

Piglets & Spudlets

By John P. Taberna, Soil Scientist - Western Laboratories Inc. 2018

If you're the kind of person who likes to have total control of your potatoes, have I got a program for you. I started work on this program in 1969 and with some help, Dr. Robert Thorton (WSU) and Dr. Dale Westerman (USDA) this program has been successful on potatoes, onions, mint, hops and Atlantic Giant Pumpkins for the past 15 years. Luther Burbank developed Russet Burbank's in 1894. There have been yields exceeding 70 tons (1400 CWT) in test trials on this variety. Working with a young farmer in Washington state, we exceeded 50 tons (1000 CWT) but this requires a 6 row bed planter with rows 24 inches apart. In the 1980's Dr. Joe Pevek and Dr. Dennis Corsini developed the Russet Umatilla and Russet Ranger. If you live in a growing area of greater than 120 days, a 50 ton average could be in your future. If you live in a growing area less than 120 days, a 40 ton average (800 CWT) could be in your future. In 2018 our research with Dr. Clint Shock at the Malheur Experiment Station potato trials, yielded 44 tons of Clearwater Russet with two rows on a 72 inch bed. If you plant six rows on a 134 inch or 6 rows on a 144 inch bed you could average 60 tons on a 100 day crop. Other than Shepody, each plant should produce 12-15 tubers. Proper irrigation and nutrient management will guarantee your tubers will grow to a marketable size.

Potatoes have 5 Growth Stages from planting to harvest. There are two major phases of production:

Growth Phase Maturation Phase

Growth Phase's:

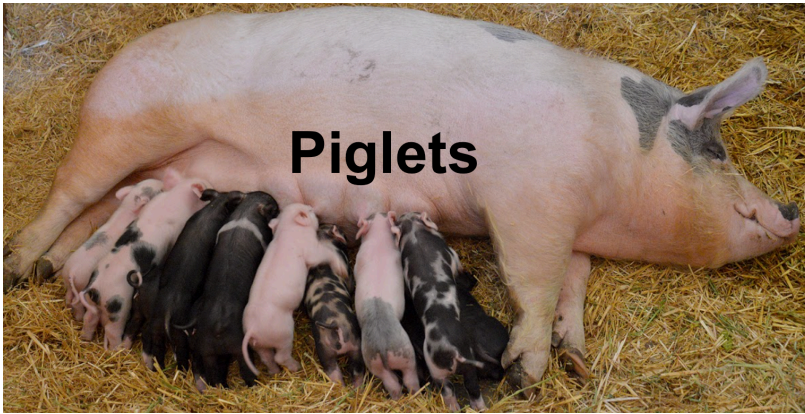
Growth Stage I (approx. 30 days) is when the seed breaks dormancy until emerging above the soil surface. All energy and nutrient needs come from the seed piece and not from the soil.

Growth Stage II (approx. 30-60 days after planting) is from early sprouting until initiation of young tubers on the tips of stolons. Growth Stage II is also referred to as the Vegetative Stage.

Maturation Phase's:

Growth Stage III (approx. 7-14 days) starts when new tubers form at stolon tips and ends when you see flowering. This is when you start making money. Carbohydrate partitioning now occurs, meaning surplus foods in the leaves start transporting to the tubers. Think of your plant as a pregnant mother pig (sow) with 12 piglets. She not only has to acquire enough water and nutrients to meet her requirements, but she also has to meet the requirements of her offspring. Calcium and Phosphorus are critical for cell division and cell elongation (spud size). Each stem can produce five tubers, so a three stem plant should produce 12-15 tubers.

Mother Pig



Yes, I know there is no such thing as a “spudlet” but the analogy is still the same. Until the pig becomes pregnant, she only has to take care of herself which requires less nutrients. Once the potato enters Growth Stage 3, everything changes.

Mother Potato



Growth Stage IV (bulking) is when the Potassium and Boron requirements are critical. They aid in the translocation of carbohydrates from the leaves into the phloem and then into the tubers. The late Dr. Don Horneck of Oregon State University established that 14 pounds of potassium per acre per day must be in the vine to bulk at 1000 pounds of tubers per acre per day. Dr. Horneck measured the entire plant plus the tubers.

PLANT	Copper-ppm	>	5	4	4	3	4	5	5	6	7	7	6
SOIL SOL'N	Copper-grams	>	15	12	12	15	15	18	15	18	18	18	21
PLANT	Boron-ppm	>	21	28	30	37	32	41	42	30	38	41	32
SOIL SOL'N	Boron-grams	>	15	9	11	8	11	14	17	21	18	14	12

All nutrients required by plants are obtained only from the Soil Solution. Your soil test measures the potential nutrient supply for the crop, not the supply rate in the Soil Solution which is required to meet the daily demand for maximum daily production. A tissue test alone only tells you how the plant is doing and does not measure the Soil Solution supply rate to meet maximum daily production.

Our Soil Solution test emulates the exudates plant roots release to stimulate bacteria and fungi to release nutrients from the extractable nutrients into the Soil Solution. Once nutrients are assimilated by the roots, a Zone of Depletion is

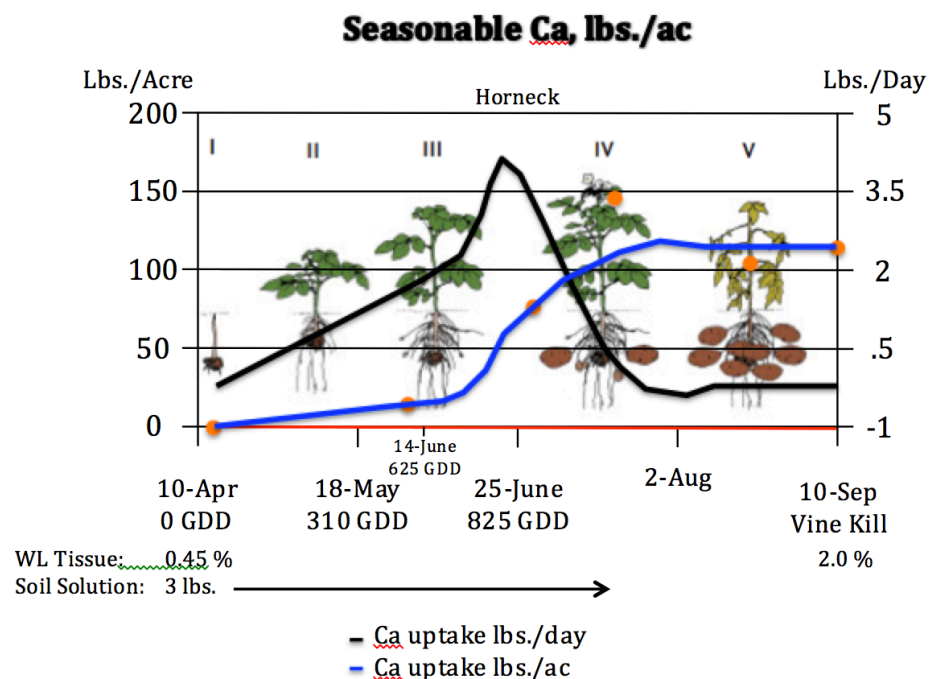
created around the roots that must be replenished by diffusion and mass flow to meet the plant demand for maximum daily bulking.

WEEK		Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	
LABORATORY NO		219	469	892	1632	2530	3527	4649	5704	6837	7773	
DATE		6/4	6/11	6/18	6/25	7/2	7/9	7/16	7/23	7/30	8/6	
		IDEAL	YOURS	YOURS	YOURS	YOURS	YOURS	YOURS	YOURS	YOURS	YOURS	
PLANT	Nitrates-ppm	> 392	18027	21935	19690	19770	17271	21178	20587	17899	14781	14604
SOIL SOL'N	Nitrogen-lbs	>	12	9	11	9	8	9	8	12	12	15
PLANT	Phosphorus-%	> 0.20	0.61	0.85	0.61	0.43	0.37	0.44	0.23	0.27	0.26	0.25
SOIL SOL'N	Phosphorus-lbs	> 0.60	1.50	1.30	1.50	1.10	1.70	2.40	2.50	3.70	3.20	3.50
PLANT	Potassium-%	> 7.5	10.6	13.8	11.9	9.3	7.1	10.4	8.7	7.6	6.5	6.1
SOIL SOL'N	Potassium-lbs	> 7.0	2.5	2.2	2.4	2.1	2.6	3.2	3.8	3.6	3.9	4.7
PLANT	Sulfur-%	> .2	0.22	0.2	0.28	0.29	0.27	0.31	0.32	0.31	0.36	0.33
SOIL SOL'N	Sulfur-lbs	> 2.0	1.9	1.5	1.6	0.8	1.1	2.5	2.0	2.8	3.3	3.5

This is a field of Umatilla potatoes grown in Washington in 2018. This field is coarse sand and has a very low nutrient/water holding capacity. The tissue tests indicate the plants were in good shape, but the soil supply tests indicate needs of additional Potassium injected through the lines all season. This field yielded 47 tons per acre. Once Growth Stage III occurred Potassium was injected daily to make the difference between the measured supply rate in the soil and what was needed to meet the sufficiency range of 7 pounds per day. Once the plant is 3-4 weeks from vine kill, there is still 150 cwt (7.5) tons in the vine. Over-irrigation and too much nitrogen will delay carbohydrate translocation from the vine into the tuber.

This causes translucent ends and low solids.

To the right you see Dr. Horneck's nutrient needs for maximum yield. Notice the peak demand begins at Growth Stage III. If you are on sandy soils with spring precipitation and over-irrigation you are wasting your money with pre-plant potassium



fertilizer. If your pH is greater than 7 there are no sights for Potassium to be held and the soil is vulnerable for leeching either through precipitation or irrigation or both. Most farmers tend to over irrigate early in the season. Potassium would be better served if top dressed with 0-0-50 before row closure. Potassium Sulfate is only 12% water soluble. On sandy soils this is great because you are slowly adding Potassium into the Soil Solution. When Growth Stage IV beings, you will need to supplement Potassium by injection through the lines to meet the maximum bulking demands of the tubers.

Calcium

Dr. Palta at the University of Wisconsin found that a small amount of Calcium is provided to the tuber by the leaf. He also found that most Calcium can only be provided to the tubers by the roots growing from the stolon joints. There is xylem in the stolon's, which is the transport mechanism for Calcium to the tuber. Calcium reduces the incidence of internal brown spots (IBS), hollow heart (HH), storage rot, pressure bruise and black spot. Calcium gives cell wall rigidity allowing the storage potatoes in the cellar to be piled 18 feet high. Dr. Palta also observed that at harvest the potato peel needs to be at least 200 parts per million (ppm) Calcium for maximum storage and for the sprouting of potato seed.

The demand for Calcium begins at tuberization initiation. and continues through Growth Stage IV. Calcium is the only nutrient that is not provided to the tuber by phloem. **YOU NEED 3 LBS. OF CALCIUM IN THE SOIL SOLUTION FROM TUBERIZATION INITIATION THROUGH BULKING.**

PLANT	Calcium-%	>	.45	1.29	1.28	1.1	0.91	1.01	1.13	1.36	1.37	1.42	1.83
SOIL SOL'N	Calcium-lbs	>	3.0	3.4	2.8	2.7	2.8	2.9	3.2	3.5	4.0	3.8	4.5
PLANT	Magnesium-%	>	.4	0.49	0.51	0.5	0.46	0.53	0.38	0.44	0.4	0.34	0.3
SOIL SOL'N	Magnesium-lbs	>	0.7	0.6	0.5	0.7	0.6	0.5	0.7	0.8	0.9	0.7	0.8

This field received 250 pounds gypsum per acre before planting. When the Soil Solution level dropped below 3 pounds the field received 4 pounds Calcium per week through the lines. Note, the tissue Calcium levels never indicated a need for Calcium. The Soil Solution test is needed for maximum yields, better storage and a stronger seed piece.

If you have questions, or would like to chat further about this write up, please feel free to contact me.

john@westernlaboratories.com

Regards,

John P. Tabera

Soil Scientist & Owner of Western Laboratories