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Controlled-Release Fertilizer Opportunities and Costs for Potato Production in Florida[1]

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The recent emphasis on the development of vegetable production Best Management Practices has prompted a re-examination of fertilization practices in Florida potato production. One fertilizer practice that can meet the production and environmental goals of both growers and regulatory agency personnel is the use of controlled-release fertilizers (CRFs). CRFs are polymer coated nitrogen N fertilizers, typically urea, that are engineered to release nutrients based on soil temperature and not soil moisture. This release profile decreases the N leaching potential of the fertilizer. IFAS research over the past three years has demonstrated that N rates can be reduced with a CRF program compared to a soluble N fertilizer program (non-coated urea and/or ammonium nitrate) without reducing crop yield or quality. Although CRF technology can improve N use efficiency, the high cost of the material has limited the adoption of CRF technology in potato production. However, the development of BMPs coupled with the cost-share potential of CRFs at the national, state and/or local level has improved the chance that CRFs will be used as a fertilizer source for potato production.

The objective of this article is to compare the costs and benefits of a *nitrogen* CRF program to a traditional soluble N program in potato. The cost of a soluble N fertilizer program varies between growers and over years based on manufacturing costs, N sources, and rate. Therefore, a range of possible costs and rates are detailed in Table 1. The BMP N rate for a soluble program is 200 lb N/acre and is included for comparison. In Table 2, several cost and rate combinations for a CRF program are listed. There are several unknowns with the CRF program. The most important of which is material cost per ton.

Soluble Nitrogen Source

Highlighted in Table 1 are combinations of common costs and rates for a soluble N program in northeastern Florida over the past few years. Highlighted N costs range from 2.1 to 3.5% of the total production cost for potato ($1800 total production cost). To find the N cost for a specific farm or program, locate the cost of N per acre for the previous season at the top of the chart and move down the column to the appropriate nitrogen fertilizer rate.

CRF Nitrogen Source

Current IFAS research indicates that tuber quality and yield with a CRF program of 150 to 175

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lb N/acre are comparable to a standard soluble fertilizer program at the BMP rate (200 lb N/acre). CRF prices used here are based on discussions with industry personnel. To be competitive, however, products should be priced between $400 and $700/ton. Therefore, the projected cost of N from a CRF program ranges from 3.9 to 7.8% of the total production costs for potato ($1,800 total production cost) (Table 2).

Discussion

Tables 1 and 2 list the potential grower costs for the soluble and CRF fertilizer programs. The most expensive highlighted CRF program ($142/acre) is 3.7 to 2.3 times more expensive than the least and most expensive highlighted soluble fertilizer programs ($38 and $63/acre), respectively. There are, however, several benefits to using a CRF program that may offset some of the cost of the CRF program. The benefits of a CRF program compared to a soluble fertilizer program include:

1. A CRF program requires a single, pre-plant, fertilizer application compared to multiple applications (application number dependent on season) with a soluble fertilizer program. The BMP program recommends at least a single split application (2 trips) when using soluble N sources. Each trip across the field costs approximately $3/acre.

2. A polymer coated CRF releases nutrients based on soil temperature and not soil moisture. Therefore, during potato seasons with substantial rain, N in the CRF prill will remain in the field and not leach into the watershed. The current BMPs for the soluble fertilizer program allow up to 30 lb N/acre to be added during the season after each leaching rain event to make-up for leaching. In the 2003 season, some growers applied an extra 90 lb N/acre as part of the BMP program because of the substantial rainfall (total 290 lb N/acre for BMP program in 2003). No added N was necessary with the CRF program (150 to 175 N/acre in 2003).

3. The CRF program improves N use efficiency as alluded to above (2). A higher percentage of applied N makes it into the crop when fertilized with a CRF compared to a soluble fertilizer source. This is because CRFs release N slowly over the season as the crop needs it. Therefore, there is less opportunity for N to leach into the watershed with a CRF program. CRF N rates of 175 and 150 lb/acre translate into a yearly N savings of 450,000 to 900,000 lb in the St. Johns River watershed production area compared to the *BMP nitrogen rate*. By reducing the CRF N rate below the BMP rate, growers and manufactures can develop good will with the public while reducing the potential for nitrate to enter the watershed.

4. The CRF program improves operational efficiencies. With limited trips through the field to apply fertilizer and reduced worry during rainy seasons, growers can spend more time doing other things such as marketing potatoes.

CRF is more expenxive than a traditional soluble fertilizer on a per unit basis. However, Florida citizens and growers would benefit if CRF costs were shared by all parties that have a stake in improving water quality in the St. Johns River watershed. In this simple model, the cost of a soluble N fertilizer program in most years falls between $38 to $63/acre (Table 1). Estimated CRF program costs (highlighted in Table 2) would be approximately $8 to $79/acre more than the most expensive soluble N cost ($63/acre, Table 1). If this cost difference was supported 100% by local, state or national regulatory agency funds, the cost-share program would require $144,000 to $1,422,000 annually to be fully funded. The northeast Florida potato crop is valued at approximately $60 to 75 million. The cost share program costs would be a relatively small cost to keep a northeast Florida business with a potential $75 million dollar annual return solvent.

These numbers serve as a starting point for discussion regarding the value of using CRFs in potato production in the St. Johns River watershed. There are approximately 18,000 acres of potatoes in the St. Johns River watershed that can benefit from a CRF program. In addition, there are well over 100,000 acres of other vegetable crops on seepage irrigation across Florida that could benefit from a CRF program. This acreage increases greatly if one considers all the production areas in the U.S. where N

may be negatively impacting surrounding watersheds. A CRF program can be a win-win-win opportunity for growers, manufacturers, and regulatory agencies by helping all meet their production, business, and environmental goals.

Additional Information

Hutchinson, C.M., W.A. Tilton, and E.H. Simonne. 2002. On-farm demonstration of a controlled release fertilizer program for potato production. Vegetarian Newsletter, Horticultural Sciences Department, University of Florida. June. http://www.hos.ufl.edu/vegetarian/02/June/June.htm

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Table 1. Traditional soluble fertilizer program costs per acre using a blend of urea and ammonium nitrate with a final grade of 32-0-0.

Rate (lb N/a)	Soluble Fertilizer Cost (per acre) ($/ton product)[z]					% Total Production Costs
	130	**140**	**150**	**160**	**170**	
150	31	33	35	38	40	
175	36	***38***	***41***	***44***	47	2.1 - 2.4
200	41	***44***	***47***	***50***	53	2.4 - 2.8
225	46	***49***	***53***	***56***	60	2.7 - 3.1
250	51	***55***	***59***	***63***	66	3.1 - 3.5
275	56	60	64	69	73	
300	61	66	70	78	80	

[z]1 ton of 32-0-0 material would fertilize 3.2 acres at the BMP nitrogen rate (200 lb N/acre).

Table 2. Alternative CRF program costs per acre using a polymer coated urea with a final grade of 43-0-0.

Rate (lb N/a)	CRF Cost (per acre) ($/ton product)[z]						% Total Production Costs
	300	**400**	**500**	**600**	**700**	**800**	
125	44	59	73	88	101	116	
150	53	***71***	***87***	***105***	***122***	140	3.9 6.7
175	61	***82***	***102***	***123***	***142***	163	4.6 7.8
200	70	94	116	140	162	186	
225	79	105	130	157	183	209	

[z]1 ton of 43-0-0 material would fertilize 5.7 and 4.9 acres at the 150 and 175 lb N/acre, respectively.