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뜻거름작물의 토양환원이 수박의 생육 및 토양의 질산염 농도에 미치는 영향

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Effects of Incorporation of Green Manure Crops on the Growth of Watermelon and Soil Nitrate Nitrogen Concentration

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Abstract

BACKGROUND: In this study, we evaluated the effects of soil incorporation of hairy vetch (HV) or rye as a green manure on the growth and yields of watermelon and soil nitrate nitrogen in a green house.

METHODS AND RESULTS: HV and rye were cultivated for 151 days after sowing on October 30th and incorporated into soil before transplanting watermelon. The amount of N added by soil incorporation of HV and rye were 79 kg/ha and 88 kg/ha, respectively. Five different N treatments for each of HV and rye were included as follows: green manure, green manure with urea at 25%, 50% or 75%, and 100% urea for the N recommendation rate. The growth and fruit yield of watermelon were not different among the treatments of both HV and rye. Soil nitrate N content at both HV and rye treatments decreased continuously with the lapse of days after planting (DAP) and was lowest at 75 DAP: 44 mg/kg and 52 mg/kg for the HV and rye treatment without urea, respectively.

CONCLUSION: These results indicate that the N mineralized from the soil incorporated HV or rye accounts for an important portion of N available for the growth and

fruit yield of watermelon. It can be suggested that the green manures, comparable to urea could ensure the yield of watermelon, if soil nitrate N content is above 40 mg/kg by soil incorporation of HV and rye during watermelon cultivation. However, further studies on the relationship between soil nitrate N content during cultivation periods and the fruit yield of watermelon are required.

Key words: Fruit yield, Hairy vetch, N recommendation, Rye, Soil nitrate, Watermelon

서론

가

가

(Choi *et al.*, 2010; Lim *et al.*, 2014).

(Park *et al.*, 2008).

(*Secale cereale* L.)

(*Sorghum bicolor* L.)

(*Vicia villosa*)

Roth)

(*Crotalaria juncea* L.)

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Table 1. Chemical properties of the soil before sowing hairy vetch and rye.

Treatment	pH	EC	OM	Av.P ₂ O ₅	Ex. Cation (cmol ⁺ /kg)			NH ₄ -N	NO ₃ -N
					K	Ca	Mg		
	(1:5)	(dS/m)	(g/kg)	(mg/kg)	----- cmol+/kg -----			----- mg/kg -----	
HV	5.8(0.1) [†]	3.8 (0.14)	19 (0.6)	543 (13.1)	0.9 (0.07)	8.6 (0.3)	3.4 (0.15)	36 (2.3)	194 (17)
Rye	5.6 (0.1)	3.7 (0.12)	20 (0.5)	431 (21.6)	1.1 (0.09)	8.4 (0.2)	3.4 (0.13)	35 (1.4)	177 (19)

[†]Values are means with standard errors in parentheses (n=3).

Lim *et al.*, 2012), (Won *et al.*, 2012; 가 (36 93'68.41'', 127 52'30.81'') .

(Fageria *et al.*, 2005), 1% ha 60 kg 10 30 ,

(Lee *et al.*, 2006; Kim *et al.*, 2012). 29 500 m² . 3

2.5-4.0% pH 5.7 5.8

(Jeon *et al.*, 2009; Lee *et al.*, 2011, Song *et al.*, 2010). Jeon *et al.* (2009) (Table 1). (EC, Electrical conductivity) 3.7 3.8 dS/m ,

9 4 177 194 mg/kg .

138 kg/ha 5 Y=20.3-0.067 X (Y: kg/10 a, X:)

가 , Lee *et al.* (2011) 5 9 (46-0-0) (NIAST, 2006),

5,449 kg/ha (84 73

kg/ha .

63,815 ha 2014 가 + 50%, + 75%, 25%, 100% 5

(MAFRA, 2015a), 10 3

2015b). 가 가 5 m× 4 m 1

4 7 가 5 m× 4 m 1

7 10 가 2.2 m . 60 cm

가 3 75 4 13 1

84 6 89

(PR-101, ATAGO) 15 15

0-15 cm .

토양 및 식물체 분석

2 mm

재료 및 방법 pH 1:5 30

pH meter (ORION Model 720 A, MA, USA)

시험토양 및 처리방법 , EC 1:5 (YSI Model

2012 10 2013 7 35, OH,USA) . Tyurin (Nelson and

Table 2. Fresh weight, dry weight, N content and N application rates from hairy vetch and rye incorporation of soil, respectively.

Treatment	Fresh weight ----- kg/ha -----	Dry matter ----- kg/ha -----	N content (%)	N application rates (kg/ha)
HV	19,000 (1258) [†]	1,980 (126)	4.0 (0.10)	79
Rye	31,000 (1500)	4,000 (150)	2.2 (0.07)	88

[†]Values are means with standard errors in parentheses (n=3).

Table 3. The growth of watermelon under soil incorporation of hairy vetch or rye as green manure crops and different N fertilizer application.

Treatment	Plant height ----- cm -----	Leaf height ----- cm -----	Leaf width ----- cm -----
Rye	492.8(9.7) [†]	24.6 (0.9)	25.8(0.8)
Rye + Urea 25%	494.8(10.9)	24.2(0.8)	25.0(0.7)
Rye + Urea 50%	487.0 (9.5)	23.4 (0.6)	24.6(0.6)
Rye + Urea 75%	480.2(6.8)	23.6 (0.6)	25.4(0.7)
Urea 100%	474.0(11.2)	23.2 (0.9)	24.8(0.5)

Treatment	Plant height ----- cm -----	Leaf height ----- cm -----	Leaf width ----- cm -----
HV	474.8(14.4)	24.0 (1.0)	24.0(1.2)
HV + Urea 25%	463.0(7.5)	24.2 (1.1)	24.0(0.9)
HV + Urea 50%	447.0(13.9)	22.8 (0.9)	22.2(0.7)
HV + Urea 75%	451.2 (10.7)	23.0 (0.7)	23.0(0.7)
Urea 100%	446.2(15.6)	22.4(0.8)	22.0(1.1)

[†]Values are means with standard errors in parentheses (n=6).

Sommers, 1996), Lancaster (NIAST, 2010) N/ha 88 kg N/ha
 K, Ca, Mg 1N-CH₃COONH₄ (pH 7.0) 11 Mg/ha
 ICP-OES (MX2, GBC, Australia)
 2 M KCl
 (B-316, Büchi, Switzerland) 0.01
 N (Mulvaney, 1996). 3
 70°C (HClO₄:H₂SO₄=
 10:1) Kjeldahl (NIAST, 2010) (Jung *et al.*, 2015).

결과 및 고찰

헤어리베치와 호밀의 질소 고정량

19 Mg/ha
 1,980 kg/ha 10.4% , 4.0%
 (Table 2). 31 Mg/ha
 4,000 kg/10 a 12.9% ,
 2.2% .
 79 kg

수박의 생육 및 수량

75
 492.8 cm, 24.6 cm, 25.8 cm
 + 25%, + 50%, +
 75% 100%
 474.0 cm, 23.2 cm, 24.8 cm
 (Table 3). 가
 474.8 cm,
 24.0 cm, 24.0 cm + 25%,
 + 50%, + 75% 100%

Table 4. Influence of soil incorporation of hairy vetch or rye as green manure crops and different N fertilizer on the fruit growth and the yield of watermelon.

Treatment	Fruit height	Fruit width	Fruit weight	Soluble solids content	Yield
	----- cm -----		(kg/ea)	(°Brix)	(kg/ha)
Rye	29.1 (1.0) [†]	23.2 (0.4)	9.0 (0.4)	11.7 (0.2)	66,940 (2960)
Rye+Urea 25%	28.5 (0.5)	22.9 (0.3)	8.8 (0.2)	12.2 (0.3)	65,090 (1490)
Rye+Urea 50%	28.3 (0.4)	22.8 (0.2)	8.6 (0.2)	12.2 (0.3)	63,460 (1560)
Rye+Urea 75%	28.7 (0.3)	23.2 (0.3)	8.9 (0.3)	11.9 (0.3)	65,980 (2240)
Urea 100%	29.5 (0.8)	23.0 (0.2)	8.8 (0.5)	11.8 (0.2)	65,230 (3730)

Treatment	Fruit height	Fruit width	Fruit weight	Soluble solids content	Yield
	----- cm -----		(kg/ea)	(°Brix)	(kg/ha)
HV	29.3 (0.3)	23.0 (0.4)	8.9 (0.2)	11.9 (0.2)	65,840 (1470)
HV+Urea 25%	28.1 (0.4)	23.1 (0.7)	8.6 (0.2)	12.0 (0.3)	64,150 (1550)
HV+Urea 50%	28.6 (0.4)	23.0 (0.5)	8.7 (0.2)	11.7 (0.2)	64,880 (1630)
HV+Urea 75%	28.1 (0.3)	23.1 (0.4)	8.8 (0.2)	11.8 (0.2)	65,650 (1510)
Urea 100%	28.8 (0.6)	23.1 (0.8)	8.6 (0.3)	11.6 (0.2)	64,220 (2360)

[†]Values are means with standard errors in parentheses (n=4).

8.9 kg
9.0kg
가
가
(Table 4).
가 65,840 kg/ha
가 66,940 kg/ha
가
100%
Waggar (1989) 16
8:1 87% 11:1
65%가 36:1
47% 가
수박 생육기토양 중 질산태 질소 농도
25%, 50%, 75%
가
가
(Fig 1).

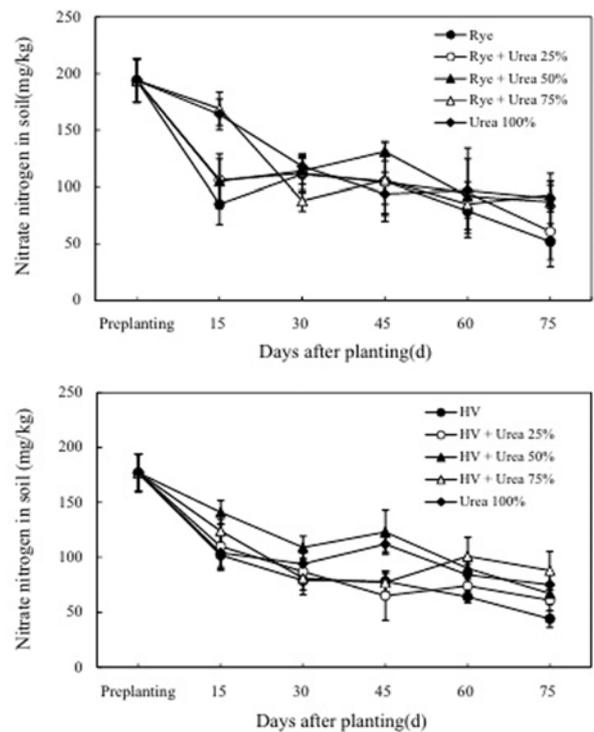


Fig. 1. The change of nitrate nitrogen in soil during the growing season of watermelon after hairy vetch or rye as green manure crops and different N fertilizer. Vertical bars indicate standard deviation of the mean(n=3).

가
(Lee *et al.*, 2012).

75 가
가 52 mg/kg 가
가
가 가

44 mg/kg
 25-40 mg/kg
 가
 가
 (Binford and Hansen, 2000; Hartz *et al.*, 2000; Heckman *et al.*, 2002).
 가 25 mg/kg
 (Heckman *et al.*, 1995),
 10-40 mg/kg (Kang *et al.*, 2011).
 40 mg/kg 가
 100% 가 가
 가 가

적 요

151
 79 kg/ha 88 kg/ha
 25%, 50%, 75% , 100%
 5
 가 가
 75 가
 가 52 mg/kg 가
 가 가
 가 44 mg/kg
 가 40 mg/kg
 가 가

Notes

The author declare no conflict of interest.

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