

**Table 3** Average soil available nitrate, available N, nitrification and net N mineralization at three depths, from samples collected at the end of the growing season of 2007 and 2008 with different cover crops in a Fraser fir Christmas tree plantation in Michigan, U.S.A. Treatments are: Conventionally managed (CONV), Dutch white clover with banding (DWCB), Dutch white clover with no banding (DWCNB), alfalfa with banding (ALFB), alfalfa with no banding (ALFNB), perennial ryegrass with banding (PRGB), and perennial ryegrass with no banding (PRGNB). \* Mean values followed with the same letters are not statistically significant. ns = not significant.

Depth (cm)	Management practice	NO <sub>3</sub> <sup>-</sup> -N (kg ha <sup>-1</sup> )		(NO <sub>3</sub> <sup>-</sup> +NH <sub>4</sub> <sup>-</sup> )-N (kg ha <sup>-1</sup> )		Nitrification (kg ha <sup>-1</sup> )		Net N-mineralization (kg ha <sup>-1</sup> )	
		2007	2008	2007	2008	2007	2008	2007	2008
0-15	CONV	8.3 a*	7.9 a	12.4 a	13.6 a	25.8 a	28.4 a	22.9 a	20.0 a
	ALFB	13.0 b	24.5 c	17.8 bc	35.5 c	44.3 c	98.1 d	40.9 c	87.4 de
	ALFNB	13.1 b	21.6 bc	22.1 c	32.3 bc	37.8 bc	98.1 d	30.6 ab	88.5 de
	DWCB	11.0 b	24.0 c	16.9 b	32.0 bc	41.0 bc	101.4 d	36.5 bc	94.1 e
	DWCNB	11.3 b	20.5 bc	17.3 b	26.1 b	32.7 ab	77.3 c	27.9 ab	70.2 cd
	PRGB	11.1 b	16.4 b	16.3 ab	26.2 b	31.9 ab	57.5 b	28.6 ab	49.5 b
	PRGNB	11.8 b	16.5 b	15.6 ab	24.8 b	33.3 ab	67.3 bc	31.4 ab	61.4 bc
	<i>P</i> -value	<b>0.050</b>	<b>0.004</b>	<b>0.010</b>	<b>0.001</b>	<b>0.029</b>	<b>&lt;0.001</b>	<b>0.021</b>	<b>&lt;0.001</b>
15-30	CONV	3.7 a	5.3 a	10.6	8.1 a	11.4 a	14.7 a	5.7 a	12.3 a
	ALFB	7.8 b	18.5 bc	11.6	24.9 c	25.0 c	39.5 b	22.1 bc	33.6 b
	ALFNB	6.5 b	20.5 c	10.4	27.3 c	25.8 c	46.0 b	22.8 c	39.9 b
	DWCB	5.7 ab	19.4 bc	9.0	27.5 c	24.4 bc	68.3 cd	22.2 c	60.6 cd
	DWCNB	8.0 b	15.1 bc	10.4	24.5 bc	25.4 c	55.6 bc	24.1 c	46.7 bc
	PRGB	6.0 ab	12.9 abc	10.1	20.2 bc	17.8 abc	57.2 bc	14.7 abc	51.0 bc
	PRGNB	6.0 ab	10.2 ab	10.1	15.3 ab	15.2 ab	79.6 d	12.1 ab	75.2 d
	<i>P</i> -value	<b>0.021</b>	<b>0.038</b>	<i>ns</i>	<b>0.005</b>	<b>0.027</b>	<b>&lt;0.001</b>	<b>0.010</b>	<b>&lt;0.001</b>
30-45	CONV	5.4	4.9 ab	6.6	7.0 a	5.0	16.9 a	4.4	8.9 a
	ALFB	2.9	7.9 cd	6.5	15.6 c	8.6	41.1 bc	5.6	32.5 c
	ALFNB	4.9	8.5 d	6.4	12.7 bc	7.1	24.3 ab	6.2	17.4 ab
	DWCB	4.9	7.2 abcd	6.6	13.6 bc	10.0	43.5 c	9.2	27.8 bc
	DWCNB	3.0	7.7 bcd	4.8	10.1 ab	13.0	34.7 abc	11.5	31.4 c
	PRGB	6.5	4.5 a	7.9	10.9 abc	9.5	38.1 bc	8.5	33.5 c
	PRGNB	4.6	5.1 abc	6.2	11.5 abc	10.5	29.6 abc	9.5	23.3 bc
	<i>P</i> -value	<i>ns</i>	<b>0.032</b>	<i>ns</i>	<b>0.022</b>	<i>ns</i>	<b>0.021</b>	<i>ns</i>	<b>0.012</b>