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Maize Fodder Yield and Nitrogen Uptake as Influenced by Farm Yard Manure and Nitrogen Rates

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Abstract:

The field experiment was laid down at experimental area, Department of Agronomy, Sindh Agriculture University Tandojam, Pakistan, during spring 2013 to observe the impact of farm yard manure and nitrogen rates on the maize fodder yield and nitrogen uptake. Maize variety Akbar was treated with different levels of farmyard manure (0, 8, 10 and 12 t ha^{-1}) along with nitrogen rates (0, 100, 150 and 200 kg ha^{-1}). Maximum stem girth was significantly increased with the application of 10 t ha^{-1} FYM and 150 kg N ha^{-1}. Further increase in the dose of FYM and N levels showed non-significant effects. Reducing fertilizer and manure rates significantly decreased green fodder yield and other parameters. It is concluded that the integrated use of inorganic N and organic N sources (farmyard manure) performed better than the unfertilized treatment in terms of improvement in germination, stem girth, dry matter, nitrogen concentration, nitrogen uptake by plants and green fodder yield of maize. Integrated application of 150 or 200 kg N ha^{-1} and 10 or 12 t FYM ha^{-1} were found best combination for obtaining best N uptake and green fodder yield of maize.

Key words: Nitrogen, FYM, growth, maize, yield

Introduction

Presently inefficient use of local resources in agriculture for higher crop productivity is major concern to feed ever increasing population. Declining soil fertility is also alarming for the sustainability of agricultural production at current levels. The utilization of resources available with farmers is of high importance. Such resources include green manure, compost and farm yard manure**.** Locally available inorganic fertilizers like FYM **s**upplemented with organic fertilizers have potential to increase soil fertility (Gruhn *et al*., 2000). As reported by**,** Salim *et al*, (1988); that application of organic manure alone or with inorganic fertilizer helped in maintenance of physical and chemical properties of soil. Thus, strategies for increasing and sustaining agricultural productivity will have to be focused on using available nutrient resources more effectively and efficiently. Organic manures have great impact over the health of soil and its fertility, as it enhances organic matter content of soil. The application of synthetic fertilizers are expensive and farmers are unable to maintain balanced fertilizers as per requirements of the crop which have resulted in lower production than the potential demonstrated yield and thus could be termed as low fertilizer use efficiency (Ahmad, 2000). Therefore, among the major constraints, inefficient use of fertilizers and manures are major causes for low productivity in Pakistan, fertilizer and manure applications still need to be standardized for an array of vegetables for achieving production goals. Crop inputs especially manure with chemical fertilizers if applied intelligently could be helpful in increasing yield by improving fertilizer use efficiency. Farmyard manure is a good alternative to chemical fertilizers, in terms of maintaining the amount of soil organic matter and supplying important macro and micronutrients (Reichardt *et al.,* 2000; Yadav *et al.,* 2000; Timsina and Connor, 2001). The strategies for increasing and

sustaining agricultural productivity farmers have to focus on using available nutrient resources more effectively and efficiently which could be helpful in increasing soil organic matter. To increase the organic matter, soil fertility as well as crop yield, the sufficient use of inorganic nitrogen sources are required (Anatoliy and Thelen, 2007); and if, FYM is additionally incorporated in the soil, it has positive effects on plant growth, yield and soil physiochemical properties and as according to Huang *et al.* (2007) synergistic effects of N with manures (FYM) accumulate more soil total N and causes increase in yield of maize. Manures applied in the organic or inorganic form also enhance the bio-availability of macronutrients viz. N, P, and K, and thus increases the concentration of these nutrients in plant tissues (Masti *et al*., 2003). Siam *et al*. (2008) found that N levels and its sources considerably influence the maize production and there is strong correlation between N sources and N levels. Thus an experiment was designed to see the impact of organic and inorganic manures on maize green fodder yield including nitrogen concentration in plants and nitrogen uptake by them

Material and Methods

The field experiment was conducted during Spring (February 15) 2013 at Students Farm, department of Agronomy, Sindh Agriculture University Tandojam to asses the maize fodder yield, nitrogen concentration in plants and nitrogen uptake by them under the influence of farmyard manure and nitrogen rates. Experimental design was, RCBD (factorial) with 3 replications having net plot size of 12 m^2 (3 x 4 m). Maize variety Akbar was sown in lines. There were four nitrogen levels as factor A viz. 0.0 , 100 , 150 and 200 kg N ha^{-1} and four farm yard manure (FYM) levels i.e. 00, 08 , 10 and 12 t ha^{-1} as factor B.

Observations and method of determination

Germination (%) was calculated through quadrate method, randomly thrown thrice in each plot, stem girth (cm) was determined by selecting 10 plants at random from each treatment and their averages were worked out. One square meter area of each plot was harvested at 50% teaseling, weighted and yield was computed on hectare basis. For dry matter yield ha[1], harvested matter was dried under sun for one week, weighted and computed on hectare basis. Nitrogen content in (%) was determined by Kjeldahl method as described in soil chemical analysis by Jackson, (1958) method No. 8-4, P. 183. Hence nitrogen uptake (kg ha^{-1}) was calculated according to formula; TDM x N concentration in plant.

Statistical analysis:

The data were statistically analyzed through MSTATC computer software. The LSD values for mean comparison were calculated only if the general treatment *F* test was significant at a probability of ≤ 0.05. (Gomez and Gomez, 1984)

Results and Discussion

Seed Germination (%)

The maximum germination (86.1, 86.2 and 85.5 %) was found in the plots receiving 10, 12 and 8 t ha^{-1} farmyard manure (Fig.1). All these farmyard manure treatments had non-significant differences in the values of seed germination. However, minimum germination (84.7 %) was found in the plots receiving no farmyard manure. Nitrogen (N) fertilizer had positive impact in enhancing the germination (fig.2).The increase in nitrogen level also increased the seed germination. Seed has better natural germination ability if, soil has proper organic matter, improved soil physical conditions soil porosity and water holding capacity, (Gaur, 1994, Prasad and Sinha, 2000 Bhattacharyya *et al.,* 2008). In our case plants germinated well

in the plots receiving well rotten farmyard manure which was applied 3 months before sowing, with split application of nitrogen (during final harrowing). Thus, it seems sound to get FYM rotten prior to seed sowing for enhancing soil physical condition due to which improved seed germination was observed in this study. The findings of this study are in confirmation with those reported by Khan *et al.* (2009) where according to them; FYM @ 20 t ha^{-1} combined with 60 kg N ha^{-1} gave better results (Table-1).

Stem girth (cm)

Organic source increases the availability of macro and micro nutrients; increases the protoplasmic constituents, and accelerate the process of cell division and elongation, which, in turn increases the values of growth attributes (Hadda and Arora, 2006). Stem girth is very important character of the crop especially grown for fodder because the maize fodder is mainly the function of thickness of the plant stem. Maximum stem girth (6.83 and 7.33 cm) was obtained through the application of 10 and 12 t ha^{-1} of FYM (Fig.3). Both of these FYM treatments had non-significant differences with each other. However, minimum stem girth (5.25 cm) was observed in the control treatment. Nitrogen fertilizer significantly enhanced stem girth of maize (Fig.4). The greater stem girth (9.08 cm) was recorded at high N level (200 kg ha^{-1}), followed by 150 kg N ha^{-1} which recorded 7.16 cm stem girth. However, the minimum stem girth (3.83 cm) was noted in the unfertilized plots. Gonzalez *et al.* (2001); Materechera and Salagae (2002) and Vadivel *et al.* (2001) were also of the idea, that combination of organic and inorganic fertilizers increased the thickness of the stems. Oad *et al.* (2004) also reported that in Pakistan, most of the farmers commonly use urea as N sources, but if, farmyard manure is to added there could be significant increase in plant height, stem girth and ultimately green fodder yield. Our findings indicate that application of farmyard manure including

urea is very much helpful in formation of stem girth which ultimately increased green fodder yield (Table-1).

Total Dry Matter yield (kg ha^{-1})

The addition of farmyard manure improved dry matter content in plants and higher dry matter (6338 kg ha^{-1}) was found in the plots supplied with 12 t ha^{-1} FYM (Fig.5), followed by 10 and 8 t ha^{-1} FYM (6149 and 6159 kg ha^{-1}). However, the lowest dry matter (5392 kg ha^{-1}) in the unfertilized plots. Ahmad *et al.* (2002) also obtained enhanced straw yield by combining organic manure and N fertilizer. Similarly, the application of nitrogen fertilizer showed good impact on the dry matter production (Fig.6). The maximum dry matter (7693 kg ha^{-1}) was achieved from the higher rate of nitrogen (200 kg ha^{-1}), followed by 6952 kg ha^{-1} with the application of 150 kg N ha^{-1}. From unfertilized plots significantly minimum dry matter (4269 kg ha^{-1}) yield was obtained.

Nitrogen concentration in plant (%)

The concentration of N in plants (fig.7) improved by increasing farmyard manure and was higher (0.83 %) by incorporating of 10 t ha^{-1} FYM in the spilt. Further increase in the dose of FYM had non-significant effect on the N concentration in plants. However, lower N concentration in plants (0.71 %) was noted in the unfertilized plots. The increase in N concentration in plants indicate, that plant has good efficiency to take N from the soil possessing improved physical and chemical condition. Patidar and Mali (2001); Rao and Shaktawat (2002) and Silva et al. (2006), are of the opinion, that crop take optimum N through roots from well rotten soil, which helps plants to increases N concentration within them. Our findings are in agreement with them as during conductance of this experiment FYM was incorporated into the soil three months before sowing, that might have helped the FYM to rot well and plants were facilitated to make the proper use of available N. Naeem *et al.*,

(2009) observed higher macro and micro nutrient concentrations in plants receiving organic manure in comparison to mineral fertilizers, whereas, Sial *et al.* (2007) are of the opinion, that N concentration in maize were superior with the combined use of organic and chemical fertilizers and our rests are in agreement with them. The effect of nitrogen was significant on N concentration in plant (Fig.8). The higher N concentration in plants (1.08 %) was found in the plots supplied with 200 kg N ha^{-1}, followed by 1.03 % treated with 150 kg N ha^{-1}. The unfertilized plots had significantly lower N concentration i.e. 0.36 %.

Nitrogen uptake (kg ha^{-1})

Nitrogen uptake improved significantly with the addition of farmyard manure (fig.9). Application of 12 t ha^{-1} FYM recorded higher N uptake (56.28 kg ha^{-1}), followed by 54.56 kg ha^{-1} in the plants where 10 t ha^{-1} FYM was added. However, plots receiving no manure had lowest (41.93 kg ha^{-1}) plant N uptake. Yadav *et al.* (2006) also observed that use of FYM proved the best in term of maize nutrient uptake. The effect of N fertilizer on N uptake (fig.10) was significantly different, being maximum (82.99 kg ha^{-1}) in case of higher N rates (200 kg ha^{-1}), followed by 150 kg N ha^{-1} (71.65 kg ha^{-}). However, minimum (15.51 kg ha^{-1}) N uptake was found in the unfertilized plants. Feil *et al.* (2005) found higher nitrogen content as well as uptake in plants with receiving increasing N levels and his findings are in line with our results.

Green fodder yield (kg ha^{-1})

The green fodder yield of maize enhanced due to application of farmyard manure presented in figure 11. The higher green fodder yield (31880 and 31530 kg ha^{-1}) was recorded with the incorporation of 12 and 10 t ha^{-1} FYM respectively, followed by 31370 kg ha^{-1} in the plots receiving 8 t ha^{-1} FYM. However, the plots without manure had lower green fodder yield (26340 kg

ha^{-1}). The results of this study agree with those reported by Silva et al. (2006); Patidar and Mali (2001) and Rao and Shaktawat (2002); all reported that commercial fertilizer in the form of urea for supplying N to the plants is commonly used, whereas, organic material from manures can markedly increase soil productivity by providing essential plants nutrients and by improving physical properties of soil. Gondek and Mazur (2005) reported that use of mineral fertilizer declined the organic C content in soil, whereas, FYM caused an increase. Kanchikerimath and Singh (2001) also reported that crop yields are improved if organic manure is supplemented with mineral fertilizers. Similar results for yield increase of maize with synergistic use of organic matter and mineral N fertilizers were obtained by Thind *et al.* (2002) and Mugwe *et al.* (2009). Nitrogen fertilizer presented (Fig-12) showed improved green fodder yield of maize and was found higher (36860 kg ha^{-1}) with the application of 200 kg N ha^{-1}, followed by 36170 and 29890 kg ha^{-1} @ 150 and 100 kg N ha^{-1} respectively. The lower green fodder yield (18200 kg ha^{-1}) was noted in the unfertilized plots. In this study findings suggest that the combination of FYM at the rate of 10 t ha^{1} and 200 kg N ha^{1} seems to be more appropriate for obtaining sufficient output in sense of yield and other attributes.

Conclusion

It is concluded from the results that the integrated use of mineral N source (urea) and organic N sources (farmyard manure) performed better than the unfertilized treatment in terms of improvement in germination, stem girth, dry matter, nitrogen concentration, nitrogen uptake and green fodder yield of maize. Application of 150 or 200 kg N ha^{-1} and 10 t FYM ha^{-1} were found best for obtaining higher N uptake; green fodder and dry matter yield of maize.

Table 1. Interactive effect of nitrogen (N) and farmyard manure (F) on germination (%), Stem girth (cm), Dry matter yield (kg ha^{1}), Nitrogen concentration (%), N uptake (%), and Green fodder yield (kg ha^{1})

nitrogen(N) x farmyard manure(F)	Germination (%)	Stem girth (cm)	Dry matter Yield (kg ha^{1})	Nitogen concentration	N uptake	Green Fooder Yield (kg ha^{1})
N1xf1	83.0 e	2.33 g	4100 c	0.28 h	11.66 h	14120 h
N1xf2	84.3 d	3.66 f	4247 c	0.32 h	13.59 gh	19510 g
N1xf3	85.0 cd	4.33 ef	4293 c	0.42 g	18.18 fg	19550 g
N1xf4	85.0 cd	5.00 e	4437 c	0.42 g	18.63 fg	19640 g
N2xf1	85.0 cd	4.66 e	4200 c	0.54 f	22.68 f	19500 g
N2xf2	85.6 bc	5.00 e	5523 b	0.63 e	34.77 e	32990 f
N2xf3	85.6 bc	6.00 d	5327 b	0.70 d	37.29 e	33040 f
N2xf4	85.6 bc	6.33 d	5443 b	0.71 d	39.00 e	34010 e
N3xf1	85.3 cd	6.33 d	5797 b	0.94 c	54.49 d	35220 d
N3xf2	86.0 abc	7.33 c	7213 a	1.03 b	74.27 c	36090 c
N3xf3	86.6 ab	7.33 c	7250 a	1.08 ab	78.30 bc	36540 b
N3xf4	87.0 á	7.66 c	7550 a	1.05 ab	79.54 bc	36840 ab
N4xf1	85.6 bc	7.66 c	7470 á	1.05 ab	78.90 bc	36510 b
N4xf2	86.0 abc	8.66 b	7653 a	1.05 ab	80.61 bc	36910 a
N4xf3	87.0 á	9.66 a	7727 a	1.09 ab	84.48 ab	37000 a
N4xf4	87.0 á	10.33 a	7923 a	1.11 a	87.95 a	37020 á
LSD (5%)	0.956	0.860	838.5	0.058	6.080	341.4
SE	0.298	0.268	262.1	0.018	1.901	106.7

Means followed by common letter are not significantly different at 5% probability level.

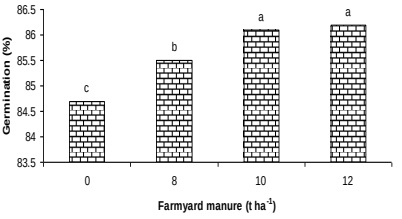

Figure 1. **Effect of farmyard manure on seed germination (%) of maize across nitrogen**

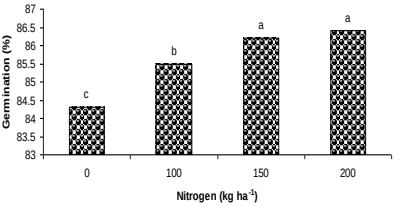

Figure 2. **Effect of nitrogen on seed germination (%) of maize across farmyard manure**

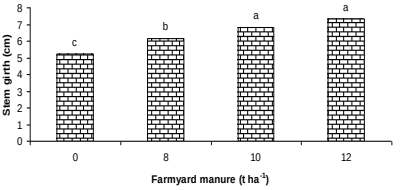

Figure 3. Effect of farmyard manure on Stem girth (cm) of maize across nitrogen

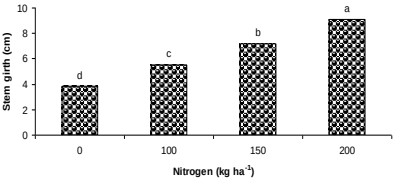

Figure 4. Effect of nitrogen on Stem girth(cm) of maize across farmyard manure

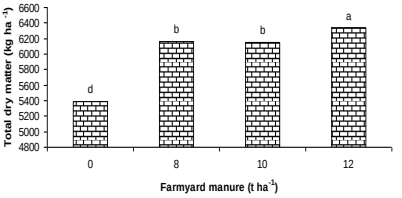

Figure 5. **Effect of farmyard manure on Total dry matter (kg ha-1) of maize across nitrogen**

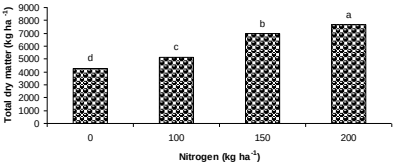

Figure 6. **Effect of nitrogen on Total dry matter (kg ha-1) of maize across farmyard manure**

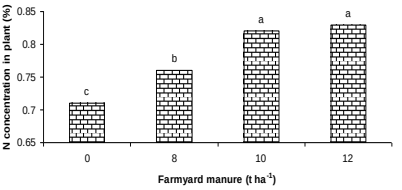

Figure 7. **Effect of farmyard manure on N concentration in plants (%) of maize across nitrogen**

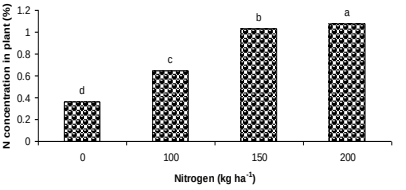

Figure 8. **Effect of nitrogen on N concentration in plants (%)of maize across farmyard manure**

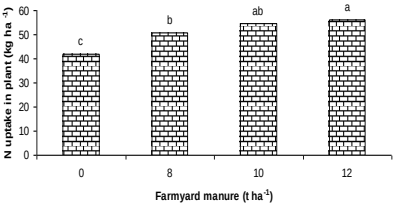

Figure 9. **Effect of farmyard manure on N uptake in plants (kg ha-1) of maize across nitrogen**

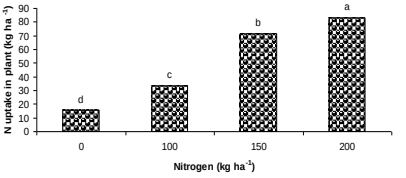

Figure 10. Effect of nitrogen on N uptake in plants (kg ha-1) of maize across farmyard manure

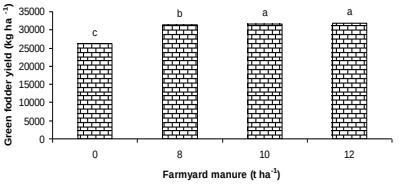

Figure 11. **Effect of farmyard manure on Green fodder yield (kg ha^{-1}) of maize across nitrogen**

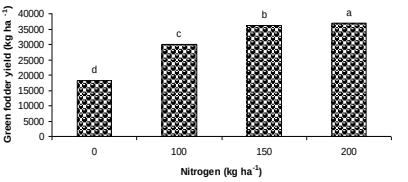

Figure 12**. Effect of nitrogen on Green fodder yield (kg ha^{-1}) of maize across farmyard manure**

REFERENCES

Ahmad, N. 2000. "Fertilizer scenario in Pakistan: Policies and development." In *Proc. of conf. Agric. and fertilizer use.* 2000. Feb. 15-16, NFDC, Islamabad, 1999.

Ahmad, S. I., M. K. Abbasi and G. Rasool. 2002. "Integrated plant nutrition system in wheat under rainfed conditions of Rawalakot, Azad Jammu and Kashmir." *Pak. J. Soil Sci.* 21: 79-86.

Anatoliy, G.K. and K.D. Thelen. 2007. "Effect of winter wheat crop residue on no-till corn growth and development." *Agron. J.*, 99: 549-555.

Bhattacharyya, R., S. Kundu, V. Prakash and H. S. Gupta. 2008. "Sustainability under combined application of mineral and organic fertilizers in a rain-fed soybeanwheat system of Indian Himalayas." Europ. J. Agron. 28: 33-46.

Feil, B., S. B. Moser, S. Jampatong and P. Stamp. 2005. "Mineral composition of the grains of tropical maize varieties as affected by pre-anthesis drought and rate of nitrogen fertilization." *Crop Sci.* 45:516-523.

Gonzalez, D., R. Alvarez and J. Matheus, 2001. "Comparison of three organic fertilizers for the production of sweetcorn

(*Zea mays*saccharata)." *Proc. Int. Am. Soc. Trop. Hortic*. 45: 106-109.

Gaur, A. C. 1994. "Bulk organic manures and crop residual." In: H. L. S. Tandon, J. Ced. (Eds.) *Fertilizers, Organic manures, Recyclable Wastes and Biofertilizers,* 36-51. Fertilizer Development and Consultation Organization. New Delhi, India.

Gruhn, P., F. Goletti and M. Yudelman. 2000. *Integrated nutriment management, Soil fertility and sustainable agriculture: Current issues and future challenges. A 2020 vision for food, Agriculture and Environment.* International food policy Research Institute Washingtion D.C., USA.

Hadda, M. S. and S. Arora. 2006. "Soil and nutrient management practices for sustaining crop yield under maize - wheat cropping sequence in sub-mountain Punjab, India." *Soil Environ.*, 25: 1- 5.

Huang, B, W.Z. Sun, Y.Z. hao, J. Hu, R. Yang, Z. Zou, F. Ding and J. Su. 2007. "Temporal and spatial variability of soil organic matter and total nitrogen in an agricultural ecosystem as affected by farming practices." *Geoderma.* 139: 336-345.

Khan, A., M. Tariq, K. B. Marwat and M. Arif. 2009. "Organic and inorganic nitrogen treatments effect on plant and yield attributes of maize in a different tillage systems." *Pak. J. Bot.* 41: 99-108.

Materechera, S.A. and A.M. Salagae. 2002. "Use of partially-decomposed cattle and Chicken manure amended with wood-ash in two South African arable soils with contrasting texture: Effect on nutrient uptake, early growth and dry matter yield of maize." *Commun. Soil Sci. Plant Anal.* 33: 179-201.

Masti, T., A.S. Lithourgidis, and A.A. Gagianas. 2003. "Effect over of injected liquid Cattle manruse on growth and

yield of winter wheat and soil characteristics." *Agron. J.* 95: 592 -599.

Naeem, M., F. Khan and W. Ahmad. 2009. "Effect of farmyard manure, mineral fertilizers and mung bean residues on some microbiological properties of eroded soil in district Swat." *Soil Environ*. 28: 162-168.

Oad, F. C., U. A. Buriro and S. K. Agha. 2004. "Effect of organic and inorganic fertilizer application on maize fodder production." *Asian J. Plant Sci*. 3(3): 375-377.

Patidar, M. and A.L. Mali. 2001. "Integrated nutrient management in sorghum and its residual effect on wheat." *Indian J. Agric. Sci*., 71: 587-590

Prasad, B. and M. K. Sinha. 2000. *Effects of fertilizers and organic manures on crop yield, nutrient balance and soil properties in rice-wheat cropping system in Bihar Rice-wheat consortium New Dehli, India*. pp. 105-109.

Rao, S.S. and M.S. Shaktawat. 2002. "Residual effect of organic manure, phosphorus and gypsumapplication in preceding groundnut (*Arachis hypogea*) on soil fertility and productivity of Indian mustard (*Brassica juncea*)." *Ind. J. Agron*. 47: 487-494.

Reichardt, W., K. Inubushi, and J. Tiedje. 2000. *Microbial processes in C and N dynamics. Carbon and Nitrogen Dynamics in Flooded Soils*. International Rice Research Institute, Makati city, Philippines. 101-146.

Salim, M. S., M. Mian, and Mahmoodul Hassan.1988. "Annual technical report of project improvement of soil productivity through biological mean." Pak. Agric. Res. Council, Islamabad

Sial, R. A., E. H. Chaudhary, S. Hussain and M. Naveed. 2007. "Effect of organic manures and chemical fertilizers on grain yield of maize in rain- fed area." *Soil Environ*. 26: 130-133.

Siam, H. S., M. G. Abd-El-Kader and H. I. El-Alia. 2008. "Yield and yield components of maize as affected by different

sources and application rates of nitrogen fertilizer." *Res. J. Agric. Biol. Sci.*, 4: 399-412.

Silva, P.S., L. Silvaj, F.H.T. Oliveira and D. Sousaakf. 2006. "Residual effect of cattle manure application on green ear yield and corn grain yield." *Hort. Brasileria* 24: 166-169.

Timsina, J., and D.J. Connor. 2001. "Productivity and management of rice-wheat cropping systems: issues and challenges." *Field Crops Res*. 69:93-132.

Vadivel, N., P. Subbian and A. Velayutham, 2001. "Effect of integrated nitrogen-management practices on the growth and yield of rainfed winter maize (*Zea mays*)." *Ind. J. Agron*. 2:250-254. .

Yadav, R. L., B. S. Dwivedi, K. Prasad, O. K. Tomar, N. J. Shurpali, and P. S. Pandey. 2000. "Yield trends and changes in soil organic-C and available NPK in a long-term rice-wheat system under integrated use of manures and fertilizers." *Field Crop Res.* 68:219-246.

Yadav, R. P., P. Singh, R. K. Aggarwal and M. K. Yadav. 2006. "Improved technology for sustainable production of maize (*Zea mays* L.) in Shivalik foothills of Himachal Pradesh." *Indian J. Dryland Agric. Res. Dev*. 21: 1-6.