OPEN ACCESS

International Journal of Graduate Research and Review

ISSN: 2467-9283

Vol-2, Issue-1 (February 2016)

Indexing and abstracting

Infobase Index, Cosmos etc.

SEM-Biotech Publishing

Research Article

Effect of preceding crops and nitrogen rates on soil organic carbon and total soil nitrogen content

B.P. Yadav[1], D.N.Yadav[2], K.B. Koirala[1], K.R. Pandey[2] and R.B.Thapa[2]

[1]Regional Agriculture Research Station, Parwanipur, Bara, Nepal Agriculture Research Council, Nepal.
[2]Institute of Agriculture and Animal Science, Rampur Chitwan, Tribhuban University, Nepal.

Corresponding author's email: masteryadavbp2001@gmail.com

Abstract

Field experiment was conducted during 2010 and 2011 at IAAS farm Rampur chitwan to find out the effect of preceding crop and nitrogen rates on soil organic carbon and total soil nitrogen. In summer season crops grown where green gram , cowpea , black gram , cluster bean maize and fallow in main plots and in winter season, winter maize was grown with five levels of nitrogen 0, 50, 100, 150, 200 kg N/ha in sub plots in each season after the harvest of crop. Soil from each plot analysed for organic carbon and total nitrogen content of soil. Organic carbon and total nitrogen content of soil after summer legume crops was found higher than after summer maize and fallow. Similarly soil organic carbon and nitrogen content were higher under legume consisting sequence than fallow maize and maize -maize sequence. Further organic carbon and total nitrogen content of soil after winter maize increased with increasing rates of nitrogen to maize.

Keywords: Organic carbon; Preceding crop; nitrogen; summer legumes crops

Introduction

Organic carbon and total soil nitrogen content is the most important index of soil fertility and productivity. Most of the cereal crop productivity depends on the supply of nitrogen from soil, through nitrogenous fertilizer and organic manures and organic carbon is also the index of nitrogen soil. Inclusion of legumes in the crop sequences enriched the organic carbon content of soil (Sharma and Singh, 1970; Singh and Awasthi, 1978; Singh and Sandhu, 1980).

Ghosh (1981) recorded higher organic carbon (0.65%) in plots were two legumes crops were included in the rotation as compared to fallow – wheat (0.43%) and fallow wheat – fallow –pea (0.42%) over a period due to moong to rice – wheat – moong rotation.

Deka *et al.* (1984) reported an improvement in organic carbon content of soil in legume – cereal rotations over a cereal – cereal rotation (rice – wheat) and it as maximum in berseem- rice rotation. Mandal and Ghosh (1984) recorded higher organic carbon (1.06 %) in soil after sesame having 0.97 % organic carbon . the organic carbon content of soil was found to be greater in the plots where legumes were grown either in rabi or in kharif (Sonar and Zende , 1986) . Gopal krishna et al, (1987) observed that inclusion soil fertility over cereal – cereal sequences.

Sharma and Singh (1970) observed higher nitrogen content in lots where legumes were grown as compared to fallow plots. Among legumes berseem resulted significantly higher nitrogen content than sweet clover and pea. Even after the harvest of maize the plots after legumes and higher nitrogen content than after fallow plots. Sharma and saxena (1970) reported a positive balance of nitrogen could be maintained by judicious nitrogen fertilization of wheat. Fallow- wheat and green manures – wheat did not show any advantages over the double cropped sequences (sorghum – wheat, pearl millets + cowpea – wheat).

Organic carbon and total nitrogen content of soil was higher after green gram, cowpea, black gram than wheat and fallow. The increase in organic carbon content of soil under legume plots was probably due to addition of biomass of narrower C: N ratio by legumes. Higher soil nitrogen content after legumes can be explained by the mechanism of biological nitrogen fixation occurring in legumes. Sharma and Singh (1970) observed higher nitrogen contents in plots where legumes were grown as compared to fallow plots. Ahlawat et al (1981) also reported higher soil nitrogen content after chickpea, lentil, pea and *Lythyrus sativius* than after fallow and wheat.

Soil organic carbon and nitrogen content were higher under legumes consisting sequences than fallow -maize and maize -maize sequences. An improvement in these properties after green gram- maize sequence was better than after other legumes. . Higher soil organic carbon and total nitrogen content under legumes maize sequences was probably because of faster decomposition of biomass of legumes. Madison (1981) recorded higher organic carbon content in soil under legumes - cereal sequences than cereal – cereal sequences. Deka and singh s1984 reported higher organic carbon and total soil nitrogen under berseem- rice and lentil-rice sequence as compared to wheat - rice sequence. Organic carbon and total nitrogen content of soil after maize

increased with increasing nitrogen rates. The higher organic carbon and total N content under nitrogen treated plots was probably due to addition of more root biomass as a result of better growth of maize under these plots.

Materials and Methods

The experiment was conducted at IAAS Rampur, chitwan during (2010 &2011) in split plot design with three replications keeping crop sequences in main plots and nitrogen rates to winter maize in sub plots.

The experiment consisted six crop i.e. summer maize , green gram, cowpea , black gram , cluster bean and fallow in main plots in summer season and in winter season, winter maize was grown in five sub plots with five levels of nitrogen 0,50,100,150,200 kg N/ha. The experiment consisted 30 plots in 1 replications and 90 plots in 3 replications. Four analysis of organic carbon and total nitrogen after the harvest of summer crop during first year 18 composite samples from 18 main plots was taken. Further after the harvest of winter maize, 90 samples was taken from 90 plots and then analysis for organic carbon and total nitrogen content was done. Similarly during second year 18 composite samples from 18 main plots and 90 samples from 90 plots after winter maize harvest was taken. Organic carbon was determined by modified walkley and black method (Jackson 1967) and total nitrogen by macro kjeldahl method (Jackson 1967).

Result and Discussion

Maximum organic carbon content was noted after green gram which was closely followed by cowpea during both the years while it was minimum after cluster bean Crop sequences had significant effect on organic carbon content during both the years.

Maximum organic carbon content was recorded after green gram –maize sequence and it was significantly higher than after all other crop sequences in both the years except black gram maize sequence in 2011. During 2010 significantly higher organic carbon content was noted after cowpea maize sequence than after black gram- maize sequence, maize - maize sequence fallow maize sequence and cluster bean maize sequences. In 2011 organic carbon content after black gram maize cowpea maize and maize – maize sequence was significantly higher than after fallow maize and cluster bean maize sequence. Nitrogen rate brought significant variation in organic carbon content of soil during both the years. Organic carbon content recorded with 100kg, 150 kg and 200 kg N/ha was significantly more than no nitrogen and 50kg nitrogen during both the years.

Table 1: Organic Carbon % of Soil after Different Crops

Treatments Crop sequence	**2010**		**2011**	
	SUMMERCROPS	WINTER MAIZE	SUMMERCROPS	WINTER MAIZE
Maize – maize	1.22	1.20	1.21	1.20
Fallow maize	1.22	1.19	1.20	1.18
Green gram maize	1.26	1.23	1.26	1.22
Cowpea maize	1.25	1.21	1.24	1.20
Black gram maize	1.23	1.20	1.22	1.21
Cluster bean maize	1.20	1.18	1.19	1.18
S. Em ±	--	0.0026	--	0.0038
C. D at 5 %	--	0.0082	--	0.0120
Nitrogen rates(kg/ha)				
0	--	1.16	--	1.17
50	--	1.17	--	1.18
100	_	1.23	--	1.22
150	_	1.24	--	1.22
200	_	1.241	---	1.221
s.Em. ±	_	0.0032	--	0.0045
C. D at 5 %	_	0.0110	--	0.0129

Table 2: Total nitrogen content of soil (%) after different crops**.**

Treatments Crop sequence	2010		2011	
	SUMMER CROPS	WINTER MAIZE	SUMMER CROPS	WINTER MAIZE
Maize – maize	0.1163	0.1168	0.1168	0.1164
Fallow maize	0.1168	0.1132	0.1166	0.1114
Green gram maize	0.1228	0.1191	0.1224	0.1187
Cowpea maize	0.1178	0.1180	0.1176	0.1174
Black gram maize	0.1173	0.1176	0.1175	0.1171
Cluster bean maize	0.1165	0.1133	0.1164	0.1126
S. Em ±	--	0.0003	--	0.0001
C. D at 5 %	--	0.0011	--	0.0004
Nitrogen rates(kg/ha)				
0	--	0.1134	--	0.1123
50	--	0.1142	--	0.1125
100	_	0.1150	--	0.1180
150	_	0.1227	--	0.1197
200	_	0.1228	---	0.1198
s.Em. ±	_	0.1198	--	0.0001
C. D at 5 %	_	0.0009	--	0.0003

Total Soil Nitrogen Content

In general, total soil nitrogen after all the legume plots was higher than after fallow and wheat crop during both the years. Maximum total soil nitrogen content was noted after green gram in both the years.

Total soil nitrogen content was influenced significantly due to preceding crops during both the years .maximum total soil nitrogen content was recorded after green gram maize sequence and it was significantly more than after all the other crop sequences. During both the years. significantly more nitrogen content was also noted after cowpea maize than after maize -maize, cluster bean maize and fallow maize, further nitrogen content after cowpea maize and black gram maize was significantly more than after cluster bean maize and black gram maize was significantly more than after cluster bean maize and fallow maize in 2010 and after maize -maize, cluster bean maize fallow maize in 2011. And after maize, cluster bean maize and fallow maize in 2011. During 2011 nitrogen content after cluster bean maize was significantly more than after fallow maize.

Nitrogen rate has significant effects on total soil nitrogen content during both the years , nitrogen content in plots fertilized with 150 , 200kg n/ha , was maximum and it was significantly higher than plots fertilized with 100 kg 50kg n/ha and no nitrogen during both the years, in 2010, soil nitrogen content with 100g/ha plots was significantly more than with no nitrogen plots but in 2011 nitrogen content with 100 kg/plots was significantly more than with 50 kg /ha and no nitrogen treated plots.

Summery and Conclusion

Soil organic carbon and nitrogen content under legumes consisting sequences was found significantly higher than fallow-maize and maize-maize cropping sequences. Organic carbon and total nitrogen content of soil after maize increased with increasing rates of nitrogen. Higher soil organic carbon and total nitrogen content under legume-maize sequences was probably because of faster decomposition of biomass of legume. The higher organic carbon and total N content under nitrogen treated plots was probably due to addition of more rout biomass as a result of better growth of maize under nitrogen applied plots.

References

Deka JC, Singh Y, Sharma KC and Gupta PC and Bhardawaj AK (1984) Studies on rice based multiple crop sequences I crop yield and economics. *Ind. J. Agron*. **29**(4): 485 – 489.

Ghosh, A.B 1981. Soil fertility dynamics under different cropping systems. *Fert. News* **26**(9): 64 -70.

Madison JT, Thompson JF and Muenster AE (1981) Turnover of storage protein in seeds of soya bean and pea. *Annals of Botany* **47**(1): 65-73.

Sharma RP and Singh A (1970) Effect of growing winter legumes on certain properties of an alluvial soil of northern India. *Indian Journal of Agricultural Science* **40**: 45-53.

Singh G and Sandhu HS (1980) Studies on multiple cropping .II effects of crop rotation on physical and chemical properties of soil. *Ind. J. Agron.* **25**(1): 57-60.

Singh KK and Awasthi OP (1978) Maintenance of soil fertility in the hills with incorporation of legumes in cropping sequences. *Indian Journal of Agricultural Sciences* **48**(1): 41-66.