Research Journal of Biological Sciences 7 (6): 255-259, 2012
ISSN: 1815-8846

Effect of Azolla Compost and Nitrogen on Yield and Components Yield Rice (*Oryza sativa*) in North of Iran

[1]Z. Changiz-Dalivand, [1]M. Ashouri and [2]T. Razavipur
[1]Department of Agronomy, Lahidjan Branch, Islamic Azad University, Lahidjan, Iran
[2]Rice Researches Institute, Rasht, Iran

Abstract: In order to assess the effect of Azolla compost and Nitrogen on yield and yield component of *Oryza sativa*, an experiment in factorial format based on randomized complete block design with 3 replications in Iran's Rice Research Institute (Rasht township) in 2011 was conducted. Experiment factors include chemical fertilizer on 3 levels (control, 40 and 80 kg ha^{-1} nitrogen) and organic fertilizer on 4 levels (control, 2.5, 5 and 7.5 ton ha^{-1} Azolla compost) based on dry weight. Results indicated that using of Nitrogen fertilizer and Azolla compost rate had a significant effect on the grain yield, thousand grains weight, plant height, number of panicle and number of tiller. Also in this experiment determined that interaction effects of Nitrogen fertilizer and Azolla compost is significant only on the number tiller.

Key words: Rice, Azolla compost, Nitrogen fertilizer, yield, yield components

INTRODUCTION

Despite many developments that occurred during the past decade, food crisis has continued in the world yet. This is particularly significant in areas where populations are increasing rapidly (Guttman and Gregory, 2002). Rice is considered as a key component of global food security so that it is main part of daily diet for >3 billion people especially in Asia. Organic and animal manure fertilizers were common before of 1940s in Iran and many farmers using of chemical fertilizers know as unlawful and refrain its using. But many advertisements caused to use of chemical fertilizer by some farmers was extremist and forgot its effect on bioenvironmental pollution and in other words forgot organic animal manure and green fertilizers (Malakoti, 1996). Applications of Nitrogen fertilizers are responsible for emissions of green house gases like nitrous oxide (N_2O) and ammonia (NH_3). Besides supplying nitrogen, ammonia can also increase soil acidity. Excessive nitrogen fertilizer applications lead to pest problems by increasing the birth rate, longevity and overall fitness of certain pests (Jhan, 2004; Jahn *et al*., 2005). Rice absorbs chemical elements from soil but often absorbed rates from soil are not efficient for improved growing. So thus by use types of fertilizers, supplies rice food need and with correct using organic, animal manure and chemical fertilizers supplies rice needed elements (Polthanee *et al*., 2008). Nitrogen is very essential for the growth and development of crops. It enhances biomass and seed yield subject to the efficient water supply. Lack of N results stunted growth, pale yellow color, small grain size and poor vegetative as well as reproductive performance. Nitrogen is an essential component of amino acid and related protein of the plant structure. Growth of plants primarily depends on nitrogen availability in soil solution and its utilization by crop plants during growth and development. Today, using organic materials are not desirable in this data bases. In one hand, excessive use of chemical fertilizers also may cause environmental problems. Recent research has shown that supplying required nutrient factors for cultivated plants by using organic fertilizers can play a key role in maintaining soil fertility and agricultural sustainability (Erhat *et al*., 2005; Sing and Sherma, 2000). Paying attention to positive effect of organic materials on soil fertilizing, the consumption of these materials was considered so that the optimum management of organic materials was called as the heart of sustainable agriculture (Stevenson, 1994). Along this, a worthy point may be that >80% of agricultural land in Iran is dry and mid-dry lands. Due to insufficient attention to importance of organic materials in agricultural lands, the level of using this materials are low in the country and it leads to significant decreasing in soil fertility. Organic material provides the nutrient elements as well as intensifying the biological activities help better food cycle. In one hand, using organic materials in soil cause better physical situation for soil and in return it help plant to grow well (Stevenson, 1994).

Corresponding Author: Z. Changiz-Dalivand, Department of Agronomy, Lahidjan Branch, Islamic Azad University, Lahidjan, Iran

Today, due to using chemical fertilizer too much, the organic material was decreased in Iran and the soil texture become hard and undesirable (Maramati *et al*., 2007). Animal manures, compost and city garbages are the best alternatives for chemical fertilizers and can significantly impact on improving the physical and chemical features of soil and increase their activities. The present study aimed to investigate the effect of Azolla compost and nitrogen fertilizer on yield and yield components of rice in Guilan.

MATERIALS AND METHODS

The experiment was conducted in 2011 at Rice Research Institute of Iran, Guilan province located in the North of Iran at the rice cultivation season. The 1st factor of nitrogen was from urea resource in three levels (control, 40 and 80 kg ha^{-1} nitrogen) and the 2nd was organic fertilizer on 4 levels (control, 2.5, 5 and 7.5 ton ha^{-1} Azolla compost) based on dry weight. In late February, 1st plough and in early May main field after 2nd plough polished and after that administered plan conducted. Sowing in nursery in late April conducted and seedlings after 3-4 leaves transferred in early June to main field variety used was Hashemi, widely cultivated in Guilan province. Healthy and smooth rice seedlings in 20*20 distances with 4 seedlings per hill selected. A sampling had been done from the depth of 0-30 cm in order to measure the amount of nitrogen and other nutrient elements. The operation for selecting treasury land was done several days before wetting and seed germination; it was similar to operation for preparing the original land and includes plowing, disc and toweling. Before plowing, the amount of 100 kg in hectare the triple superphosphate and potassium sulfate fertilizers were added to the soil (with respect to phosphate and potassium contains in tested soil). Nitrogen was added to the soil 2 times, 75% after transplant and 25% at the time of maximum tiller.

RESULTS AND DISCUSSION

Grain yield: Variance analysis results (Table 1) indicated that grain yeild was significantly affected by Nitrogen and Azolla compost levels. Maximum grain yield (3353.03 kg ha^{-1}) was obtained of in case of treatment A3N3 (80 kg ha^{-1} nitrogen with 5 ton ha^{-1} Azolla compost) followed by the treatment A4N3 (80 kg ha^{-1} nitrogen with 7.5 ton ha^{-1} Azolla compost) which yielded 3411.08 kg ha^{-1} and was at par with each other. The lowest grain yield (1765.23 kg ha^{-1}) was observed by the treatment A1N1 (no nitrogen and organic fertilizer). Research report of Politanee also indicated that organic fertilizers using causes rice yield increasing. Many researchers studies results as this experiment results show that rice grain yield significantly is affected by organic and chemical nitrogen fertilizer rate and type (Islam *et al*., 2008; Razavipour and Ali, 2006) (Fig. 1 and 2).

Number of panicle: Grain yield in cereals depends on any plant fertilized tillers. Number of panicle (barer tillers) in area unit depends on plant density, plant tillering properties and soil fertility. The data (Table 1) indicated that there was significant difference among treatments under test. Maximum number of panicel was produced in case of treatment A4N3 (80 kg ha^{-1} nitrogen with 7.5 ton ha^{-1} Azolla compost). The other treatments produced significantly lesser number of panicel. Also in this experiment determined that interaction effects of rates chemical fertilizer and Azolla compost on the number of panicle was no significant (Table 2).

The productivity of rice plant is greatly dependent on the number of productive tiller (tillers which bears panicle) rather than the total number of tillers. In present investigation maximum number of fertile tillers and spikelet per panicle were observed in the all the treated plants. If

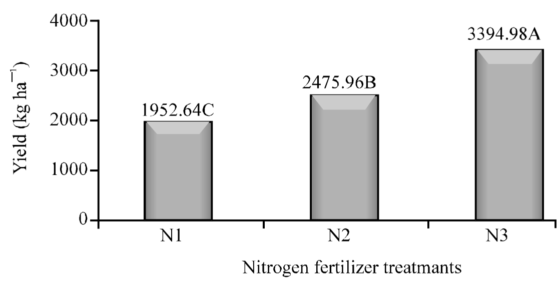

Fig. 1: The effect of amounts of chemical nitrogen fertilizer on rice grain yield

Table 1: Analysis of variance yield and yield components

		Mean square				
SOV	df	Yield	Plant hight	No. of panicel	No. of tiller	1000-grain weight
Replication	2	93527.556	336.712	18845.312	47.396	6.831
Nitrogen	2	6397610.960**	47.227**	2826.562**	859.896**	1.023**
Azolla compost	3	211619.490*	3.039**	164.618**	202.546^{NS}	0.084**
Nitrogen*Azolla compost	6	27776.980^{NS}	0.176^{NS}	21.007^{NS}	2440.220**	0.007^{NS}
Estandard error	22	43905.990	0.766	32.434	74.100	0.008

*and** respectively significant at 5 and 1%

Table 2: Yield and yield components as affected by different nitrogen and Azolla compost levels

Treatments	Yield	Plant hight	No. of panicel	No. of tiller	1000-grain weight
Nitrogen					
N1	1953.64C	120.78C	163.75C	174.79C	21.33C
N2	2476.96B	122.90B	173.12B	218.33B	2165B
N3	3394.98A	124.74A	193.75A	233.12A	21.97A
Azolla compost					
A1	2407.84B	122.22B	171.94B	198.61A	21.13C
A2	2582.16AB	122.51AB	174.44B	205.83A	21.56BC
A3	2673.87A	122.95AB	178.61AB	208.05A	21.83AB
A4	2767.59A	123.55A	182.50A	209.16A	21.33A
A1N1	1765.12C	119.90G	161.66G	195.00DE	21.13D
A1N2	2206.32ABC	122.35CDE	167.50G	228.33BC	21.56ABCD
A1N3	3253.45ABC	124.33AB	186.66CD	172.50FG	21.83ABC
A2N1	1943.02BC	120.34FG	163.33G	182.50EF	21.33CD
A2N2	2420.35ABC	122.68CD	169.16FG	198.33D	21.63ABCD
A2N3	3383.15ABC	124.50A	190.83BC	236.66AB	21.90AB
A3N1	1978.27ABC	121.07EFG	164.16G	162.50G	21.36BCD
A3N2	2511.75A	122.85BCD	175.83EF	214.16C	21.66ABCD
A3N3	3353.60ABC	125.00A	195.83AB	247.50A	21.93A
A4N1	2124.16ABC	121.78DEF	165.83G	159.16G	21.50ABCD
A4N2	2767.23AB	123.74ABC	180.00DE	232.50AB	21.73ABC
A4A3	3411.45A	125.15A	201.66A	235.83AB	22.00A

Within each column, means followed by the same letter do not differ significantly at $p<0.05$; Where as N1 (control), N2 (40 kg ha^{-1} nitrogen), N3 (80 kg ha^{-1} nitrogen) are nitrogen on 3 levels and A1 (control), A2 (2.5 ton ha^{-1} Azolla compost), A3 (5 ton ha^{-1} Azolla compost) and A4 (7.5 ton ha^{-1} Azolla compost) are 4 leveles of Azolla compost applied

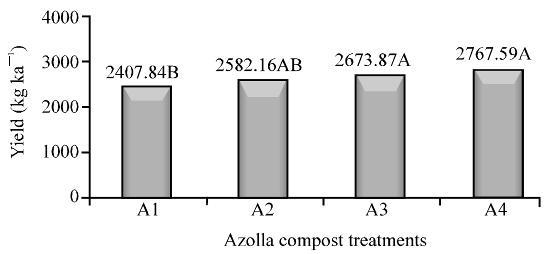

Fig. 2: The effect of amounts of Azolla compost on rice grain yield

researchers can supplement it from organic manures which also help in providing essential micronutrients to the plants (Belefant-Millera, 2007; Rakshit *et al*., 2008). Hasanuzzaman *et al*. (2010), Islam *et al*. (2008) and Lampayan *et al*. (2010) also reported similar results in rice.

Number of tiller: Nitrogen and Azolla compost levels significantly affected number of tillers/m^2. Maximum number of tillers/m^2 was produced in case of treatment A3N3 (80 kg ha^{-1} nitrogen with 5 ton ha^{-1} Azolla compost) 247.500 which were statistically at par with A2N3 (80 kg ha^{-1} nitrogen with 2.5 ton ha^{-1} Azolla compost) 236.67, A4N2 (40 kg ha^{-1} nitrogen with 7.5 ton ha^{-1} Azolla compost) 232.50 and A4N3 (80 kg ha^{-1} nitrogen with 5 ton ha^{-1} Azolla compost) 235.83. The other treatments produced significantly lesser number of tillers/m^2. Different Azolla compost levels along its type was no significant on number of tillers/m^2.

Tillering is an important trait for grain production and is thereby an important aspect in rice yield. Hasanuzzaman *et al*. (2010) reported increase in number of tillers in rice plants due to influence of different fertilizer combinations. According to them, more number of tillers per square meter might be due to the more availability of nitrogen which plays a vital role in cell division. Organic sources offer more balanced nutrition to the plants, especially micro nutrients which positively affect number of tiller in plants (Belefant-Millera, 2007). Similar results were reported by Islam *et al.* (2008) and Siavoshi *et al.* (2011).

1000-grain weight: Thousand grains weight is the most important components in rice yield that is genetic property and different in types that its rate is not affected by environmental and agricultural agents (Kalita *et al*., 1995). The 1000-grain weight was affected significantly with different nitrogen and Azolla compost levels. Maximum 1000-grain weight (22 and 21.93 g) were produced by the treatments A4N3 and A3N3, respectively which was statistically at par with each other. The other treatments produced significantly lower 1000-grain weight. The increase in biological and grain yield could be due to the increase in yield attributes (plant height, number of productive tillers/hill, panicle weight and 1000-grain weight) consequently (Ebaid and El-Refaee, 2007). The increase in grain yield components can be due to the fact that available more water enhanced nutrient availability which improved nitrogen and other macro- and micro-elements absorption as well as enhancing the production and translocation of the dry matter content from source to sink (Ebaid and El-Refaee, 2007). Salem (2006) reported that application of FYM along with nitrogen fertilizer significantly increased number of panicles persquare meter, panicle length, panicle weight, number of filled grains/panicle, 1000-grain weight and grain yield in rice. Similar results were reported by Hasanuzzaman *et al.* (2010), Siavoshi *et al.* (2011), Ghoneim (2008) and Chaturvedi (2005).

Plant height: It is obvious from the results (Table 1) that there were significant differences among various treatments under test. Maximum plant height (125.15, 125 and 124.50 cm) were produced by the treatments A4N3, A3N3 and A2N3, respectively which was statistically at par with each other. Minimum plant height (119.9 cm) were produced under the treatment A1N1. Same results about that observe in Islam *et al.* (2008) and Nahvi *et al.* (2005) studies.

CONCLUSION

From the discussion, it is clear that organic fertilizer have a significant influence on growth and productivity in rice. Organic fertilizer can be a better supplement of inorganic fertilizer to produce better growth and yield. All the treatments showed significant influence on growth and productivity of rice. Form the present study, it appears that good harvest can be achieved by the application of 80 kg ha^{-1} nitrogen with 5 ton ha^{-1} Azolla compost. From the economic point of view farmers can use the combination of Azolla compost and reduced rate of chemical fertilizers to boost the yield of rice as well as to maintain and improve soil health.

REFERENCES

Belefant-Millera, H., 2007. Poultry litter induces tillering in rice. J. Sustain. Agric., 31: 151-160.

Chaturvedi, I., 2005. Effect of nitrogen fertilizers on growth, yield and quality of hybrid rice (*O. sativa*). J. Cent. Eur. Agric., 6: 611-618.

Ebaid, R.A. and I.S. El-Refaee, 2007. Utilization of rice husk as an organic fertilizer to improve productivity and water use efficiency in rice fields. Afr. Crop Sci. Conf. Proc., 8: 1923-1928.

Erhat, E., W. Hartl and B. Putz, 2005. Biowaste compost arrects yield, nitrogen supply during the vegetation period and crop quality of agricultural crops. Eur. J. Agron., 23: 305-314.

Ghoneim, A.M., 2008. Nitrogen dynamics and fertilizer use efficiency in Rice using the Nitrogen-15 Isotope Techniques. Word Applied Sci. J., 3: 869-874.

Guttman, H. and R. Gregory, 2002. Developing Appropriate Interventions for Rice-Fish Cultures. In: Rural Aquaculture, Edwards, P., D.C. Little and H. Demaine (Eds.). CABI Publishing, New York, USA., pp: 15-29.

Hasanuzzaman, M., K.U. Ahamed, N.M. Rahmatullah, N. Akhter, K. Nahar and M.L. Rahman, 2010. Plant growth characters and productivity of wetland rice (*Oryza sativa* L.) as affected by application of different manures. Emir. J. Food Agric., 22: 46-58.

Islam, M.S., M.M. Akhter, M.S. Rahman, M.B. Banu and K.M. Khalequzzaman, 2008. Effect of nitrogen and number of seedling per hill on the yield and yield components of t. aman rice (brridhan 33). Int. J. Sustain. Crop Prod., 3: 61-65.

Jahn, G.C., L.P. Almazan and J. Papa, 2005. Effect of nitrogen fertilizer on the intrinsic rate of increase of *Hysteroneura setariae* (Thomas) (Homoptera: Aphididae) on rice (*Oryza sativa* L.). Environ. Entomol., 24: 938-943.

Jhan, G.C., 2004. Effect of soil nutrients on the growth, survival and fecundity of insect pests of rice: An overview and a theory of pest outbreaks with consideration of research approaches. Multitrophic interactions in soil and integrated control. Int. Organiz. Biol. Control, Bull., 27: 115-122.

Kalita, U., N.J. Ojha and M.C. Talukdar, 1995. Effect of levels and time of potassium application on yield and yield attributes of upland rice. J. Potassium Res., 11: 203-206.

Lampayan, R.M., B.A.M. Bouman, J.L. de Dios, A.J. Espiritu and J.B. Soriano *et al*., 2010. Yield of aerobic rice in rainfed lowlands of the Philippines as affected by nitrogen management and row spacing. Field Crops Res., 116: 165-174.

Malakoti, M.G., 1996. Sustainable Agriculture and Optimizing Performance Increase in Fertilizer. Agricultural Education Publishing. Iran.

Maramati, A.N., M.A. Bahnanyar, H. Pirdashti and S.S. Gilani, 2007. Effect of differentrate and type of organic and chemical fertilizers on yield components of different rices cultivars. Proceedings of the 10th Iranian Conference of soil Science, September, 2007, Tehran, pp: 766-767.

Nahvi, M., A.Q. Pour, M. Ghorbanpour and H. Mehregan, 2005. Effect of space planting and nitrogen fertilizer levels in hybrid rice. J. Constr. Res., 66: 33-38.

Polthanee, A., V. Tre-loges and K. Promsena, 2008. Effect of rice straw management and organic fertilizer application on growth and yield of dry direct-seeded rice. Paddy Water Environ., 6: 237-241.

Rakshit, A., N.C. Sarkar and D. Sen, 2008. Influence of organic manures on productivity of two varieties of rice. J. Cent. Eur. Agric., 9: 629-634.

Razavipour, T. and A.J. Ali, 2006. Effect of fresh and composted Azolla on rice grain yield and quality. Proceedings of the 2nd International Rice Congress, October 6-13, 2006, New Delhi, India.

Salem, A.K.M., 2006. Effect of nitrogen levels, plant spacing and time of farmyard manure application on the productivity of rice. J. Applied Sci. Res., 2: 980-987.

Siavoshi, M., S.L. Laware and S.L. Laware, 2011. Effect of organic fertilizer on growth and yield components in rice (*Oryza sativa* L.). J. Agric. Sci., 3: 217-224.

Sing, M. and S.N. Sherma, 2000. Effect of eheat resudue managent practices and nitrogen rate on productivity and nutrient uptake of rice (*Oryza sativa*)-wheat (*Triticum aestivum*) cropping 4-system. Indian J. Agric. Sci., 70: 835-839.

Stevenson, F.I., 1994. Humus Chemistry. John Wiley and Sons Inc., USA., pp: 1- 20.