

Comparison of the Effects of Green Manure Crops and Chemical Fertilization on Red-pepper Growth and Nitrogen Utilization

Jwa-Kyung Sung^{1)*}, Sang-Min Lee¹⁾, Yong-Hwan Lee¹⁾, Young-Ho Kim¹⁾, Du-Hoi Choi¹⁾, Gap-Hee Ryu¹⁾, Tae-Wan Kim²⁾, Beom-Heon Song³⁾

¹⁾ National Institute of Agricultural Science and Technology, RDA, Suwon, Korea

²⁾ Dept. of Plant Resources and Science, Hankyong National University, Anseong, Korea

³⁾ Dept. of Agronomy, Chungbuk National University, Cheongju, Korea

Objectives

In order to find out the effects of green manure crops as carbon and nitrogen sources, we analyzed plant growth parameters and uptake and utilization of inorganic nitrogen, and monitored changes in soil inorganic nitrogen (NO_3^- -N and NH_4^+ -N).

Materials and Methods

- Main crop Red pepper (transplanted on May 10, 2005)
- Winter green manure crop
 - Hairy vetch and Rye (sown on October 4, 2004 and applied as green manure on May 4, 2005)
- Treatments
 - No fertilization
 - Chemical fertilizer 16.8(N)-0(P)-18.7(K)kg/10a + Fowls excrement 438kg/10a
 - Hairy vetch 1,808kg(fresh) + Sesame dregs 107.5kg/10a
 - Rye 2,160kg(fresh) + Sesame dregs 207kg/10a
- Soil samples : collected in the same sites at intervals of 3 days from April, 27 2005
- Plant samples : collected at intervals of 10 days after transplanting

Results and Discussion

- Soil NO_3^- -N of plots growing hairy vetch and rye as green manure crop was less accumulated than a bare land. Inorganic N supply from the residues of two crops was observed on 7th day after cutting, although it was distinctly higher hairy vetch than rye (data not shown).
- After 10th day from transplanting red pepper seedlings, the increase rate of observed growth parameters such as plant height, dry matter and leaf area showed in order of chemical fertilizer, hairy vetch, rye and control.
- Due to temporary N deficiency, red pepper plants of plot grown rye as green manure crop were retarded in early growth.
- Considering the results of total-N and nitrate-N, nitrate-N rate in leaves and roots of red pepper plants was in the range of 4 to 5% and 2 to 3%, respectively.
- A rapid decomposition of hairy vetch residues temporarily resulted in an excess N supply, consequently, it caused the accumulation of nitrate-N content in red pepper leaves and roots. In contrast to hairy vetch, nitrate-N content in rye grown plot was gradually reduced in leaves, however it in roots showed a slow increase.

*Corresponding author --- 031-290-0551. E-mail . jksung@rda.go.kr

Table 1 Growth responses of red-pepper plants under different mineral nutrients sources

Date	Treatment	Plant height (cm)	Stem width (mm)	Leaves (No)	Dry matter (gplant ⁻¹)	Leaf area (cm ² plant ⁻¹)
5/10(Planting)	-	23.3	37.7	5.5	0.6	63.4
5/20	Control	24.4	36.8	7.8	1.0	89.4
	Chemicals	23.9	39.3	8.5	1.1	110.2
	Hairy-vetch	24.9	38.0	8.5	1.1	109.9
	Rye	23.8	38.3	8.3	1.1	89.3
5/30	Control	30.0	54.5	12.3	2.7	273.3
	Chemicals	32.3	63.8	14.3	3.8	395.5
	Hairy-vetch	32.0	61.0	13.8	3.6	380.4
	Rye	28.3	48.0	11.5	1.9	209.0
6/9	Control	41.7	81.5	66.3	6.9	1008.0
	Chemicals	51.4	108.0	113.3	12.5	2042.9
	Hairy-vetch	51.2	101.0	83.0	11.8	1719.4
	Rye	46.1	94.3	74.5	9.7	1555.6

Table 2. The effects of green manure crops on nitrogen utilization in red-pepper plants

Date	Treatment	Nitrogen Content			
		Leaves		Roots	
		T-N(%)	NO ₃ ⁻ -N(mgkg ⁻¹)	T-N(%)	NO ₃ ⁻ -N(mgkg ⁻¹)
5/10(Planting)	-	2.14	1,549 (7.3)*	1.65	934 (5.6)
5/20	Control	2.62	1,377 (5.2)	1.74	567 (3.3)
	Chemicals	3.50	1,838 (5.2)	2.01	678 (3.4)
	Hairy-vetch	3.20	1,281 (4.0)	2.33	564 (2.4)
	Rye	2.78	1,957 (7.0)	1.52	582 (3.8)
5/30	Control	2.83	1,819 (4.7)	2.41	601 (2.5)
	Chemicals	4.12	1,856 (4.5)	2.85	727 (2.5)
	Hairy-vetch	4.41	1,909 (4.3)	3.01	1,178 (3.9)
	Rye	3.84	1,796 (4.7)	2.20	796 (3.6)
6/9	Control	3.76	1,655 (4.4)	2.32	752 (3.2)
	Chemicals	3.75	1,757 (4.7)	2.25	838 (3.7)
	Hairy-vetch	3.89	1,860 (4.8)	2.65	799 (3.0)
	Rye	3.94	1,697 (4.3)	2.59	808 (3.1)