

Whole Farm Corn Starter Phosphorus Fertilizer Imports

Q.M. Ketterings¹, G. Albrecht¹, M. Hunter², P. Carey³, S.N. Swink¹, and K.J. Czymmek⁴

¹Department of Crop and Soil Sciences, ²Cornell Cooperative Extension of Jefferson County,
³Cornell Cooperative Extension of Sullivan County, ⁴ProDairy

Introduction

The results of the New York Starter P Project (see What's Cropping Up? 14(1): 1-3 and 14(5): 1-2) showed that on sites that test *high* in P and have no manure applications planned for the season, no yield or quality penalty is expected when P starter levels are *reduced* below 25 lbs P₂O₅/acre. On sites that test *very high* in P or when manure is applied to high testing sites, there is a low probability of a starter P response and P could be *eliminated* from the starter without a yield or quality penalty. This assumes that the proper pH (minimum of pH 6.0 for corn) is maintained and other nutrients are available in sufficient quantities.

At the 2003 Empire Farm Days, 75 producers from 30 New York counties filled out a survey on starter P use in corn. Of these producers, 37% grew more than 200 acres of corn, 25% had 100-200 acres in corn production while 37% had less than 100 corn acres. That winter, 274 producers (24 different New York State counties) answered the same survey questions during Cornell Cooperative Extension meetings. Of the latter group, 26% grew more than 200 acres of corn, 32% had 100-200 acres, and 42% had less than 100 corn acres. The combined groups represented over 72,000 acres of corn. The surveys indicated that the three most common starter blends were 19-19-19, 15-15-15, and 10-20-20 and that the average application rate was 250 lbs/acre (the equivalent of 48 lbs of P₂O₅/acre).

We analyzed 30 complete dairy farm plans to answer the question: how many pounds of P₂O₅ can a dairy farm save by shifting from a standard starter application of 250 lbs of 19-19-19 (48 lbs P₂O₅/acre) to soil-test based management for corn?

Materials and Methods

Soil tests and field data (crops and planned manure applications) were obtained for 30 dairy farms from across New York State. The acres of corn per farm ranged from 41 to 1,488 acres. The percentage of acres testing high or very high in P varied from 18% (corn acreage basis) on the farm with 41.3 acres of corn to 92% on a farm with 982.6 acres of corn. On average 50% of all corn acres tested high or very high in P (48% on total farm acreage basis – i.e. including non-corn fields). This is similar to distributions observed in the database of the Cornell Nutrient Analyses Laboratory (see What's Cropping Up? 14(5): 3-6). The four scenarios are listed in Table 1. Scenario 1 assumes that all corn fields receive 250 lbs of 19-19-19, independent of soil test P level. In scenario 2, the application rate is reduced to 125 lbs of 19-19-19. Scenario 3 is soil test based management following Cornell recommendations (which implies a P-free starter and implementation of three rates of 19-19-19), while scenario 4 is a more producer friendly farm option with a P-free fertilizer for all fields that receive manure and/or test high or very high in P and 250 lbs of 19-19-19 for all other fields.

Results and Discussion

If we assume that all corn fields on the farm received 250 lbs of 19-19-19 per acre (scenario 1 in Table 1), P fertilizer imports onto the farms would have varied from 1,982 lbs P₂O₅ on the farm with approximately 41 acres of corn to 71,443 lbs P₂O₅ for the farm with

1,488 corn acres. Implementing a reduction in P application without shifting to two application rates (i.e. scenario 2; 125 lbs of 19-19-19 per acre for all corn fields) would reduce the average annual P imports by 11,244 lbs P₂O₅ per farm. Scenario 2 would not meet the P guidelines for all fields, and this could possibly impact corn yields on low P fields.

Table 1: Scenarios for P starter use as implemented on 30 dairy farms in New York.

ID	Blends	Rates	Description
(1)	1	1	250 lbs of 19-19-19 for all corn fields, independent of soil test P
(2)	1	1	125 lbs of 19-19-19 for all corn fields, independent of soil test P
(3)	2	3	No fertilizer P (i.e. P-free starter) for fields testing very high in P For high P fields: <ul style="list-style-type: none"> • no fertilizer P (i.e. P-free starter) if manure is applied • 125 lbs 19-19-19 if no manure is applied For fields very low, low or medium in P: <ul style="list-style-type: none"> • 125 lbs 19-19-19 if manure is applied • 250 lbs 19-19-19 if no manure is applied for medium P soils • 300 lbs 19-19-19 if no manure is applied for low P soils
(4)	2	1	No fertilizer P (i.e. P-free starter) for: <ul style="list-style-type: none"> • all fields that receive manure • high and very high P soils that do not get manure 250 lbs 19-19-19 for all other fields

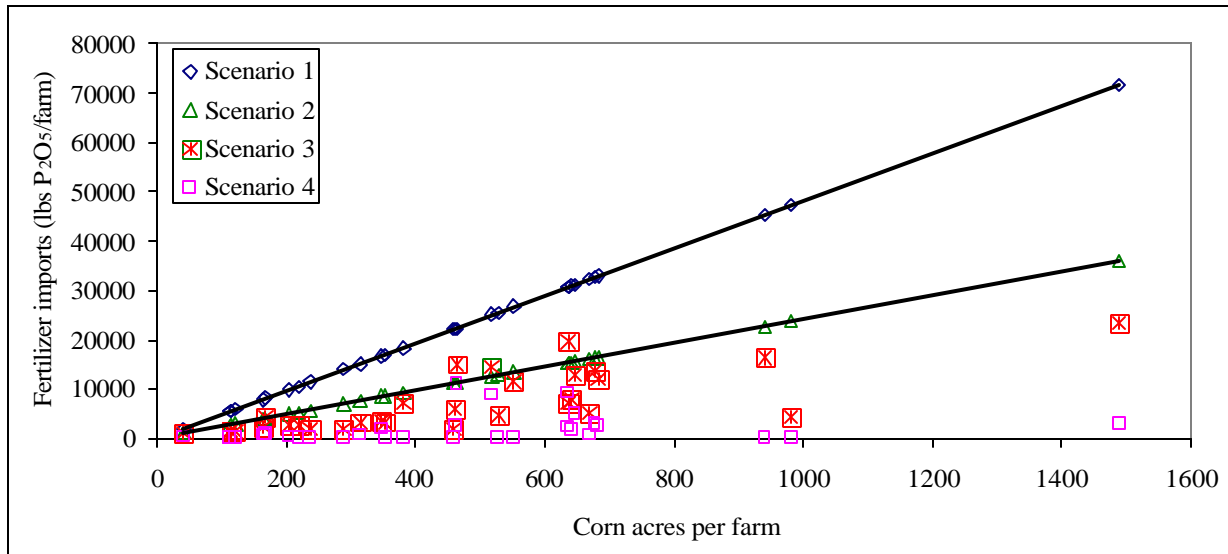


Figure 1: Effect of starter fertilizer management on whole-farm corn starter P imports. Scenarios are explained in table 1.

Following Cornell guidelines (scenario 3 in Table 1) would have allowed for substantial reductions in P fertilizer imports (Figure 1). However, this scenario implies the use of two blends (a P-free blend and a P-containing blend) and 3 rates (125, 250 and 300 lbs of 19-19-19 in our example) for the P-containing blend and may not be practical on many farms. On 15 of the 30 farms, all high P fields were scheduled to receive manure. Shifting to a more practical management option of 250 lbs of 19-19-19 per acre for low and medium P corn fields that do not get manure and P-free fertilizer for all other corn fields (scenario 4 in Table 1), would have eliminated the use of P containing starter on 12 of the farms and reduced the

average annual P fertilizer imports on the other 18 farms from 1,982-71,443 lbs of P₂O₅ under scenario 1 to 144-10,992 lbs of P₂O₅ under scenario 4 (Table 2 and Figure 1). As shown by the results of the New York Starter P Project, in most years, this shift to scenario 4 is not likely to negatively impact yield or quality of the forage. However, regular soil testing is needed to monitor soil test P levels over time.

Table 2: Effect of P starter management for corn on total P fertilizer imports per farm for 30 New York dairy farms. See Table 1 for a description of the management scenarios. Soil test classifications (Cornell Morgan test) are L (low), M (medium), H (high) and VH (very high).

County	Corn		Soil test phosphorus classification				P starter fertilizer use for corn fields under 4 different management scenarios			
			L	M	H	VH	1	2	3	4
	Acres	Fields	% of total corn acres				lbs P ₂ O ₅ /farm			
Yates	41	9	33	48	18	0	1982	991	924	168
Dutchess	114	24	17	24	59	0	5458	2729	1726	144
Clinton	114	8	16	35	50	0	5467	2734	1375	0
Chautauqua	121	18	16	30	28	27	5827	2913	1339	0
Erie	165	14	10	35	50	5	7920	3960	2400	768
Chautauqua	169	19	49	35	14	2	8088	4044	4089	1008
Yates	203	29	16	24	47	14	9758	4879	2741	307
Ontario	219	16	33	8	24	35	10507	5254	2693	0
Erie	237	15	20	16	42	23	11381	5690	2006	0
Cattaraugus	289	16	10	19	71	0	13872	6936	2016	0
Erie	314	26	6	26	49	20	15077	7538	3228	533
Chenango	348	31	9	15	45	30	16685	8342	3453	1896
Jefferson	352	18	20	18	41	20	16896	8448	3288	0
Erie	383	28	47	32	21	0	18360	9180	7236	0
Cortland	458	30	1	15	79	5	21960	10980	1944	0
Clinton	461	24	6	35	59	0	22142	11071	5842	2664
Jefferson	464	19	48	26	22	5	22272	11136	14808	10992
Chautauqua	519	41	51	16	33	0	24898	12449	14383	8803
Cattaraugus	527	28	0	36	64	0	25296	12648	4613	0
Franklin	552	40	27	59	13	1	26506	13253	11398	0
Jefferson	637	33	19	19	54	7	30576	15288	7275	2352
Schuyler	638	52	62	17	20	0	30600	15300	19527	9264
Cattaraugus	643	51	30	14	48	8	30845	15422	7899	1474
Jefferson	646	35	16	46	35	2	31008	15504	12756	4896
Ontario	670	40	3	9	66	22	32150	16075	5246	672
Chautauqua	677	49	30	38	31	1	32486	16243	13739	2894
Columbia	684	60	44	9	17	31	32818	16409	12044	2674
Clinton	942	47	15	57	28	0	45197	22598	16198	0
Cayuga	983	70	2	7	68	23	47165	23582	4260	0
Franklin	1488	50	10	49	40	2	71443	35722	23522	2928
Average	468	31	22	27	41	9	22488	11244	7132	1815
Minimum	41	8	0	7	13	0	1982	991	924	0
Maximum	1488	70	62	59	79	35	71443	35722	23522	10992

Soil test based management for corn starters can save dairy producers money without sacrificing yield or quality. Let's take a look at a few cost saving examples. If we assume that 19-19-19 costs about \$270 per ton, shifting from scenario 1 (250 lbs of 19-19-19) to a reduced rate of 125 lbs 19-19-19 per acre the producer would save almost \$17 per acre for each field that did not need the extra P for optimum yield. If a producer is using 250 lbs of 19-19-19 per acre on fields testing high and very high in P and K, a shift to 115 lbs of ammonium sulfate per acre (approximately \$200 per ton of 21-0-0) would result in a \$22 per acre savings, while still providing a responsive amount of N in the starter fertilizer band (20-30 lbs N). A shift from 125 lbs 19-19-19 to 115 lbs of ammonium sulfate per acre (i.e. without altering the N application rate), would save the producer about \$5.50 per acre. Corn fields that are very high in P tend to be high in K as well. Soil test results will indicate if extra K (as well as lime) is needed. If we assume testing fields on a regularly scheduled basis (at least once in three years) with a minimum of one sample per 10 acres, savings in fertilizer expenses easily exceed the cost of collecting and analyzing soil samples.

Conclusion/Recommendation

Fertilizing based on soil test results benefits the environment and farm profitability. *Depending on the acres of corn on the farm, cost saving on a whole-farm basis can be quite substantial.* We recommend that corn growers test their fields for soil fertility status at least once every three years, target manure to low and medium P fields where possible, and adjust starter P application rates accordingly. Low P or P-free blends are recommended for fields that regularly receive manure and/or are high in soil test P.

References

1. Ketterings, Q.M., J.E. Kahabka, and W.S. Reid (2004). The phosphorus fertility status of New York agricultural land. What's Cropping Up? 14(5): 3-5.
2. Ketterings, Q.M., S.N. Swink, G. Godwin, K.J. Czymmek, G. Albrecht (2004). New York Starter Phosphorus Project – Does starter P fertilizer impact silage quality? What's Cropping Up? 14(5): 1-2.
3. Ketterings, Q.M., S.N. Swink, G. Godwin, K.J. Czymmek, A. Durow, and G. Albrecht (2004). New York Starter Phosphorus Project – Results of the 2003 growing season. What's Cropping Up? 14(1): 1-3.

Acknowledgments and For Further Information

Special thanks to the 30 producers that shared their whole-farm nutrient management plans with us and Sander van den Hoogen for evaluation the P fertilizer scenarios for the farms. For further information contact your local Cornell Cooperative Extension office, contact Quirine M. Ketterings at (607) 255 3061 or gmk2@cornell.edu, and/or visit the New York Starter P Project website: <http://nmssp.css.cornell.edu/projects/starterp.asp>.



Nutrient Management Spear Program

<http://nmssp.css.cornell.edu/>

A collaboration among the Department of Crop and Soil Sciences, Pro-Dairy, and Cornell Cooperative Extension.