EFFECTS OF PRIMING ADVANCE TREATMENT (PAT) ON SEED GERMINATION AND YIELD OF SUGAR BEETS

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ABSTRACT:

Rapid germination and uniform emergence are desirable traits when establishing optimum plant populations. The objective of this study was to determine how the Priming Advanced Treatment (PAT) utilized by Seed Systems, Inc. would affect speed of seed germination, stand establishment and yield of sugar beets under field conditions. Varieties used in the studies compared PAT to standard seed treatments from the same seed lots. Over four years, different environmental conditions were encountered including warm, cool, wet and dry soil conditions. PAT treatments generally emerged and established faster under most conditions. Largest differences in emergence occurred in cool soil, improving speed of emergence by several days. Largest yield enhancement occurred for PAT treatments under cool emerging conditions and ranged from 0-3 tons under all conditions.

MATERIALS AND METHODS:

Sugar beet seed from the same seed lot was used when comparing standard seed to PAT Pelleted Seed Treatment. Trials that were conducted for harvest were planted with grower equipment and field preparations. Each trial was planted in a randomized complete block and replicated three to four times. Harvest consisted of four or six row strips with grower equipment directly loading beets into a 10-ton beet cart with digital scales. Emergence counts were taken in the center two 50-foot rows of each strip. Planting dates and soil temperatures varied greatly between years and locations.

INTRODUCTION:

The majority of the Michigan Sugar Beet Industry is located in the "Thumb" and near proximity of the Saginaw Bay and Lake Huron. Predominate lake bed soil types are light colored loams, good water holding capacity and low in organic matter (2%). Soils are generally slow to warm up in the spring and prone to crusting when significant rainfall occurs. Emergence of seedlings have been a problem with producers only achieving on average 60% emergence. Improving speed of emergence could help in stand establishment by limiting the time a potential crust could form, minimize seedling disease exposure and increasing plant growing season by a few days.

At six locations in 1997, observation strips were established to simply look at the emergence effects of Priming Advanced Treatment (PAT) to standard seed. (See Table 1) Pelleted seed and standard seed were not from the same seed lot, however five of the six (PAT) trials showed a substantial improvement at the ten day emergence, over standard seed of the same variety. Starting in 1998 controlled studies were conducted using standard research design and comparison of the same seed lot treatments. Trials were established to evaluate the effect of PAT treatment on emergence, yield and quality of sugar beets and to determine under what environmental conditions would PAT be most responsive. In 2002 a trial was conducted to look at the effects of PAT Treatment (Seed Systems) on varieties with different emergence characteristics – B-5736 (slow emerger) and PROMPT (fast emerger). Treatments for each variety were from the same seed lot. Four replications of each variety were planted under cool (5/5/02) and warm (4/14/02) soil planting conditions. The April planting date experienced several days of unseasonable hot temperatures while the May planting date had very cold conditions. No crusting of soil occurred for either planting date. There were not any significant difference on the final stand for PAT vs. NON PAT treated pellets for either variety.

RESULTS:

Studies conducted in nine locations in four years indicate Priming Advance Treatment (PAT) on average will significantly improve tonnage by 1.2 tons and improve 10-day and 30-day plant emergence over standard seed treatment (See Table 2). Six of the nine trials conducted had significantly better emergence at 10 days than the standard seed. These six trials had significantly better recoverable white sugar per acre (RWSA) and tonnage (See Table 3). In the three trials that 10-day emergence was similar for PAT vs. No PAT, there were not any significant differences that occurred in yield. The cooler the soil conditions, the greater the differences in emergence were observed between standard seed and PAT seed (See Table 4 & 5). Different varieties result in different rates of emergence (See Table 6 and 7).

CONCLUSIONS:

Priming Advanced Treatment (PAT) of sugar beet seed can improve speed of emergence on varieties with different emergence characteristics. When emergence of PAT treated seed is significantly faster at the ten day stand count, tonnage on average may increase by 1.5 tons. When ten day emergence is equal, no yield enhancement is seen. Under Michigan conditions we would expect to see faster emergence two out of three times, with yield improvement ranging from 0-3 tons on average 1.2 tons. Largest response to PAT treatment occurs under cool soil conditions and early planting. Under normal emergence conditions, final stand of standard seed and PAT seed are equal. Under crusting conditions and faster emergence, PAT treated seed can improve final stand. PAT pellets improved the speed of emergence for fast and slow emerging varieties under both warm and cool soil conditions. The largest response to PAT treatment occurred under cool soil conditions and with the slow

emerging variety (Beta 5736). Stand establishment occurred most rapidly with PAT treatments.

Table 1 – Effect of Pelleting Seed Treatment on Emergence at six locations in 1997

	78	**171**	**173**
	43	**190**	**196**
	30	**183**	**192**

Table 3: *Effect of PAT Treatment on Yield and Quality when 10-Day Emergence is significantly faster than standard seed. Six locations, year 1998, 1999, and 2000.*

	6168 a	**22.02 a**	**266 a**	**18.73 a**	**115 a**
	5578 b	**20.58 b**	**259 a**	**18.40 a**	**52 b**
	518	**1.11**	**NS**	**NS**	**25**

***Table 2:** Effect of Priming Advanced Treatment (PAT) on Yield, Quality and Emergence in 1998, 1999, 2000 and 2001*

	RWSA		TONS		RWST		% SUGAR		Emergence / 100 ft. 10-DAY		Emergence/ 100 ft. 20-DAY		Emergence/ 100 ft. 30-Day	
Year	PAT	Check	PAT	Check	PAT	Check	PAT	Check	PAT	Check	PAT	Check	PAT	Check
1998	4357	4078	16.5	15.4	265	265	18.7	18.8	169	103	181	148	165	124
1998	6132	5993	21.0	20.5	293	291	20.2	20.3	128	52	198	177	190	157
1998	5939	5169	25.2	22.6	236	229	17.0	16.6	159	129	203	170	184	152
1998	8130	7080	27.4	25.2	297	281	20.2	19.4	60	1	174	144	172	149
1999	5843	5768	22.5	21.8	259	264	18.8	18.7	30	0	65	30	78	64
1999	5588	5760	24.0	24.0	233	240	17.4	17.8	40	44	96	115	107	115
1999	7684	7791	28.0	27.7	275	281	19.2	19.5	6	10	48	56	113	126
2000	6607	5378	26.7	23.78	247	226	17.5	16.6	105	6	105	6	178	87
2001	6932	7202	28.9	29.1	240	248	17.3	17.4	35	47	175	188	256	239
MEAN	6357	6024	24.6*	23.4	261	258	18.5	18.3	81*	44	138	113	160*	135
LSD (5%)	NS		.8		NS		NS		30		NS		24	

**= Significantly Different from Mean Check*