EVALUATION OF STOCKOSORB® AS A SOIL CONDITIONER FOR POTATO PRODUCTION

Clinton C. Shock, Erik Feibert, and Lamont D. Saunders
Malheur Experiment Station
Oregon State University
Ontario, OR, 2009

Introduction

Potatoes are best grown in soil with low bulk density and excellent air and water movement, since they are sensitive to both water stress and stresses due to the lack of soil oxygen (Shock et al. 2007). Consequently, potatoes need to be grown in a narrow range of soil moisture, complicating irrigation management. Stockosorb® (Stockhausen, Inc., Greensboro, NC) is a soil conditioner that is designed to enhance the water retention capability of soils. Stockosorb is a potassium polyacrylamide and is applied in dry granular form. Stockosorb might hypothetically attenuate water stress. This trial evaluated Stockosorb for use in potato production.

Materials and Methods

Trials were conducted at two sites, on a grower's field near Weiser, Idaho, and at the Malheur Experiment Station, near Ontario, Oregon. The potatoes at Weiser were grown on sand and irrigated with a center pivot sprinkler system. The potatoes at Ontario were grown on silt loam and irrigated with a solid-set sprinkler system.

Seed of all potato varieties was hand cut into 2-oz seed pieces and treated with Tops-MZ® plus Gaucho® dust and placed in storage to suberize.

Weiser procedures:
The experimental design was a randomized complete block with two treatments as main plots and three varieties as split plots within the main plots. Main plots were replicated six times. Each main plot was 3 rows wide (1 variety per row) by 30 ft long. The two treatments were an untreated check and Stockosorb-treated soil. The three varieties were 'Russet Burbank', 'Owyhee Russet', and 'Premier Russet'. Potato seed pieces were planted manually on April 21 using a hand tool to dig holes at 9-inch intervals on 36-inch hills. Red potatoes were planted at the end of each plot as markers to separate the potato plots at harvest. Stockosorb 660 medium dry granular was applied manually over the row at 3 lb/acre. After planting, the beds were reformed manually with a rake. All agronomic practices were conducted by the grower.

Soil water tension was measured at seed piece depth using 12 Watermark soil moisture sensors Model 200SS connected to two dataloggers. For each datalogger, three

sensors were installed in each of three varieties in an untreated check plot and the other three sensors in each of three varieties in a treated plot (6 sensors total/treatment).

Potatoes at the Weiser site were dug on September 23 with a two-row digger that laid the tubers back onto the soil in each row. All tubers from each plot were placed into burlap sacks and hauled to a barn where they were kept under tarps until grading.

Ontario procedures:
The experimental design was a randomized complete block with two treatments as main plots and three varieties as split plots within the main plots. Main plots were replicated six times. Each main plot was 3 rows wide (1 variety per row) by 30 ft long. The two treatments were an untreated check and Stockosorb treated soil. The three varieties were Russet Burbank, Owyhee Russet, and Premier Russet. Each plot was 1 row by 30 ft long. Potato seed pieces were planted using a 2-row assist-feed planter with 9-inch seed spacing in 36-inch rows. Red potatoes were planted at the end of each plot as markers to separate the potato plots at harvest. Stockosorb 660 medium dry granular at 3 lb/acre was applied over the row during planting with a Gandy applicator installed behind the planter.

After planting, hills were re-formed over the rows with a Lilliston rolling cultivator. Prowl® H_2O at 0.95 lb ai/acre, Dual Magnum® at 1.3 lb ai/acre, and Buccaneer® at 2.0 lb ai/acre were applied as a tank mix for weed control on May 14. The herbicides were incorporated with sprinkler irrigation applying 0.56 inch of water. Matrix® at 0.38 oz ai/acre was applied on May 29 through the sprinkler system. Poast® at 2.5 pt/acre was broadcast on June 4 for weed control. QuadrisOpti® at 0.1lb/acre of azoxystrobin and 1.0 lb ai/acre of chlorothalonil was applied for preventive control of fungal diseases on June 11. Dithane at 2.0 lb/acre was applied through the sprinkler system for preventive control of fungal diseases on June 22.

Emergence started on May 22. Irrigation was applied 13 times, from June 10 to September 1, with scheduling based on a soil water tension criterion of 60 cb. Soil water tension was measured at seed piece depth using 12 Watermark soil moisture sensors Model 200SS connected to two dataloggers. For each datalogger, three sensors were installed in each of three varieties in an untreated check plot and the other three sensors in each of three varieties in a treated plot (6 sensors total/treatment). Irrigations were managed to maintain soil moisture below 60 cb. Irrigation decisions were based on the average of all 12 sensors. Crop evapotranspiration (ET_c) was estimated by the U.S. Bureau of Reclamation using data from an AgriMet weather station on the Malheur Experiment Station.

Fertilizer was applied based on petiole tests taken on June 26 and July 13. Fertilizer was injected into the sprinkler system during irrigation. During the season, 140 lb nitrogen/acre, 5 lb magnesium /acre, and 0.25 lb zinc/acre were applied.

The vines were flailed on September 22. The potatoes in each plot were lifted with a two-row digger that laid the tubers back onto the soil in each row on September 28.

Tubers from each plot were placed into burlap sacks and hauled to a barn where they were kept under tarps until grading.

Procedures common to both sites:
Tubers were graded by market class (U.S. No. 1 and U.S. No. 2) and weight (<4 oz, 4-6 oz, 6-12 oz, and >12 oz). Tubers were graded as U.S. No. 2 if any of the following conditions occurred: growth cracks, bottleneck shape, abnormally curved shape, or two or more knobs. A 20-tuber sample from each plot was placed into storage. The storage temperature was gradually reduced to 45°F. After 6 weeks, a 20-tuber sample from each plot was evaluated for tuber quality traits for processing. Specific gravity was measured using the weight-in-air, weight-in-water method. Ten tubers per plot were cut lengthwise and the 10 center slices were fried for 3.5 min in 375°F soybean oil. Percent light reflectance was measured on the stem and bud ends of each slice using a Photovolt Reflectance Meter model 577 (Seradyn, Inc., Indianapolis, IN), with a green tristimulus filter, calibrated to read 0 percent light reflectance on the black standard cup and 73.6 percent light reflectance on the white porcelain standard plate.

Data from all trials were analyzed with the General Linear Models analysis of variance procedure in NCSS (Number Cruncher Statistical Systems, Kaysville, UT) using Fisher's protected LSD (least significant difference) for means separation.

Results and Discussion

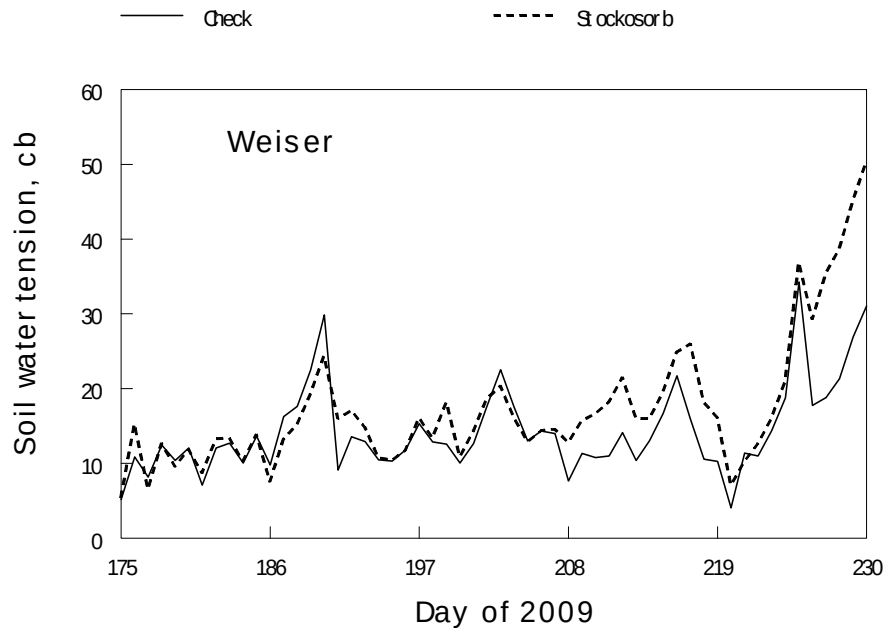
From June 10 to September 1, 12.6 inches of irrigation water was applied at Ontario. Precipitation from emergence to vine kill totaled 3.8 inches. Evapotranspiration from emergence to vine kill totaled 27.5 inches. Soil water tension at Ontario generally remained below the target of 60 cb, except briefly in early July (Fig. 1). During most of July, the Stockosorb-treated soil remained slightly wetter than the untreated soil. Soil water tension at Weiser remained below 30 cb, consistent with the soil moisture requirements in a sandy soil. There was no apparent difference in soil water tension between treatments at Weiser. The certainty of the effects of Stockosorb on soil moisture were limited, since the comparison of soil water tension between treatments at each site was based on only 6 sensors per treatment.

At Ontario, Stockosorb-treated soil produced higher total and marketable yield, and yield of U.S. No. 1 tubers (Table 1). At Weiser there was no significant difference in yield between treatments for any of the varieties, except for U.S. No. 2 yield for Russet Burbank. U.S. No. 2 yield for Russet Burbank was higher in the untreated plots.

There was no significant difference in specific gravity or tuber fry color between the treatments at either site (Table 1).

References

Shock, C.C., A.B. Pereira, B.R. Hanson, and M.D. Cahn. 2007. Vegetable irrigation. pages 535-606 in R. Lescano and R. Sojka (ed.) Irrigation of agricultural crops. Second ed. Agron. Monogr. 30. ASA, CSSA, and SSSA, Madison, WI.



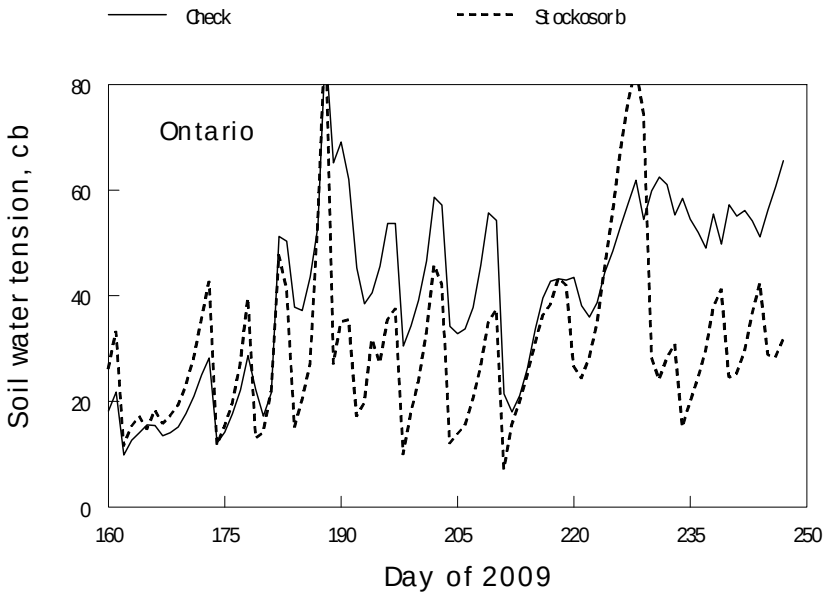


Figure 1. Soil water tension over time for the untreated check and Stockosorb treated soil at Ontario and at Weiser. Malheur Experiment Station, Oregon State University, Ontario, OR, 2009.

Table 1. Influence of Stockosorb on the tuber yield and grade of three potato varieties at two sites. Malheur Experiment Station, Oregon State University, Ontario, OR, 2009.

				U.S. No. 1										
Site, soil	Variety	Treatment	Total yield	Percent No. 1	Total	>12 oz	6-12 oz	4-6 oz	U.S. No. 2	Marketable	<4 oz	Cull	Specific gravity	Average fry color, light reflectance
			cwt/acre	%	cwt/acre								g cm^{-3}	%
Ontario, silt loam	Russet Burbank	Check	543.3	38.1	207.1	51.6	105.5	50.0	263.8	470.9	62.7	9.6	1.0750	42.1
		Stockosorb	587.7	42.9	247.2	77.5	106.0	63.6	267.9	515.1	70.1	2.5	1.0745	41.6
		average	565.5	40.5	227.1	64.5	105.8	56.8	265.9	493.0	66.4	6.1	1.0748	41.8
	Owyhee Russet	Check	551.3	90.7	500.4	171.3	249.4	79.7	16.9	517.2	34.1	0.0	1.0998	55.7
		Stockosorb	561.9	90.4	508.0	155.7	267.8	84.5	11.8	519.8	42.1	0.0	1.1002	55.6
		average	556.6	90.5	504.2	163.5	258.6	82.1	14.3	518.5	38.1	0.0	1.1000	55.7
	Premier Russet	Check	562.5	89.4	502.9	215.2	232.2	55.5	23.8	526.7	35.7	0.0	1.0997	48.8
		Stockosorb	615.5	87.3	536.8	194.9	273.4	68.5	34.6	571.4	44.1	0.0	1.0986	47.0
		average	589.0	88.3	519.8	205.1	252.8	62.0	29.2	549.1	39.9	0.0	1.0991	47.9
	Average	Check	552.3	72.7	403.5	146.0	195.7	61.8	101.5	504.9	44.2	3.2	1.0915	48.9
		Stockosorb	588.4	73.5	430.7	142.7	215.7	72.2	104.8	535.4	52.1	0.8	1.0911	48.0
	LSD (0.05)	Treatment	22.6	NS	26.5	NS	12.3	NS	NS	19.3	6.0	NS	NS	NS
		Variety	NS	47.2	43.4	40.5	34.5	15.0	35.3	NS	5.7	NS	0.0	1.4
		Trt X var	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Weiser, sand	Russet Burbank	Check	631.4	59.3	381.5	123.2	187.9	70.5	190.2	571.8	59.3	6.2	1.0726	46.0
		Stockosorb	557.6	58.9	333.7	84.6	168.3	80.8	160.4	494.1	62.6	0.0	1.0808	44.5
		average	594.5	59.1	357.6	103.9	178.1	75.7	175.3	533.0	61.0	3.1	1.0767	45.2
	Owyhee Russet	Check	582.4	87.5	511.6	112.0	284.5	115.1	10.7	522.3	59.7	1.2	1.1020	54.3
		Stockosorb	602.7	84.7	513.6	123.7	273.7	116.2	27.2	540.8	61.9	0.1	1.0983	54.2
		average	592.6	86.1	512.6	117.8	279.1	115.7	19.0	531.5	60.8	0.7	1.1002	54.2
	Premier Russet	Check	559.5	87.9	492.8	198.0	237.2	57.7	28.5	521.3	38.2	0.0	1.1002	47.9
		Stockosorb	502.0	84.1	425.9	156.7	201.1	68.1	33.5	459.4	42.6	0.8	1.0976	47.4
		average	530.8	86.0	459.3	177.3	219.1	62.9	31.0	490.3	40.4	0.4	1.0989	47.6
	Average	Check	591.1	78.3	462.0	144.4	236.5	81.1	76.5	538.4	52.4	0.2	1.0916	49.4
		Stockosorb	554.1	75.9	424.4	121.7	214.4	88.4	73.7	498.1	55.7	0.3	1.0922	48.7
	LSD (0.05)	Treatment	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
		Variety	NS	5.3	56.3	NS	28.2	10.4	16.2	NS	9.1	NS	0.0109	1.2
		Trt X var	NS	NS	NS	NS	NS	NS	22.9	NS	NS	NS	NS	NS