CROP EXCELLENCE®

THESE SPUDS ARE FOR YOU!

A different perspective on practical fertility programs to enhance the yield and quality of potatoes.

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Easter or Good Friday was always a big day in the Smith family history. Not because of religious reasons per se but because for my Grandfather Bert, it was his only day off of the year from the local traction and bus company where he doubled as the driver and head mechanic – whenever Easter fell on the calendar, it only meant one thing – "get them 'taters in". So, it started, a lifetime spent in and around potatoes; intern at the Scottish Plant Breeding Station, Pentlandfield, later working for Mr. J.R. Simplot in the fields of Idaho to travelling the world chasing the perfect potato. Spuds are indeed the crop of legend in my experiences.

Throughout all of my experiences in production and processing to the delights of fancy restaurants and even MacDonald's, potato fertility has been a major consideration in the presentation of the abundance and quality of this menu staple. Genetics, location and thus environment, crop protection, storage, and processing are huge but the glue holding these components together is plant fertility.

As a plant physiologist, I tend to look to history, genetics, and plant morphology – soil science is left to layer in on these essentials. However, keep an open and very active management eye on each growing season – your management of the uncertainties of the present and future cannot be solely managed on the certainties of the past! Science-based products and technologies will assist...

Potatoes hail from South America, most likely Chile but the Andean cordillera for sure – try drinking a potato beer down here with local farmers and resolve that debate between Peru, Ecuador, and Colombia! The Spanish took the crop home to Spain and eventually, according to Woodbury and Kraus (University of Idaho, Bulletin 21, 1975) became more valuable the all the gold plundered by the conquistadores. The potato grew as a food staple, initially for the poor and livestock, throughout Europe, probably getting to Ireland around 1700. Everybody knows an Irishman on this side of the pond, particularly around March 17 and the fine constabularies of Boston, New York, and Chicago to name a few. Even Billy the Kid had Irish parents – a former resident of Lincoln County, New Mexico which I now call home! The Irish Potato Famine of the 1840s triggered a mass wave of immigration to the U.S., all caused by a plant disease – potato blight. Historic crop indeed, and might plant nutrition have avoided this significant event?

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Interestingly, the potato appears to be the only crop not mentioned in the Bible. Some speculation suggests that because the potato is part of the family Solanaceae which also covers nightshades, belladonna, and other such toxic delights – so much for tomatoes and tobacco! Nonetheless, Solanum tuberosum is what we know as the Irish Potato or the Idaho potato depending on your marketing commission. Probably the most iconic variety and parent of present-day production and processing is the Russet Burbank – as a sidebar, Luther Burbank could be the Nicolas Tesla of the plant breeding world, fascinating histories largely unrecognized yet gave technologies touching most beings on this rock we call Earth. Burbank derivatives remain the core of the processing and fresh packaging crop in the U.S. yet there is a rapid expansion into "wild-type" varieties, close to South American staples – generally smaller, more colorful, and certainly more tasteful tubers. The fertility principles remain the same – here's why.....

To most potato agronomists and practitioners, the light bulb-popping moment happens when you realize that botanically potatoes are not a root crop – tubers are enlarged stolons which are, wait for it, modified stems! Could more of a foliar approach to fertility as compared to soil, root-based philosophy avoid the great famine? Pure speculation, obviously, but good botanical and physiological clues to potential fertility regimes. Potatoes have roots and thus a soil/root interface but the roots tend to be fairly shallow, highly dependent on soil structure and nutrients supplied via mass diffusion of water. Potato root nutrition can be very inefficient – below 20% for example, for phosphate, hence such high rates of soil-applied P are routinely used for potato crops. Physiologically, the tuber crop is very fickle, and quality can be compromised by lack of attention or adverse environmental factors, including fertility.

There are four key stages to potato growth and related fertility:

- Planting (Vegetative)
- Tuber Initiation (Tuberization)
- Bulking (Tuber growth)
- Harvest (Maturation)

The serious grower knows you cannot plant, shut the gate, and re-open it at harvest time!

The following is intended as a guideline only – the principles are the same but local conditions, variety, market destination, and so forth dictate site-specific recommendations and product choice and practice. For the record, my wife and I grow an assortment of red, white, blue, gold, and purple table spuds appreciated by us and farm market customers – yes, we always have a box of Russets on hand from our good friends in Idaho!

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Nitrogen
Start high, go low as a general rule. The crop canopy needs a quick start and the longevity is vital to eventual tuber size and quality. Constant tissue (4th petiole) analysis is an essential tool in processing fresh-pack crops – Russets for example need to be managed from early season highs of 25,000 ppm nitrate-N to pre-harvest levels of less than 5,000 ppm. Failure to do so will adversely impact specific gravity (dry matter content needs to be high for fries and chips) and storage longevity. Little and often approaches to in-season nitrogen management are thus recommended – utilize tools such as slow-release N sources, fertigation, and foliar practices. Similarly, make sure all other nutrient levels are optimized, not least phosphorus, potassium, calcium and boron. As a general principle, N and K increase the size of tubers, and P will influence the tuber set and thus quantity.

Phosphorus
Potatoes are one of the most P-inefficient crops we grow – simply loading up front as per tradition helps but certainly fades during later key developmental stages. High P starters are essential to stimulate early growth but a shot of foliar P at tuber initiation can pay dividends in terms of tuber number and retention. Similarly, later season doses as sprays or via irrigation will enhance tuber growth and quality, as well as deter late-season diseases such as verticillium wilt and premature dieback of foliage.

Potassium
Lack of adequate K nutrition quite simply limits N efficiency, tuber bulking, starch formation, and thus specific gravity, notably for fresh-pack and processing potatoes. Arguments abound on the form and delivery of K but essentially use it early, mid-season, and pre-maturity – soil and foliar mechanisms will complement a programmed fertility approach.

Sulfur
Interestingly, potato offtake levels indicate S requirements close to P requirements. In-season S is a must to ensure maximum N efficiency and utilization for both foliage longevity and tuber quality.

Magnesium
Like S, another nutritional no-brainer for potatoes – essential to foliage health and longevity.

Calcium
For potatoes, Ca is a plant nutrient too often overlooked or dismissed as an essential ingredient in a quality nutrient program. Calcium correctly applied will reduce tuber disease (notably bacterial rots), reduce hollow heart and internal browning, "jelly-ends", fry caramelization and "black-ends" in both processing and fresh-pack crops. Nitrogen efficiencies will also be realized with commensurate quality and storage benefits.

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Boron

Later season B applications greatly assist in N utilization and partitioning within the bulking crop contributing significantly to the yield, quality, and storability of potatoes. Use of molybdenum in small quantities with foliar B will greatly assist here. Boron and Ca are really inseparable in a good potato program – B is essential to cell wall development facilitated by Ca in the plant, notably during tuber bulking.

Zinc

Zinc deficiency is fairly widespread in potatoes, particularly on eroded high free-Ca soils, and as a result of P antagonism after high phosphate fertilization, common for potatoes. Inclusion in starter formulations and as foliar supplementation from tuber initiation and during bulking should be considered as necessary.

Manganese, Copper, and Iron

Actual visual deficiencies of these essential elements are less common but are seen based on prevailing soil and environmental conditions. Similarly, the reduction in use of metal dithiocarbamate fungicides has also been implicated in some regions. As always, if soil or tissue tests indicate, pre-empt the deficiency– avoid subliminal or transient deficiencies and incorporate the elements into the fertility regime, notably during tuber bulking.

Humics, seaweeds and other essentials

Over the years, potatoes have been inundated with "non-fertilizer" materials and inputs. Consider the following, all backed with data and experience!

- Humic acids, include in starters to improve P uptake and availability
- Fulvics – very good companion to foliar nutrient formulations – assist in membrane permeability and nutrient absorption
- Seaweed extracts – a rich source of beneficial plant hormones and vitamins with a good track record in potatoes – check the coastal regions of Ireland and Scotland for example!
- Biologicals – aside from pest and disease control, certain beneficial bacteria and fungi have shown promise in elevating overall soil health and native nutrient (notably P) supply to roots
- Silicon – watch this space! We use Si routinely to enhance the efficiency of other nutrients and mitigate fungal disease and insect feeding.

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Summary program by key potato development stage

Pre-plant fertilization

- Treat all Nitrogen (N) with **SERPENTINE® Nitrogen Stabilizer**

Planting / Vegetative

- High P, K starter fertilizer, band applied preferably, consider fertilizer enhancing biologicals
- Recommended inclusions to consider are humic acid and micronutrients such as zinc
- Recommended applications of **Crop Pop™, MicroMax™, Rapids®, Undertow®,** and **Zn X-TREME®**

Tuber initiation

- Boost tissue P levels with a foliar application to enhance tuber number and retention
- Consider seaweed extract formulations
- Recommended applications of **Crop Pop™** and **CELP™ 4-0-9**

Bulking / tuber growth

- Start foliar applications to complement nitrogen strategies
- Foliar K, early bulking, Foliar Ca and B throughout
- Address tissue levels of other nutrients, notably micronutrients through fertigatoin or foliar with N
- Include fulvics in foliar programs
- Recommended applications of **Boron X-TREME®, N Amino Pop, Ca X-TREME®, Foli-Pop K™ Stress Master™, and Tentacle®**

Maturation

- Close with B and Ca to mop up excess N, improve specific gravity and storability with
- Recommended applications of Boron X-TREME® and Calcium X-TREME®

Gear up soon and plan ahead, as Bert Smith would note, Good Friday will be here before you know it!