except the treatment of 100%mineral nitrogen in both seasons. The mean value of plant height in this rate was 41.23 and 42.07 cm in the first and second season, respectively. Considering the rates of organic and inorganic nitrogen fertilizers in 1st season, the following means values of plant height could be arranged in descending order 25%OF +75% MIN (41.23), > 50% OF +50% mineral (38.40cm), > 75% OF +25% MF (37.07cm),> 100% OF + Zero% MF (32.97cm). The difference between the rates of integrated nitrogen fertilizers was significant in both seasons.

Effect of types of organic nitrogen fertilizers:

As shown in Table 4 different organic N fertilizers had significant effect on plant height in both seasons at 90 days from planting. In this respect the differences in plant height means among different organic N fertilizer were significant. The superiority mean value was due to applying chicken manure fertilizer with mean value 45.86 (cm) in the first season and 43.46 (cm) in the second season. The mean value of plant height increased significantly with application the chicken manure by about 17.71% and 12.47 % than farm-yard manure (FYM) and compost (Comp), respectively, in the first season. The obtained results may be related to the important role of N for plant which reflected on vegetative growth. Kandil *et al* .(2011) found that application of 60% inorganic nitrogen (238 kg/ha) + 40% organic chicken manure (158 kg N/ha) on potato resulted in highest values of number of tubers/plant,

Table 4: Effect of rates of N sources and types of organic fertilizers on plant height (cm) of potato, 90 days after planting in the winter seasons of 2011/2012 and 2012/2013.

Rates of nitrogen sources (%)		Organic Fertilizer types							
OF	MF	FYM	Chicken	Compost	Mean	FYM	Chicken	Compost	Mean
		2011/2012 season				2012/2013 season			
Zero	100	48.7	48.7	48.7	48.70	46.6	46.6	46.6	46.60
25	75	37.7	46.7	39.3	41.23	40.3	44.6	41.3	42.07
50	50	35.6	42.3	37.3	38.40	38.7	42.7	39.6	40.33
75	25	34.3	41.3	35.6	37.07	34.3	40.6	37.7	37.53
100	Zero	28.3	38.3	32.3	32.97	26.6	37.3	33.6	32.50
Mean		36.92	43.46	38.64		37.3	42.63	39.76	

LSD at 0.05 for:
Rates of N sources (NS): 0.05 0.06
Types of Organic Fertilizers (OF): 0.07 0.08
NS x OF: 0.12 0.14
OF : Organic Fertilizers MF : mineral fertilizer (ammoniumnitrate33.5%)FYM : farmer yard manure

Effect of inorganic and organic Nitrogen fertilizers and their Interaction on number of stems at 90 days from planting at 1st and 2nd years 2011/2012 and 2012/2013:

Rates effect:

In 1st season, data in Table (5) reveal that the treatment of rate 25% OF combined with 75 % MIN (Ammonium nitrate 33.5%) application significantly increased the mean values of number of stems' than the other treatments. Considering the rates of nitrogen, the following mean values of number of stems could be arranged in descending order 25% OF +75% MIN (5.63),100% MIN + Zero OF(5.60), 50% OF +50% Mineral (4.30cm), > 75% OF +25% MIN (3.83),> 100% OF + Zero% Min (2.73).

In 2nd season as shown in Table 5 the treatment of rate of 25% OF +75% MIN applications ascertained slightly less significant than the treatment 100% mineral +0 OF. At this rate (25% OF +75% MIN) the mean values of number stems increased from 5.63 to 6.07 at 1st season and 2nd season respectively. The difference between the rates of different nitrogen sources was significant. Otherwise, the superiority means value for number of stems due to the applied 100%MIN+ OF at 2nd was 6.30.

Table 5: Effect of integrated inorganic and organic N fertilizers, their rates and their interactions on number of stems of potatoes after 90 days from planting at1st and 2nd years2011/2012 and 2012/ 2013.

Rates of nitrogen sources (%)		Organic Fertilizer types							
OF	MF	FYM	Chicken	Compost	Mean	FYM	Chicken	Compost	Mean
		2011/2012 season				2012/2013 season			
Zero	100	5.6	5.6	5.6	5.60	6.3	6.3	6.3	6.30
25	75	4.6	7.3	5	5.63	5.6	6.3	6.3	6.07
50	50	4.3	4.3	4.3	4.30	5.3	5.6	5.6	5.50
75	25	3.6	4.3	3.6	3.83	4.6	5.3	4.6	4.83
100	Zero	2.3	3.3	2.6	2.73	3.3	5.3	3.6	4.07
Mean		4.08	4.96	4.22		4.48	5.76	5.28	

LSD at 0.05 for:
Rates of N sources (NS): 0.01 0.05
Types of Organic Fertilizers (OF): 0.02 0.07
NS x OF: 0.03 0.11
OF : Organic Fertilizers MF : mineral fertilizer (ammoniumnitrate33.5%)FYM : farmer yard manure

Organic nitrogen fertilizers effect:

Data in Table 5 show the effect of nitrogen sources, their rates and their interactions on number of stems in 1st and 2nd season. Data illustrate that the treatment which got chicken manure as organic N source significantly increased the mean value of number of stems as compared to FYM and Comp in *1st and 2nd* seasons. The differences between FYM, CH and Comp are significantly in both seasons. The mean values of number of stems. In 1st season for each FYM, CH, Comp were 4.08, 4.96 and 4.22, respectively.

in 2nd season, the mean values of number of stem were 4.48, 5.76 and 5.28, respectively. It is noticed that the difference between the organic N sources is significant in 1st season and in 2nd season, where the superiority for 1st and 2nd was the treatment of chicken manure. This effect of organic N sources on number of stems might be related to organic matter which has essential nutrients such as N, P**.**

Data in same table 5 show also that the effect of different nitrogen sources, their rates (organic matter types and mineral nitrogen) on number of stems were significant in 1st season and 2ndseasons.The highest number of stems is 7.3 and 6.3 at 1st and 2nd seasons which recorded by the interaction between rate of 25%chicken (CH) + 75% mineral (MIN).(El-Gendy *et.al*., 2001 a).

Effect of Integrated of inorganic and organic Nitrogen fertilizers, their rates, foliar spray fertilizers and their Interactions on total chlorophyll (T.Chlo) reading from plantingat 70 days from planting at 1st and 2nd years 2011/2012 and 2012/2013:

Rates effect:

As shown in Data of Table 6 the rates of OM with Min nitrogen fertilizers application had significent effecte on T.Chlo. in both seasons. The mean values of T. Chlo. were 56.50, 50.27, 43.27, 40.30, 35.77 in 1st season, whereas were 47.30, 44.53,42.67,40.13,38.28 in 2nd season at the applied rates of 100%MIN +zero OF, 25%OF +75MIN, 50%OM +50MIN, 75%OF +25MIN, and 100% OF + zero MIN, respectively. Amir *et al.* (2010) Showed that the interaction between manure and N fertilizer gave the maximum content of total chlorophyll and tuber yield of potato.

In addition the difference between all rates related to the level of significant in both seasons where the rate of 100%MIN +zero OF gave highest values.

This effect of mineral nitrogen (ammonium nitrate) on T.Chlo. might be related to N in form of NH_4 and NO_3 ions easy to absorbed as it considered from macro nutrients which are important for photosynthesis which are process, respiration, carbohydrate metabolism, protein synthesis and chloroplasts formation, that leads to an increase in chlorophyll. While N in Organic matter slowly release because of its decomposition process(Jouda, *et al.*, 2001).

Table 6: Effect of integrated inorganic and organic N fertilizers, their rates and their interactions on total chlorophyll (T.Chlo) of potatoes after 70 days from planting at1st and 2nd years2011/2012 and 2012/ 2013.

Rates of nitrogen sources (%)		Organic Fertilizer types							
OF	MF	FYM	Chicken	Compost	Mean	FYM	Chicken	Compost	Mean
		2011/2012 season				2012/2013 season			
Zero	100	56.5	56.5	56.5	56.50	47.3	47.3	47.3	47.30
25	75	43.7	54.6	52.5	50.27	42.2	46.7	44.7	44.53
50	50	41.6	44.7	43.5	43.27	40.7	45.3	42	42.67
75	25	39.1	41.7	40.1	40.30	36.3	44.1	40	40.13
100	Zero	33.8	38.1	35.4	35.77	35.7	40.3	38.8	38.27
Mean		42.94	47.12	38.40		41.44	44.74	42.56	

LSD at 0.05 for:
Rates of N sources (NS): 0.06 0.06
Types of Organic Fertilizers (OF): 0.07 0.08
NS x OF: 0.13 0.14
OF:Organic Fertilizers
MF:mineral fertilizer (ammoniumnitrate33.5%)FYM:farmer yard manure

Organic nitrogen fertilizers effect:

Data in Table 6 show the effect of different organic N fertilizers in 1st and 2nd season. Data illustrate that chicken manure CH addition significantly increased T.Chlo. as compared to other types of organic fertilizers in both seasons. The differences between CH, FYM or Comp respectively are significant in both seasons. The mean values of T.Chlo. in 1st season were 47,12, 42.94, 38.40 for CH, FYM or Comp, respectively. Where, in 2nd season were 44.74, 41.44 and 42.56 for the treatments of CH, FYM or Comp respectively. It is noticed that the superiority mean values for chicken manure (Ch) was 47.12 especial in the 1st season. Fernéndez-Luqueño *et al.* (2010) studied the effect of organic fertilizers on the amount of chlorophyll pigments and rate of photosynthesis. They concluded that the application of organic fertilizers can not only enhances the synthesis and amount of chlorophylls but also increases the rate of photosynthesis. The effect of N on chlorophyll may be due to that N is a constituent of the chlorophyll molecule. Similar observation are obtained by El-Gamal (1996) and Jouda, *et al.* (2001) and . Fernéndez-Luqueño *et al.* (2010).

Effect of Integrated of inorganic and organic Nitrogen fertilizers, their rates and their Interactions on total tuber yield at harvesting stag at 1st and 2nd years 2011/2012 and 2012/2013:

Rates effect:

Data in Table 7 indicate that means value of tuber yield increased significantly with all rates as shown for the two seasons. The mean value of tuber yield to the rate (25%OF +75MIN) increased by 5%, 13.7%, 22.9, 45.6 in 1st season than the rates (zero OF+ 100%MIN), (50%OF +50 MIN), (75%OF + 25%MIN), (100%OF +zero MIN) respectively, and The mean value of tuber yield to the rate (25%OF +75MIN) increased by 3.2, 18.2, 21.3 and 82.4 in 2nd season than the rates (zero OF+ 100%MIN), (50%OF +50 MIN), (75%OF + 25%MIN), (100%OF +zero MIN) respectively . In addition to this, the difference between (25%OF +75MIN) and (zero OF+ 100%MIN) was significant in both seasons and the rate of (25%OF +75MIN) has highest yield. Finally, the effect of integrated treatment of chicken manure with rate (25%OF +75MIN) to became the best treatment on mean values of tuber yield by 15.98t/f, 16.80 t/f at 1st and 2nd seasons respectively and which it may be attributed to its effect on increasing tuber yield.

These results are agreeable with those obtained by Haidar and Sidahmed (2006)Balemi, (2012),Yoganathan *et al.* (2013) Shiferaw (2014) and Gezahegn *et al.* (2014).

Table 7: Effect of integrated inorganic and organic N fertilizers, their rates and their interactions on yield tf^{-1} after harvest stage at1st and 2nd years2011/2012 and 2012/ 2013.

Rates of nitrogen sources (%)		Organic Fertilizer types							
OF	MF	FYM	Chicken	Compost	Mean	FYM	Chicken	Compost	Mean
		2011/2012 season				2012/2013 season			
Zero	100	14.7	14.7	14.7	14.70	15.6	15.6	15.6	15.60
25	75	15.1	15.98	15.2	15.43	14.94	16.8	15.2	15.65
50	50	13	14.6	13.1	13.57	13.73	15.5	13.5	13.24
75	25	12.11	13.14	12.4	12.55	12.10	14.1	12.5	12.90
100	Zero	10.18	11.02	10.6	10.60	7.50	10.4	7.85	8.58
Mean		13.02	13.89	13.20		12.77	14.48	12.93	

LSD at 0.05 for:
Rates of N sources (NS): 0.01 0.01
Types of Organic Fertilizers (OF): 0.02 0.02
NS x OF: 0.03 0.03
OF : Organic Fertilizers
MF : mineral fertilizer (ammoniumnitrate33.5%)FYM : farmer yard manure

Organic nitrogen fertilizers effect:

Table 7 show the effect of integrated of inorganic and organic Nitrogen fertilizers on tuber yield in both seasons. The difference between means value for tuber yield was significant in both 1st and 2ndseasons. The CH treatment increased mean values for tuber yield by 6.7% and 5.2% than the treatments of both FYM and Comp respectively at 1st season. While, the mean values of dry tuber yield for CH treatment at the 2nd season was increased by 13.4 %, 13.39% than FYM and Comp treatments respectively in 2nd season.

In addition, the difference between FYM and Comp was insignificant in 2nd season. On the other hand, the superiority mean value of tuber yield was for Chicken manure treatment as N 13.89 and 14.48 t/fed for 1st and 2nd seasons . This conclusion was agreed with those of Abo-Sedera and Shehata (1994) and Saroka, *et al.* (1994).Magagula et al.(2010) who found that the positive correlation between sweet potato total tuberous root yield with increased application rate of chicken manure on sandy loam soil in Swaziland.

Effect of Integrated of inorganic and organic Nitrogen fertilizers, their rates and their Interactions on N% in tuber of potatoes after 110 days (harvest stage at 1st and 2nd years 2011/2012 and 2012/2013:

Rates effect:

Data in Table 8 show that the N % in tuber increased with 100% Mineral + zero OF addition as compared with other rates, this increase was significant in 1st season. The mean values of N% on tuber were 1.70%, 1.35%, 1.20%, 1.08% and 0.93% at applied rates of 100%MIN +zero OF, 25%OF +75MIN, 50% OF +50 MIN, 75% OF +25 MIN, and 100% OF + zero MIN, respectively.

Similar results were in 2nd season where the effect of rates application on N% in tuber was significant and means values were 1.66%, 1.54%, 1.54%, 1.04%,0.91%, at applied rates of 100%MIN +zero OF, 25%OF +75MIN, 50%OF +50MIN, 75%OF +25MIN, and 100% OF + zero MIN, respectively. The opposite effect of increasing OF rates on N % in tuber may be due to the effect of decomposition period of OF.

Data in Table 8 indicate that the effect of interactions were significant in 1st and 2nd seasons. The superiority treatment was treatment that received chicken manure at rate 25% OM and 75%mineral Generally**, Jasiwal (1994)** indicated that chemical composition of potato tubers was clearly affected by N-rate and N-source.

Table 8: Effect of integrated inorganic and organic N fertilizers, their rates and their interactions on N % in tuber of potatoes after harvest at1st and 2nd years 2011/2012 and 2012/ 2013.

Rates of nitrogen sources (%)		Organic Fertilizer types							
OF	MF	FYM	Chicken	Compost	Mean	FYM	Chicken	Compost	Mean
		2011/2012 season				2012/2013 season			
Zero	100	1.7	1.7	1.7	1.7	1.66	1.66	1.66	1.66
25	75	1.26	1.6	1.19	1.35	1.57	1.57	1.47	1.54
50	50	1.19	1.3	1.12	1.2	1.08	1.27	0.98	1.54
75	25	1.05	1.19	1.01	1.08	0.98	1.27	0.88	1.04
100	Zero	0.91	1.19	0.7	0.93	0.88	0.98	0.88	0.91
Mean		1.22	1.40	1.14		1.23	1.35	1.17	

LSD at 0.05 for:
Rates of N sources (NS): 0.063 0.069
Types of Organic Fertilizers (OF): 0.066 0.080
NS x OF: 0.114 0.138
OF : Organic Fertilizers
MF : mineral fertilizer (ammoniumnitrate33.5%)FYM : farmer yard manure

Organic nitrogen fertilizers effect:

Data presented in Table 8 show that the effect of N sources had a constant trend for N% in tubers in both seasons. However, the difference between FYM and CH or Comp was approximately insignificant in both seasons. The maximum mean of N% in tuber was 1.4% and 1.35% with addition of chicken manure as N sources in 1st and 2nd seasons, respectively. The equal means values of N concentration for different organic Nitrogen fertilizers may be due to the same approximately quantity of nitrogen added during the experiment period from each one. This resulted was agreeable withEwulo *et al.* (2008).

Effect of Integrated of inorganic and organic Nitrogen fertilizers, their rates and their Interactions on Nitrate –nitrogen (NO_3^{--} •N) in tuber potato at1st and 2nd year 2011/2012 and 2012/ 2013.

Rates effect:

Data in Table 9 illustrate that O F rates addition decreased NO_3^{--} •N in tubers significantly as compared with the treatment 100% mineral (without addition of organic matter). In addition the difference between the effect of all rates of organic matter was significant in both 1st and 2nd seasons.

The highest mean values of rates 100% Min +zero OF was 62.00 $mgkg^{-1}$for 1st and 2nd seasons, respectively. On the other hand, the lowest means values related to 100% OF + zero mineral nitrogen sources. The effect of O F addition on NO_3^{--} •N may be related to slow supply of nutrients to plants. These conclusions are agreed with those of Sud and Sharma (1999) and Kotbe, *et al.* (1995).

Table 9: Effect of integrated inorganic and organic n fertilizers, their rates and their interaction on Nitrate-nitrogen (NO_3^{--} •N) ppm in tuber potato at1st and 2nd years2011/2012 and 2012/ 2013.

Rates of nitrogen sources (%)		Organic Fertilizer types							
OF	MF	FYM	Chicken	Compost	Mean	FYM	Chicken	Compost	Mean
		2011/2012 season				2012/2013 season			
Zero	100	62	62	62	62.00	62	62	62	62.00
25	75	24.8	47.05	12.78	28.21	24.3	42.6	13.3	26.73
50	50	24.02	37	11.78	24.27	14	34.1	12.3	20.13
75	25	19.69	24.02	10.78	18.16	11.6	23.9	11.2	15.57
100	Zero	10.7	23.25	7.7	13.88	11.6	14.9	10.1	12.2
Mean		28.24	38.66	21.00		24.70	35.50	21.78	

LSD at 0.05 for:
Rates of N sources (NS): 0.06 0.07
Types of Organic Fertilizers (OF): 0.08 0.09
NS x OF: 0.14 0.15
OF : Organic Fertilizers
MF : mineral fertilizer (ammoniumnitrate33.5%)FYM : farmer yard manure

Organic nitrogen fertilizers effect:

Data in Table 9 illustrate the effect of organic nitrogen fertilizers on nitrate ion in potatotuber. The data showed significant effect in both seasons. Generally, the means values of nitrate ion were decreased by applied Comp fertilizer by 25.6 % and 45.7% than FYM and Ch manure respectively in 1st season. Similar trend was observed in the 2nd season where the mean values decreased by applied Comp fertilizer by 11.8 % and 38.6 % than applying FYM and CH manure, respectively. The obtained results were in accordance with the obtained by Worthington (2001), Hajšlová, et., al. (2005), Mohamed , *et al.* (2011).

The same previous Table indicate that the effect of interactions were significantly at 110 days. The addition of manure did not increase the NO_3^{--} •N level above those to be expected from similar quantities of inorganic sources

of N. These data indicate that greater NO,-N levels in the tubers was resulted by inorganic N fertilization. The levels of NO_3^{--} •N obtained in this study were not expected to contribute substantially to the methemoglobin- enmia health hazard. These results are agree with Carter and Bosma(1974.). Behrooz, *et al.* (2014) found that the application of mineral nitrogen fertilizer combined with manure resulted in lower amount of nitrate and also caused the highest percentage of protein.

Effect of Integrated of inorganic and organic Nitrogen fertilizers, their rates and their Interaction on protein % in tuber of potatoes at harvest at 1st and 2nd years 2011/2012 and 2012/2013:

Rates effect:

As shown in Table 10 application of N sources rates decreased the percentage of protein significantly in 1st and 2nd season. The means value of protein % decreased from 10.62 (100% MIN N) to 8.44, 7.52,6.77 and 5.83% at 1st season, whereas, it decreased from 10.37% (control) to 9.60, 6.94,6.73 and 5.83% at 2nd season with the applied rates following100%MIN +zero OF, 25%OF +75MIN, 50%OF +50MIN, 75%OF +25MIN, and 100% O F + zero MIN, respectively.

The highest mean values of protein % were observed due to100% MIN + zero O F in both 1st and 2nd season. The decreasing of protein by increasing O F rates may be due to slow release N of organic matter during its decomposition process. **Schulz (2000)** showed that mineral fertilizers in comparison with the organic fertilizer (cattle manure) increased both the potato yield and the protein content.

Organic nitrogen fertilizers effect:

Data in Table 10 reveal that the means value of protein % increased significantly with CH manure as organic nitrogen fertilizer addition in both seasons when compared with other organic N fertilizers FYM and Comp.

Table 10: Effect of integrated inorganic and organic N fertilizers, their rates and their interactions on protein % in tuber of potatoes at harvest at1st and 2nd years2011/2012 and 2012/ 2013.

Rates of nitrogen sources (%)		Organic Fertilizer types							
OF	MF	FYM	Chicken	Compost	Mean	FYM	Chicken	Compost	Mean
		2011/2012 season				2012/2013 season			
Zero	100	10.62	10.62	10.62	10.62	10.37	10.37	10.37	10.37
25	75	7.87	10	7.44	8.44	9.81	9.81	9.19	9.60
50	50	7.44	8.12	7.0	7.52	6.75	7.94	6.12	6.94
75	25	6.56	7.44	6.31	6.77	6.12	7.94	5.5	6.73
100	Zero	5.69	7.44	4.37	5.83	5.5	6.5	5.5	5.83
Mean		7.64	8.82	7.15		7.71	8.51	7.34	

LSD at 0.05 for:
Rates of N sources (NS): 0.02 0.02
Types of Organic Fertilizers (OF): 0.02 0.02
NS x OF: 0.04 0.04
OF : Organic Fertilizers
MF : mineral fertilizer (ammoniumnitrate33.5%)FYM : farmer yard manure

The difference between the three organic nitrogen fertilizers was significant in 1st and 2nd season. The mean values of protein increased in 1st season from 7.15 % (Comp) to 8.72% (CH), 7.64% (FYM) and from 7.34% (Comp) to 8.51 (CH), 7.71 in 1st and 2nd seasons, respectively. The positive effect of CH manure application than other N sources may be due to that, it has the highest percentage of N which is the main constituent of all the amino acids and hence of proteins (Marchner, 1995). The obtained results are also in agreement with Mazur and Voites (1993), El-Gamal (1996) and Anabousi, *et al.* (1997) who found that tuber protein content increased with increasing N percentage.

Effect of Integrated of inorganic and organic Nitrogen fertilizers, their rates and their interaction on soil organic matter content (OM) % at 1st and 2nd years 2011/2012 and 2012/2013:

Rates effect:

Data in Table (11) revealed that the soil O F percentage % increased by increasing the rates of OF up to the highest rate (100% (N-OF) +Zero (N-Min) significantly. The means value of soil O Fcontent the highest rate of (100% N-OF +zero N-MIN) was 2.897% to 2.957% in both seasons. These results are in accordance with those reported by Eimhoit *et al.*, (2005),Monacoa *et al.*, (2008), Ahmed, *et al.*, (2011) and Sadaf and Khan (2011).

Table 11: Effect of integrated inorganic and organic N fertilizers, their rates and their interaction on soil organic matter content (OF) % at1st and 2nd year 2011/2012 and 2012/ 2013.

Rates of nitrogen sources (%)		Organic Fertilizer types							
OF	MF	FYM	Chicken	Compost	Mean	FYM	Chicken	Compost	Mean
		2011/2012 season				2012/2013 season			
Zero	100	0.52	0.52	0.52	0.52	0.67	0.67	0.67	0.67
25	75	2.8	2.8	0.9	2.167	1.78	2.54	0.79	1.703
50	50	2.9	2.9	1.6	2.467	2.02	2.61	0.99	1.873
75	25	3.23	3.55	1.6	2.793	2.03	3.76	1.16	2.297
100	Zero	3.27	3.62	1.8	2.897	3.6	3.97	1.3	2.957
Mean		2.544	2.678	1.284		2.02	2.698	0.982	

LSD at 0.05 for:
Rates of N sources (NS): 0.276 0.259
Types of Organic Fertilizers (OF): 0.356 0.335
NS x OF: 0.617 0.580
OF : Organic Fertilizers
MF : mineral fertilizer (ammoniumnitrate33.5%)FYM : farmer yard manure

Organic nitrogen fertilizers effect

The effect of application different organic nitrogen fertilizers on soil OF content is presented in Table (11) for both seasons. Data revealed that, applying CH, FYM or Comp was associated with an increase soil OF content

than the initial data of soil for both two seasons. The highest mean values soil OF content were 2.678 % and 2.698 % which obtained by applying CH manure for both seasons. This is may be due to the highest amount of organic matter in CH manure which was applied. It is clearly that, the difference between the mean values of soil OF content due to applying different organic nitrogen fertilizers was significantly. El-Fayomy and Hammad (2001) studied the effect of FYM on some hydro-physical properties of calcareous soil. They found that soil bulk density decreased by 6.7%, while, total porosity increased by 7.3% with application of FYM up to 20 m^3/fed, while soil hydraulic conductivity was increased by 15.2%. Also, availability of N, P and K was increased by 17.49, 75.51 and 13.57% respectively as affected by FYM application up to 20 m^3/fed. Abdel-Hamid, *et al.*, (2004) found that the compost of rice straw with poultry manure reached maturity in 90 days, also found that the addition of compost (20-200 g/pot) improved selected soil chemical (increased total N, total C and CEC), and physical properties (decreased particle density). Similar results were obtained by Ahmed, *et al.*, (2012) have also reported that the inclusion of manure in the fertilization schedule improved the organic carbon status and available N,P,K and S in soil, sustaining soil health.

Effect of Integrated of inorganic and organic Nitrogen fertilizers, their rates and their Interactions interactionson Bulk density (g cm^{-3}):

Rates effect:

As shown in data the application of OF rates decrease the values of bulk density highly significant with increasing OF rates as compared with control 100% Min + Zero O F in both seasons. The maximum decreasing of BD was 1.48 and 1.38 g cm^{-3} by applying rate of 100% O F + Zero mineral for both season, respectively. The effect of interactions OF rates (R)and N sources on bulk density of soil after harvest were insignificantly in both seasons. Generally, the values of BD were decreased with interactions as compared with control (zero OF and 100%MIN nitrogen). Where, the lowest values of BD were 1.46 g cm^{-3} for both FYM and Comp in 1st season and 1.26 g cm^{-3} for Comp treatment in 2nd season. This effect was similar with the obtained effect by Zein, *et al.* (1996),Sadaf and Khan (2011) and Ahmed (2013).

Table 12: Effect of Integrated of inorganic and organic Nitrogen fertilizers, their rates and their interactions on Bulk density (g cm^{-3}) at1st and 2nd year 2011/2012 and 2012/ 2013.

Rates of nitrogen sources (%)		Organic Fertilizer types							
OF	MF	FYM	Chicken	Compost	Mean	FYM	Chicken	Compost	Mean
		2011/2012 season				2012/2013 season			
Zero	100	1.7	1.7	1.7	1.7	1.69	1.69	1.69	1.69
25	75	1.52	1.69	1.5	1.57	1.52	1.67	1.39	1.527
50	50	1.5	1.66	1.48	1.533	1.46	1.61	1.37	1.48
75	25	1.48	1.64	1.48	1.48	1.43	1.6	1.28	1.437
100	**Zero**	1.46	1.52	1.46	1.48	1.33	1.55	1.26	1.38
Mean		1.532	1.642	1.524		1.486	1.624	1.398	

LSD at 0.05 for:
Rates of N sources (NS): 0.298 0.026
Types of Organic Fertilizers (OF): 0.0384 0.034
NS x OF: 0.066 0.058
OF : Organic Fertilizers
MF : mineral fertilizer (ammoniumnitrate33.5%)FYM : farmer yard manure

Organic nitrogen fertilizers effect

Data presented in Table 12 showed that the application of Comp as organic nitrogen fertilizers decreases the mean values of bulk density significantly as compared with FYM and CH in both seasons. The mean values of BD g cm^{-3} decreased from 1.64 g cm^{-3} to 1.53 g cm^{-3} and 1.52g cm^{-3} in 1st season and from 1.62 g cm^{-3}, 1.49 g cm^{-3} and 1.40 g cm^{-3} in 2nd season by applying CH, FYM and Comp treatments, respectively. The positive effect of compost on BD of soil may be related to its vegetal origin which has high effect on aggregate soil particles together which reflected on improving soil structure and reducing the BD of soil. These results are in accordance with those reported by El-Fayomy and Hammad (2001), El-Ghamry and El-Naggar (2001) and El-Sedfy, *et al.*, (2003), Hati *et al.*, (2006) and Ahmed (2013).

CONCLUSION

On the basis of the presented data and under the same of experimental conditions, data indicated that, the application of integrated inorganic and organic nitrogen fertilizers with certain rates are considered the best option not only for maximizing tuber potato yield, its quality and reducing the harmful effects of using nitrogenous chemical fertilizers, but also for sustaining soil fertility status. Moreover, the application of integrated inorganic and organic nitrogen fertilizers with rates leads to rationalize use of N-mineral fertilizer for the growing crop, which is surplus point for sustainable agriculture system.However, NO_3^{--} •N concentrations obtained by excess N fertilizer applications may contribute to the over- all health hazard of high NO_3^{--} •N level. This can be accomplished by applying recommended amounts of N fertilizer that are based on integrated inorganic and organic nitrogen fertilizers.

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تأثير بعض مصادر النيتروجين العضوي والكيماوي على محصول البطاطس النامية فى الأراضى الرملية المستصلحة حديثا

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أجريت تجربة حقلية بمنطقه الخطاطبه – محافظه المنوفيه – جمهورية مصر العربية لمدة عامين متتاليين خلال موسمين شتويين (2012/2011 . 2013/ 2012) تم فيها تقييم التكامل بين كل من التسميد المعدنى والتسميد العضوى واثر ذلك على انتاجية وجودة محصول البطاطس .

واستخدمت ثلاثة مصادر عضوية كأسمدة عضوية نتروجينية هى (السماد البلدى – سماد الدواجن - سماد الكمبوست) ، كما تم استخدام سماد نترات الأمونيوم كمصدر للنتروجين المعدنى ، بحيث يحقق اضافة الاسمدة العضوية والسماد المعدنى للنتروجين المعدل 120 وحدة نتروجين/فدان.

وكانت معاملات التجربة خمسة معاملات هى (100 % سماد معدنى + صفر سماد عضوى) ، (75%سماد معدنى +25% سماد عضوى) ، (50%سماد معدنى +50% سماد عضوى) ، (25% سماد معدنى +75%سماد عضوى) ، (100% سماد عضوى +صفر سماد معدنى).

وقد تم إضافة الأسمده العضوية دفعة واحدة قبل الزراعة فى حين اضيف السماد المعدنى على اربعة دفعات ، الدفعة الأولى بعد الزراعة بحوالى 15 يوم وتم إضافة الدفعات الثلاثة الأخرى بحيث يكون بين كل دفعة والأخرى 15 يوما .

أوضحت النتائج المتحصل عليها ما يلى:

أن خلط الأسمدة العضوية والمعدنية أدى إلى زيادة كل من طول النبات – عدد السيقان الهوائية – نسبة الكلوروفيل الكلى – تركيز النتروجين فى درنة البطاطس –والمحتوى البروتينى.

اعطت معاملة السماد المعدنى (100% سماد عضوى +صفر سماد معدنى) أعلى قيمة لانتاجية المحصول وأيضا أعلى قيمة لنسبة النترات فى الدرنات مقارنة بالمعاملات الأخرى التى تم بها إضافة نسب من السماد العضوى .

حققت المعاملة (75% معدنى + 25% سماد الدواجن) انتاجية مرتفعة من محصول البطاطس رغم كونها غير معنوية مقارنة بالسماد المعدنى 100 %.

يعتبر انخفاض محتوى درنات البطاطس من انيون النترات من النتائج الهامة المتحصل عليها من عملية التكامل بين التسميد العضوى والمعدنى نظرا للتاثير السيء للتركيز المرتفع من النترات فى درنات البطاطس على صحة الانسان.

من النتائج المتحصل عليها من التجربة يمكن الاشارة الى ان التطبيق العملى لهذا النمط من التكامل بين كل من التسميد المعدنى المصاحب للتسميد العضوى يعتبر من الاساليب الجيدة فى التسميد حيث يساعد على تحقيق اهداف عدة منها الحصول على إنتاجية مرتفعة لمحصول البطاطس ذات جودة متميزة اضافة الى تقليل الضرر الناتج من استعمال الأسمدة النيتروجينيه الكميائيه اضافة الى رفع خصوبة التربة المزروعة بمحصول البطاطس خاصة الرملية منها، هذا الى جانب ترشيد إستخدام الأسمدة المعدنية الكيميائية وهذا امر مرغوب.