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NEW APPROACH TO USE FARM WASTES AS A NITROGEN FERTILIZER SOURCE: RICE STRAW

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ABSTRACT

A lysimeter experiment was carried out in the year 2012 at Sakha Research Farm Kafr El-Shaikh Governorate. The experiment aimed to study the effect of integrated use of ammonium sulphate (AS-N) and aqueous rice straw extract (RSE-N) as nitrogen sources on the yield (quantity and quality) of jew's mallow and spinach crops in addition the quality of leached drainage water. Ammonium sulphate (AS-N) and (RSE-N) were combined in away to supply the recommended N-dose for experimental crops from both sources in (0:0) T1; (100:0) T2; (75:25) T3; (50:50) T4; (25:75) T5 and (0:100) T6 ratios arranged in a (RCB) design with three replicates. The results indicated that the highest jew's mallow fresh yield (1583 g lysimeter^{-1}) was recorded with (AS-N 50%) + (RSE-N 50%) treatment, while the highest spinach fresh yield (1405.66 g/liyzimeter) was obtained under T2 (100:0). On the other hand, the level of nitrate either in crop leaves or drainage water was greater in treatment with T2 (100:0) ratio. Nitrate content (NO_3-N) mg kg^{-1} in jew's mallow leaves reached 1.39 > 1.20 >1.16 >1.15 > 1.11 fold for treatments (100:0 AS-N), (75% AS-N +25% RSE-N), (100% RSE-N), 25% AS-N +75% RSE-N), and (50% AS-N + 50% RSE-N), respectively, compared to that under control T1 (0:0). For spinach leaves reached 4.15 > 2.57 > 2.43 > 2.09 > 1.77 fold for treatments (100:0 AS-N), (75% AS-N +25% RSE-N), 25% AS-N +75% RSE-N), (100% RSE-N) and (50% AS-N + 50% RSE-N), respectively. Under all fertilizer treatments, the content of nitrate in plant leaves or drainage water were lower than the published maximum permissible level to cause humans health hazard.

Keywords: rice straw extract; nitrate leaching, nitrate accumulation; Jews mallow; spinach.

INTRODUCTION

Maintaining and improving soil quality is crucial if the agricultural productivity and environment quality are to be sustained for future generation (Reeves, 1977). At present, the farmers used to use chemical fertilizers in great quantities to compensate the fertility of nutrients in the soils. Statistical data showed that mineral fertilizer consumption is growing rapidly in the developing countries (Hani and Pazira, 2010). Egypt and Turkey account for 75% of the fertilizer-N consumption in the near East (Singh *et al,* 1995). Excessive production application of mineral fertilizers may affect soil health and sustainable production. This condition certainly not only increase production cost but also reduce soil fertility and resulted in serious environmental consequences such as nitrate accumulation in water sources and food supplies (Anjana *et al*, 2007) and (Savel, 2012). Nitrates (NO_3^-) are one of the most soluble forms of nitrogen and form the weakest connection with soil particles, so it easily carried out by percolated irrigating water, (Milius and Baigys, 2001). Human is exposure to nitrate primary through diets and drinking water can cause methemoglobinemia (blue baby syndrome) in faints.

For this reason, nitrate regulated in public water supplies at maximum concentration level of 45 mg L^{-1} NO_3^- (about 10 mg L^{-1} NO_3-N) (Ward, 2008). Excessive amounts of nitrogenous fertilizer are applied to crops, considering that it is reasonable insurance against yield losses and their economic consequences. However, when input of nitrogen exceeds the demand, plants are no longer able to absorb it, and nitrogen then builds up in the soil, mostly as nitrate (Nosengo, 2003). This case imbalance of nutrients in the soil and increases the nitrate level in ground water supplies (NAAS, 2005) which influences the nitrate content in plant (Dapoigny *et al,* 2000), especially the leafy vegetables. Vegetables are the major source of the daily intake of nitrate by human beings, supplying about 72 to 94% of the total intake (Ward *et al*, 2005). In connection, (Cantliffe, 1973) stated that green leafy vegetables such as spinach generally contain higher levels of nitrate than other foods. High levels of nitrate in jews mallow and spinach can be responsible for cancer and methaemolobinemia in man (Musa *et al*, 2010).

There are various standard for maximum concentration of nitrate in vegetable. For instance European Union (EU) has suggested the maximum acceptable nitrate concentration as 3000 and 2500 mg kg^{-1} on fresh weight basis for vegetable crops harvested from Nov. 1st to March 31 st and from April 1st to Oct. 31 st , respectively, (Anonymous, 2005). World Health organization (WHO) has suggested consuming 400 gm a day of vegetables and fruits, (Hord *et al,* 2009). (Satamaria, *et al,* 1999) reported that the maximum amount of nitrate entering human body should not exceed 365 mg kg^{-1} of human body a day. However, a 70 kg individual should not consume more than 225 mg of nitrate a day. Therefore, was should critically try to decrease nitrate concentration to minimize amount, particularly for people who consume a lot of vegetable in their diets. Once again nitrogen fertilization has been identified as the major source that influences the nitrate content in plant, soil and drainage water. Therefore, it is important to adopt appropriate strategies management methods, optimize the use of fertilizer nitrogen in order to limit accumulation of nitrate in vegetables and reduce the potential degradation of soil and water sources. Environmental friendly products such as natural farm-waste product could be utilized as a fertilizer if suitable management have been applied. This means, resulting back to the soil all plant residues produced on the farm in the pest form possible, with which minimum loss and maximize stability of nutrients could be given. For instance straw is the only organic material available in significant quantities to most rice farmers, contain about 40% of the nitrogen (N), 30-35% of the phosphorus (P) and 80-85% of the potassium (K) and 40 to 50% of the sulfur (S), taken up by rice, remains in the vegetative plant parts at crop maturity, Dobermann and Fairhurst, (2002) added that the nutrient contents in rice straw (% of dry matter) being 5-8, 1.6-2.7; 14-20; 0.5-1.0 and 4.7of N, P, K, Si and S, respectively. Thus, the removal with 1 ton straw calculated as 5-8, 1.6-2.7, 14-20; 0.5-1.0 and 40-70 kg for the aforementioned compounds, respectively. In Egypt, there are about 0.63 million hectares (1.5 m. fed) cultivate with rice each year. This produce about 4 million tons of rice straw (average 6 ton ha^{-1}), (EEAA, 2008). Most farmers used to burn their straw yield at the end of rice seasons which is considered as the essential reasons for “Black Cloud” that sharouds Greater Cairo at the month of October every year (Bakker *et al*, 2009). Burning of rice straw resulted in loss of N (100%), P (25%) and K (20%) (Dobermann and Fairhurst, 2002). A considerable attention has been given to use rice straw in composting and feeding animals for being cheap and abundant, has (Abd Elhamid *et al*, 2004). Practically, there are three ways, by which rice straw being return to field as organic fertilizer, they are as straw itself, as straw compost and as straw ash, (Dobermann and Fairhurst, 2002). On the basis of rice straw analysis and available published data regarding the mass of straw production burnet annually in the fields the losses of plant nutrients were given. It was found that burning resulted in loss 24 x 10^3, 3,840 x 10^3, and 86,4 x 10^3 tons of N, P, and K respectively, which corresponds 119,073 x $10^{3,}$ 12,388 x 10^3 and 207,370 x 10^3 tons of ammonium sulphate (20.5%); super phosphate (P_2O_5 15.5%) and potassium sulphate (k_2O 50%) respectively. The price of these fertilizers was calculating as 140,487,600; 9,167,120; 788,006 LE for the three fertilizers, respectively, with total price 937,660,720 LE. It clearly illustrated the value of rice straw as a source of plant nutrients and show that it should not be wasted. Problems caused by this waste each year had pushed some researchers (Hamed *et al*, 2013) to come up with new ways to so called Rice Straw Extract and used it as organic nitrogen source to partly substitute the inorganic ones. Extending to that work the current one aimed to study:

The impact of addition rice straw extracts (RSE) either solely or in combination with the mineral nitrogen source (Ammonium sulphate (AS-N) on the yield (quantity and quality) of some leafy vegetable crops.

1. **The level of nitrate leached through the percolated water " drainage water"**
2. Calculated economic income of recycling rice produced in Egypt/year

MATERIALS AND METHODS

A lysimeter experiment was conducted during the agricultural year 2012, at Sakha- Agriculture Research Station, Kafr El-Sheikh Governorate. The current research was of commitment for food safety and the environmental sustainability of agriculture and came among basic and applicable strategies to reduce the risk of nitrate exposure due to increasing of vegetable consumption especially leafy crops. In addition to overcome the rice straw problem through utilizing its aqueous extract as organic N source (Hamed *et al*, 2013).

The used soil for lysimeter was collected around farm area. Some physical and chemical characteristics of the soil are shown in Table (1).

Lysimeters Preparation:

The lysimeters of 0.5 x 0.5 x 1 m capacity were filled with 0.1 m gravel followed by 0.05 m sand then covered by filter sheet to allow good drainage conditions for lysimeter. The drain water was collected via a drainage outlet near the bottom of each lysimeter

Table 1. Some chemical characteristics of original experimental soil at Sakha, Kafr El- Sheikh Governorate.

Characteristics	Value
Particle size distribution	
Sand%	3.0
Silt%	25
Clay%	72
Textural class	Clay
Chemical properties	
pH(1:2.5)	7.75
EC dSm^{-1}	1.93
Available NO_3, mg kg^{-1}	35.0
Available P, mg kg^{-1}	3.21
Available K, mg kg^{-1}	575.4
Available Cu, mg kg^{-1}	5.58
Available Fe, mg kg^{-1}	8.87
Available Mn, mg kg^{-1}	9.16
Available Zn, mg kg^{-1}	1.61

Preparation of the Aqueous Rice Straw Extract (RSE):

After harvesting rice crop, the straw was collected from the area around the current experiment, dried, chopped into about 5 cm pieces and then prepared as tea bags. Each bag was individually soaked in liter of tab water for 24 hours at room temperature in ratio of 50 g L^{-1} and then filtrated to obtain. The chemical composition of this rice straw and its extract are given in Table (2 and 3). What is called, Rice Straw Extract (RSE-N).

Table 2. Nutrients content of air dried rice straw.

Nutrients	%
N	0.5
P	0.08
K	1.80
Ca	0.24
Mg	0.08
Si	6.30

Table 3. Some characteristic of the aqueous rice straw extract.

Components	Value
Total nitrogen% (T.N%)	0.460
Soluble nitrate% (NO_3^- N %)	0.004
Soluble ammonium% (NH_4^+%)	0.008
FAA%	1.33

FAA means: free amino acids

N-Fertilizer Source Treatments:

Ammonium sulfate 20.5% (AS-N) and rice straw extract (RSE-N) were combined in a way to supply the recommended N-dose (20.5 and 51.25 kg-N fed^{-1} of tested crops): jew's mallow and spinach), respectively, from both sources in different ratio, i.e. 0:0 (T1), 100:0 (T2), 75:25 (T3), 50:50% (T4), 25: 75 (T5) and 0: 100 (T6) ratio. The treatments were arranged in a randomized complete block design with three replicates. A basal dose of P and K for tested crops were applied to each treatment uniformly at the time of sowing.

Planting and Sampling

Jew's mallow (*Corchorus olitorus*) and spinach (*Spinaciao leracea*) seeds were cultivated on 13th June and 20th November 2012, respectively. Rice straw extract (RSE-N) as organic- N fertilizer source, and ammonium sulfate (AS-N), as mineral N source was uniformly in relevant treatment lysimeter at two spilt doses, the first after two weeks, and the second after one month from planting. Irrigation and other cropping activates were carried out as practiced in the area.

Leached (drainage water) was collected after each irrigation; the volume was recorded saved in ice-box and immediately transported to laboratory for nitrate analysis. At harvesting, 60 days from planting of both vegetable crops, the total fresh yield of each lysimeter was recorded using a digital balance. Tender a crisp crop leaves were harvested for nitrate analysis based on fresh weight.

Analytical Methods

The drainage water samples, after each irrigation were transferred immediately to the laboratory and nitrate content was determined using the copper zed cadmium reduction method as described by Keeney and Nelson, (1982). Some physical and chemical characteristics of the studied soils were determined according to (Page *et al*, 1982). Phosphorus was determined spectrophotometrically via vanadomolybdate yellow method and K was determined using flame photometer according to Jackson, (1973). Total nitrogen in the rice straw was determined by semi-micro Kjeldahl method (AOAC, 1970). Nitrate was determined in the soil and plant extracts according to Singh, (1988). All data were statistically analyzed using Mstat computer program according to procedures outlined by Snedecor and Cochran, (1980), and the means were compared using LSD test at 5% level.

RESULTS AND DISCUSSION

a)Yield of Jew's Mallow and Spinach As Affected by Mineral (AS-N) and Rice Straw Extract (RSE-N) Nitrogen Fertilizers:

Data in Table (4) show that all fertilizer treatments significantly increased fresh yield of jew's mallow and spinach compared with control T1 (0:0). Under both crops different trends of fresh yield increments were recorded. For jew's mallow, the maximum fresh yield of 1583 g lysimeter^{-1} was obtained under treatment T4 receiving from mineral source (AS-N) combined with organic source (RSE-N) in 50:50 ratio, followed by those the same in T3 (75:25); T5 (25:75); T2 (100:0) and T6 (0:100) ratio. Excluding T4 (50:50) ratio no significant increase in fresh weight in between the other ones. This indicates the yield of jew's mallow was more in response to combined application of mineral (AS-N) and rice straw extract (RSE-N) contributing in (50:50) ratio. Rice straw extract alone T6 (0:100) ratio was not supporting higher yield compared with that receiving the mineral one, T2 (100:0). In this connection (Zaki *et al,* 2008) on sweet pepper found that the highest vegetative growth and total yield were obtained by applying 50 % organic-N + 50 % mineral-N, as compared with the full dose of nitrogen either as mineral or organic form. In this regard (Shams *et al,* 2013), who reported that the best lettuce yield components were obtained with using combination of mineral, organic and bio-fertilizers (50% mineral+50% organic+ biofertilizers). (Shaheen *et al,* 2012) reported that the higher yield of most crops was given with combined application of organic and inorganic fertilizers. In addition, (Mohammadi *et al*, 2013) found that application of natural and biological fertilizers along with urea can be useful to enhance potato yield and quality.

Regarding spinach fresh yield produced under N source and combination ratio treatment, Table (4) different trend compared to that under jew's mallow was exhibited. As the maximum fresh weight of 1406 g liyzimeter^{-1} was obtained under treatment T2 (100:0) followed by T3 (75:25); T4 (50:50); T5 (25:75); T6 (0:100) ratio of (AS-N) and (RSE-N) N source, respectively. This indicates that the spinach yield production was more announced under 100% mineral N source (AS-N) and reduced gradually win increasing the level of organic one (RSE-N) in the combined fertilizer application. This is mainly due to the wither condition, as spinach is a winter season crops with which the release and availability of N fertilizer from organic sources being slow compared with mineral N source. That may not always much the need of plant, but combined use of chemical and organic N-fertilizer sources can correct any deficit. These findings are in agreement with (Vyas *et al*, 1997), (Negi and Mahjan, 2000) ; (Mohamed and Haridiy, 2011); (Safaa *et al*, 2011) and (Shahen *et al*, 2012). Farther more the role of organic-N source in increasing vegetable crops yield being attributed to the supply of more other essential elements such as given in Table (2).

Table 4. Effect of N fertilizers source on Jews mallow and Spinach fresh yield

Treatments			**Jew's mallow**	**Spinach**
No	**AS-N %**	**RSE-N %**	**F.W (g lysimeter^{-1})**	**F.W (g lysimeter^{-1})**
1	0	0	1007 c	419.5 d
2	100	0	1355 b	1406 a
3	75	25	1498 ab	1170 ab
4	50	50	1583 a	1099 b
5	25	75	1399 ab	730.2 c
6	0	100	1347 b	503.1 cd
LSD, 0.05			204.4	258.1

Means of each column with different letters are significantly different at P≤0.0
Recommended dose N units for jew's mallow = 20.5
N units for spinach = 51.25

b). Nitrate Accumulation In Jew's Mallow And Spinach Leaves

Data of NO_3-N content in jew's mallow and spinach leaves as affected by various N-source are illustrated in Table (5). It could be noticed that there was a positive relation between percent of AS-N ratio in the added N dose and NO3-N content in jew's mallow and spinach plant leaves. In jew's mallow, the levels of NO_3-N content reached 1.39 > 1.20 >1.16 >1.15 > 1.11 fold compared to that under control for treatment (100:0 AS-N), (75% AS-N +25% RSE-N), (0:100 RSE-N), 25% AS-N +75% RSE-N, and 50% AS-N + 50% RSE-N, respectively. For spinach, 4.15 > 2.57 > 2.43 > 2.09 > 1.77 fold compared to that under control for treatment (100:0 AS-N), (75% AS-N +25% RSE-N), (25% AS-N +75% RSE-N), (0:100 RSE-N) and (50% AS-N + 50% RSE-N), respectively. Results indicated that NO3-N concentration was higher in plants fertilized by fast release fertilizers (AS-N) than the slow release one (RSE). Such differed trends may be attributed to varietal influence and the experimental conditions particularly the prevailing weather. In this respect, (Maynard and Barker, 1972) stated that the accumulation of nitrate in plants depends on their genetic characteristics, nitrogen supply or methods of application, light intensity, photoperiod, temperature or water supply. This could be attributed to the high available N release from the fast release fertilizers, increasing the rate of N uptake by plant than its assimilation rates which result the accumulation of N soluble form in the plant tissues. This was in accordance with the finding of Schuphan *et al* , (1968) and Muramoto, (1999) as they demonstrated that the use of slow release fertilizers could significantly lower NO3-N accumulation in plant. Several cited literatures are referred to the potency of the combination of mineral and organic fertilizers in reducing NO_3^- levels in different vegetable crops e.g. (Vogtmann *et a,* 1993) with cabbage, (Ahmed *et al,* 2000) with jew's mallow and radish and (Williams, 2002) with leafy vegetables. (Samih *et al*, 2010) reported that the chemical fertilizers resulted in the highest levels of nitrate content with 1721 and 1600 mg kg^{-1} in spinach petioles and leaves, respectively. Generally, mean of nitrate detected in both jew's mallow and spinach leaves in Table (5) were lower than the maximum limits established by European Union (EU) Standard of 2500 mg kg^{-1} (as harvested 1 April to 30 September) and 3000 mg kg^{-1} as harvested 1 October to 31 March as well, (European Food Safety Authority, 2008).

Table 5. Effect of N- Fertilizers Combination on Nitrate Accumulated in Jew's Mallow and Spinach Leaves

Treatments			NO3 mg kg^{-1} fresh weight	
No	**AS-N %**	**RSE-N %**	**Jew's mallow**	**Spinach**
1	0	0	616.12 b	310.65 d
2	100	0	853.94 a	1288 a
3	75	25	738.22 ab	799.3 b
4	50	50	685.86 ab	550.4 c
5	25	75	710.32 ab	757.9 bc
6	0	100	714.41 ab	650.7 bc
LSD, 0.05			224.02	222.4

Means of each column with different letters are significantly different at P≤0.05

d).The Effect of Various N-Source Treatments on Nitrate (NO_3-N) Leaching and Drainage Water Pollution.

Nowadays, human being aware of harmful effects on the environmental of the use of nitrogenous fertilizers, one of the most important parameter of the pollution of water is nitrate which is basic component of fertilizer. Nitrate in drinking water are often the result of contamination of ground water by fertilizer and human wastes. Data of NO_3 concentration in the leached water under both vegetable crops showed variable response to different fertilizer treatments (Table 6). The NO_3 concentration in the leached water was significantly ($p< 0.05$) greater for fertilized treatment than the control one, with almost similar trend under both vegetable crops. It was found that the maximum NO_3 concentration of 8.14 and 10.24 mg L^{-1} was found in T2 (100% AS-N) followed by that of T3 to T6 for jew's mallow and spinach, respectively. The obtained data reveled that combination of organic (RSE-N) and inorganic (AS-N) resulted decrease the level of NO_3 leached out with percolated water (drainage water) compared with the single mineral N (100% As-N) application. The slow wash of organic fertilizers being due to their mineralization is slow and hence water contamination with nitrogen compounds is smaller. These findings are in agreement with (Mohammadi *et al*, 2013). Under our experiment condition, the mean of nitrate concentration in leached water of all fertilizer treatments were far less than the recommended maximum limit for drinking water, with which no human health problems could be expected.

Table 6. Effect of N- Fertilizers Combination on Nitrate Content in the Drainage Water Under Jew's Mallow and Spinach crops

Treatments			mg NO_3 L^{-1}	
No	**AS-N %**	**RSE-N %**	**Jew's mallow**	**Spinach**
1	0	0	1.96 e	1.33 f
2	100	0	8.26 a	10.26 a
3	75	25	7.04 b	7.87 b
4	50	50	5.83 c	6.56 c
5	25	75	4.86 d	5.93 d
6	0	100	4.05 d	5.20 e
LSD, 0.05			0.871	0.616

Means of each column with different letters are significantly different at P≤0.05

e). Rice Straw from the Stand Point of the Economical Sight:

Rice is one of the most abundant crops in Egypt, about 1.5 million feddan (EEAA, 2008), with an average production of about 4 tons fed^{-1} of both grain and straw. The total rice straw production amounted as (4 x 1.5 x 10^6) 6.0 million tons. About 20% (1.2 m ton) was used for other purposes such as, ethanol, paper and fertilizer production as well as fodders (El-Gamal and Shakour, 2001) and the remaining part (4.8 m ton^{-1}) was left in the fields for burning. The resulting emissions significantly contribute to the air pollution called "Black Cloud". Data of rice straw analysis (Table 2) reveals that such residues are good sources of plant nutrients and are important compounds for the stability of a agricultural ecosystem. Assuming rice straw to contain 0.5 % N, 0.08 % P and 1.8% K, and assuming the annual production of rice straw, left behind 4.8 m ton, rice straw will contain 24 x 10^3, 3.840 x 10^3, and 86.4 x 10^3 tons of N, P, and K respectively, which corresponds 119.073 x $10^{3,}$ 12.388 x 10^3 and 207.370 x 10^3 tons of ammonium sulphate (20.5%); super phosphate (P_2O_5 15.5%) and potassium sulphate (k_2O 50%) respectively. The price of these fertilizers was calculated and given in Table (7) as 140,487,600; 9,167,120; 788,006,000 LE for three fertilizers, respectively with total price 937,660,720 LE.

Accordingly we can say:

1. Do not burn the rice straw because it is a source of N, P, K and other nutrients
2. Rice straw could be the diamonds of future if it is used for new voluble applications.
3. Up till now there are three basic ways by which rice straw can be returned to the field. They are as straw itself as straw compost and as straw ash. The finding methods for quick decomposition of straw are important. The results of current work proved that adding the aqueous extract of rice after planting crops is a way of circumventing the problems associated with the decomposition of straw.

Table 7. Calculated Amount (ton) and Price (LE) of Fertilizers NPK Losses Through Burning.

Fertilizer	**Total (ton)**	**Price ton^{-1} (LE)***	**Total price (LE)**
Ammonium sulphate (20.5%N)	119,073	1200	140,487,600
Potassium sulphate (50% K)	207,370	3800	788,006,000
Super Phosphate (15.5% P)	12,388	740	9,167,120
Total money (LE)			937,660,720

- **Grace Mena. Egypt. Elneshwy. Prices of Agric. Fertilizers. Http:/.gracemena_elneshawy.com. /indix.php?page=Subj_Price**

CONCLUSION

Application of nitrogen fertilizers influences the nitrate concentration in the edible parts of jew's mallow and spinach leafy vegetable crops. The results show that the providing both crops with a combination (50:5 0 %) mineral (AS-N) and liquid fertilizer (RSE-N) are superior in terms of yield production nitrate contamination of percolated drainage water as well.

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اتجاه مستحدث لاستخدام مخلفات المزرعة كمصدر للسماد النيتروجينى (قش الأرز)

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أجرى هذا البحث لدراسة تأثير مستخلص قش الارز كمصدر للنتروجين العضوى جنبا الى جنب للأسمدة النيتروجينة المعدنية على مستوى تراكم النترات فى نبات الملوخية والسبانخ والتربة ومياة الصرف وأجرى البحث خلال عام 2012 فى الايزميترات بمحطة بحوث سخا بكفر الشيخ. وكانت المعاملات المقررة , 100% نيتروجين معدنى كنترول , 100% مستخلص قش الأرز , 75% نيتروجين معدنى + 25% مستخلص قش الارز, 50% نيتروجين معدنى + 50% مستخلص قش الأرز , 25% نيتروجين معدنى +75% مستخلص قش الأرز, بدون أى أضافة للأسمدة.وقد تم تصميم التجربة فى تصميم كامل العشوائية بثلاث مكررات.

ويمكن تلخيص أهم النتائج فيما يلى :

1- أظهرت المعاملات تأثير معنوى على الوزن الطازج لكل من نبات الملوخية والسبانخ, وكان أعلى محصول وزن طازج للملوخية ($1583g\ lysimeter^{-1}$) (13.3 طن للفدان) سجل للمعاملة 50% مستخلص قش الأرز+ 50% نيتروجين معدنى بينما كان اعلى محصول وزن طازج للسبانخ ($1405.66g\ liyzimeter^{-1}$) 11.81 طن للفدان سجل للمعاملة (100% نيتروجين معدنى).

2- مستوى تراكم النترات فى الاوراق لكل من الملوخية والسبانخ سجل أقل تراكما للمعاملات الخليط من 50% من مستخلص قش الأرز و50% النتروجين المعدنى اذا ماقورنت بالتسميد 100% نتروجين معدنى هى تمثل مستوياأقل من 2500 ملليجرام لكل كيلوجرام كمستوى مسموح به فى أوراق الخضروات تبعا للأتحاد الاوربى.

3- أوضحت النتائج أن مستوى النترات فى مياة الصرف تحت نبات الملوخية والسبانخ كانت أعلى فى معاملة التسميد المعدنى بالمقارنة بمستوى النترات فى مياة الصرف تحت معاملة (100% نيتروجين معدنى).

ويمكنا أن نستخلص من النتائج الموضحة سالفا أن أضافة مستخلص قش الأرز بمستوى 50% + 50% من كبريتات الامونيوم أدى الى تأثير ايجابى فى خفض مستوى النترات فى أوراق نباتى الملوخية والسبانخ وكذلك فى مياه الصرف الامر الذى يؤدى الى الحفاظ على البيئة من التلوث , بالأضافة الى وقاية صحة الأنسان من التلوث بالنترات.