PCC USE IN SOUTHERN MINNESOTA – A SUCCESS STORY OF COLLABORATION BETWEEN RESEARCH AND PRODUCTION

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The sugarbeet industry is blessed with a co-product in mass quantity sometimes referred to as spent lime, but more appropriately referred to as Precipitated Calcium Carbonate (PCC). The use of PCC as an agronomic tool to enhance sugarbeet production has been a subject of research efforts since the late 1980's. Dr. Alan Dexter showed the benefits of adding PCC in the presence of soil persistent herbicides (Table 1). Dr. Carol Windels and Jason Bratner conducted research showing PCC can reduce effects of Aphanomyces cochloides to sugarbeets (Table 2). Studies conducted in the late 1990's by Southern Minnesota Beet Sugar (SMBSC) research showed significant benefit to PCC applications for sugarbeet and field corn production (Table 3). More recent research conducted by SMBSC and University of Minnesota has shown that soil root indices of Aphanomyces cochloides and Rhizoctonia solani were reduced and sugarbeet production was increased due to applications of PCC (Table 6). University of Minnesota and SMBSC research initiated in 2008 and finalized in 2012 has shown that PCC applied 2 years in advance of crop production was the most advantageous compared to 1 and 3 years ahead of crop production (Table 6). Sugar beet and field corn yields were increased 23-30% and 22-35%, respectively with 4, 8 and12 ton of PCC applied per acre. The cooperative research efforts between University personnel and SMBSC have led to grower acceptance of this research and have developed into a successful program of PCC use in the southern Minnesota region. As a result of research conducted and its adoption by growers southern Minnesota farmers have increased the use of PCC since 2001 by 6 fold. This accounts for a successful story of research to the farm.

Table 1. PCC application influence over time on pH and sugarbeet yield in the presence of persistent herbicides

Herbicide Treatments	Lime Applied 1996	Soil pH 1997	Sugarbeet Root Yield 1997	Soil pH 1998	Sugarbeet Root Yield 1998
None	Unlimed	5.7	14.3	5.8	21.4
	3 ton/A	6.8	22.7	6.6	23.1
	10 ton/A	7.7	21.4	7.5	29.3
Imazethapyr	Unlimed	5.7	0	5.8	7.7
	3 ton/A	6.8	0	6.6	21
	10 ton/A	7.7	0	7.5	25.3
Imazamox	Unlimed	5.7	12.9	5.8	22.8
	3 ton/A	6.8	16.5	6.6	23
	10 ton/A	7.7	20.10	7.5	25.10
	LSD (0.05)		1.8		4.9

Dr. A.G. Dexter, G.A. Bresnahan and W.C. Koskenen

Table 2. Aphanomyces Root Rot Index as influenced by PCC

PCC Treatment		Root Rot Index (%)
No PCC		93-100
3 Ton Lime		62
10 Ton Lime		62

Dr. Carol Windels and Jason Bratner

Table 3. Crop yield as influenced by PCC and phosphorus, 1999, 2000 and 2001 (average)

	Sugarbeet	Rel Rev.	Soybean
Treatments	**Tons**	**Percent**	**yield**
40 lb. P	23.04	97.34	43.92
4 ton lime	23.29	99.24	46.9
80 lb. P	27.06	111.84	48.1
8 ton lime	26.51	109.94	46.04
12 ton lime	26.8	113.5	49.76
16 ton lime	20.82	90.56	42.61
check	18.07	76.93	42.85
LSD (0.05)	3.33	7.85	NS

Table 4. Rhizoctonia as influenced by PCC 2009-2010 combined

Rhizoctonia treatment	PCC treatment	Sugarbeet Root Yield	Rel. Rev. percent of mean
None	No PCC	21.9	98
	4 ton/A	24.8	116
AG 2-2 IVA	No PCC	21.5	90
	4 ton/A	22.3	97
AG 2-2 IIIB	No PCC	19.4	82
	4 ton/A	23.7	113
	LSD (0.05)	3.8	15

Table 5. SMBSC Rhizoctonoia solani assay, 2009

		Soil root rot index	
TRT	PCC applied	Aphanomyces	Rhizoctonia
Non inoculated	Pre PCC	9	20
	Post PCC	5	17
AG 2-2 IVA	Pre PCC	18	16
	Post PCC	15	10
AG 2-2 IIB	Pre PCC	19	23
	Post PCC	16	8

SMBSC Rhizoctonoia solani assay, 2010

		Soil root rot index	
TRT	PCC applied	Aphanomyces	Rhizoctonia
Non inoculated	Pre PCC	20	25
	Post PCC	10	19
AG 2-2 IVA	Pre PCC	20	23
	Post PCC	13	9
AG 2-2 IIB	Pre PCC	25	27
	Post PCC	16	8

Table 7. influence of PCC on subsequent soybean, corn and sugarbeet crop 1, 2 and 3 years after application

Year 1	Year 2	Year 3	Soybean	Corn	Sugar beet
soybean	corn	Sugarbeet	Average	average	
No fert. No lime	no fert. No lime	no fert. No lime	102.14	77.08	90.97
4 ton lime	140 N Rec P	110 N Rec P	**102.02**	99.28	79.49
8 ton lime	140 N Rec P	110 N Rec P	99.55	100.98	94.66
12 ton lime	140 N Rec P	110 N Rec P	99.26	**112.64**	92.71
No N Rec P	140 N Rec P 4 ton lime	110 N Rec P	97.55	97.33	**113.93**
No N Rec P	140 N Rec P 8 ton lime	110 N Rec P	94.54	99.11	**120.22**
No N Rec P	140 N Rec P 12 ton lime	110 N Rec P	97.26	**103.40**	**126.68**
No N Rec P	140 N Rec P	110 N Rec P 4 ton lime	**101.06**	100.53	96.24
No N Rec P	140 N Rec P	110 N Rec P 8 ton lime	99.78	99.96	101.68
No N Rec P	140 N Rec P	110 N Rec P 12 ton lime	**101.81**	99.25	100.45
No N Rec P	140 N Rec P	110 N Rec P	99.25	**104.76**	98.73
No N Rec P	140 N Rec P	no fert. No lime	99.84	102.75	75.85
4 ton Turkey Manure 4 t lime	140 N Rec P	110 N Rec P	100.40	**104.85**	**110.04**
No N Rec P	4 ton TM 4 ton lime	110 N Rec P	100.66	88.19	97.01
No N Rec P	140 N Rec P	4 ton TM 4 ton lime	99.15	82.54	**111.33**

Note: bold data indicates significance greater than the mean