

Evaluation of a Companion Crop used to Reduce the Spread of Mosaic and Improve Potato Yields

The purpose of this trial was to evaluate the effectiveness of using a companion crop with potatoes. Data was collected on the spread of potato viruses (which can result in visual mosaic symptoms) as well as yield and quality. The use of companion crops were evaluated under four different cropping scenerios (1. no insecticides were applied, 2. no insectides applied + flowers as a border, 3. insectides applied, and 4. insectides applied to the crop that was adjacent to a plot of potatoes with a flower border). Two different potato seed lots (Russet Norkotah sel. 8 with an initial mosaic level of 8%; and Russet Norkotah sel. 3 with an initial mosaic level of 2.0%) were tested at each location with and without a companion crop. Plants were visually evaluated for mosaic levels two times in the summer and a sample was collected at harvest and sent to Hawaii for evaluation. At harvest, yield and quality data was also collected at each location for each seed lot, with and without a companion crop.

The results from this study indicate that the use of a companion crop can provide benefits to a potato crop. When a border of flowering plants was planted next to potatoes planted with a companion crop, the level of mosaic was reduced for seed lots with different initial levels of mosaic (32% reduction in the low mosaic seed lot and 47% reduction in the high initial mosaic seed lot, respectively) when compared with potatoes having no insecticide applications. The impact of a companion crop on yields is less conclusive. There were no differences among treatments for the seed lot with low initial mosaic levels. There was only one location with a significant decrease in marketable yield for the potatoes planted with a companion crop in the seed lot with a high initial mosaic level. This plot had additional stress since there were two fungicide applications and two watering events that it did not recieve through the 2015 growing season, due to an avoidance of an insecticide application. This additional stress could have resulted in a reduction in yield potential, rather than soley the result of the potatoes being planted with a companion crop. Treatments were analyzed using a LSD mean separation, $p=0.05$. The use of a companion crop with potatoes, appears to reduce the spread of potato viruses (including PVY), after one year of evaluations.

**EVALUATION OF USING A COMPANION CROP TO REDUCE MOSAIC LEVELS AND IMPROVE
YIELDS IN THE POTATO CULTIVARS:
RUSSET NORKOTAH SELECTION 8 & SEL. 3, SLVRC, 2015.**

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Location: San Luis Valley Research Center, Center, CO

Cultivar: Russet Norkotah sel. 8 & Russet Norkotah sel. 3

Companion Crop: Species include Field Peas, Desi Chick Peas, Chickling Vetch, and Buckwheat. Seeding rate of 10 lbs/A

Objective: To evaluate the use of a companion crop to manage virus spread and tuber yield and quality.

Treatments:

1. Flower Border, with Companion Crop
2. Flower Border
3. No Insecticides Used, with Companion Crop
4. No Insecticides Used
5. Insecticides Used, with Companion Crop
6. Insecticides Used
7. Flower Border, planted next to field with Insecticides, with Companion Crop
8. Flower Border, planted next to field with Insecticides

Planted: May 13 & 14, 2015 (planted the potatoes & companion crop); June 5, 2015 (planted the flowering species mix)

Plot Design: Complete Block Design

Plot Size: 1-80 foot row (trts 2-8), 1-55 foot row (trt 1) per treatment per replication

Plant Spacing: 12 inches

Row Spacing: 34 inches

Replications: Four

Irrigation: Solid set irrigation (trts 1-4) or Center Pivot irrigation (trts 5-8), rate based on ET

Fertilizer: 80N-60P-0K-25S-2.5Z, preplant, 40N (trts 1 & 4) and 60N (trts 2,3,5,6) through sprinkler after tuber set.

Herbicide: Dual Magnum @ 1.25 pt/A + Eptam @ 4.0 pt/A + Sencor @ 0.17 lbs/A - trts 2,4,6,8; In addition, Matrix @ 1.5 oz/A was applied to trts 8. No herbicides were applied to trts 1,3,5,7.

Insecticide: Platinum applied In-furrow, Leverage 360 @ 2.8 oz./A & Belay @ 2.8 oz/A in-season (trts 5,6); None on trts 1-4,7,8.

Fungicide: Omega applied in-furrow, Quadri Opti @ 1.6 pts/A & Luna Tranquility @ 11.2 floz/A applied in-season (trts 5-8); Endura @ 2.5 oz/A (trts 1-4).

Vine Killer: Applied Reglone @ 2.0 pt/A on August 19, 2015.

Harvested: September 14, 15, & 16, 2015

DATA:

Mosaic Readings: Evaluated all plants for mosaic symptoms twice during the summer (June 23 & July 7, 2015). Also pulled a sample of 45 tubers (trt 1) or 74 tubers (trts 2-8) -evenly distributed down each row per treatment per replication at harvest. The samples were gassed with Rindite (October 16, 2015) and planted (November 5, 2015) on Oahu, HI and were visually evaluated for mosaic on December 21, 2015. A total percentage of potato plants with mosaic symptoms was calculated from each disease reading.

Yield & Grade: 1-40 foot row per treatment per replication, total yield expressed in cwt/A. By hand, percent tubers by weight in kilograms < 4 oz., 4-10 oz., > 10 oz., US #2's & culls.

Table 1. Effect of the use of a companion crop and a flowering species mix border crop on tuber yield and quality in the cultivar Russet Norkotah sel. 8 and Russet Norkotah sel. 3, Colorado State University, San Luis Valley Research Center, Colorado, 2015.

Russet Norkotah sel 3 (2% Mosaic, 2014 PHT)	Percent ^a			US #2's & culls	Total CWT ^b	CWT w/o 2's & culls ^c
	<4 oz.	4-10 oz.	>10 oz.			
Flowering Species Mix, CC	11.1 c	49.6 cd	31.1 a	8.2 ab	368.9	338.8
Flowering Species Mix	16.1 c	43.2 d	31.6 a	9.2 a	387.5	352.1
No Insecticides Used, CC	15.6 c	51.4 bcd	25.8 ab	7.3 abc	417.1	387.1
No Insecticides Used	16.5 bc	53.9 abc	24.1 ab	5.6 bcd	415.8	393.0
Insecticides Used, CC	22.4 ab	54.9 abc	20.8 bc	2.0 e	400.8	393.0
Insecticides Used	13.9 c	51.1 bcd	32.0 a	3.0 de	436.2	423.0
Flower Border, next to field with Insecticides, CC	28.0 a	59.8 ab	7.7 d	4.6 cde	379.0	361.2
Flower Border, next to field with Insecticides	22.9 a	61.7 a	12.2 cd	3.3 de	404.0	390.4
LSD (P=0.05)	6.24	10.13	9.96	2.77	NS	NS
CV	23.35	13.05	29.51	35.17	8.87	9.24
F value	0.0002	0.0268	0.0001	0.0001	0.2003	0.0517

Russet Norkotah sel 8 (8% Mosaic, 2014 PHT)	Percent ^a			US #2's & culls	Total CWT ^b	CWT w/o 2's & culls ^c
	<4 oz.	4-10 oz.	>10 oz.			
Flowering Species Mix, CC	16.2 bc	49.1	29.4 a	5.4	358.5 ab	339.2
Flowering Species Mix	16.6 bc	41.8	31.7 a	10.0	386.0 a	347.7
No Insecticides Used, CC	17.7 bc	50.1	26.5 a	5.8	408.0 a	384.3
No Insecticides Used	16.7 bc	46.5	29.5 a	7.3	392.4 a	363.4
Insecticides Used, CC	18.3 bc	52.6	23.5 a	5.8	353.4 ab	334.6
Insecticides Used	11.0 c	46.0	34.8 a	8.3	400.6 a	369.8
Flower Border, next to field with Insecticides, CC	36.2 a	54.4	4.7 b	4.6	296.3 b	281.7
Flower Border, next to field with Insecticides	22.0 b	63.0	7.6 b	7.5	391.5 a	362.5
LSD (P=0.05)	7.38	NS	14.76	NS	67.29	NS
CV	26.18	19.95	43.14	53.49	12.35	14.33
F value	0.0001	0.1729	0.0015	0.4909	0.0433	0.1876

^aBased on tuber weight in kilograms, mean of four replications.

^bTotal yield expressed as hundred weight per acre, 1-40 foot rows per treatment per replication, mean of four replications.

^cHundred weight per acre minus the US #2s and culls, 1-40 foot rows per treatment per replication, mean of four replications.

Means followed by the same letters are not significantly different at P=0.05 (LSD).

Table 1. Effect of a flowering species mix on reducing PVY spread in the potato cultivar Russet Norkotah sel. 3 (Low Initial Mosaic Level = 2.0%) and Russet Norkotah sel. 8 (High Initial Mosaic Level = 8%), Colorado State University, San Luis Valley Research Center, CO, 2015.

Low Initial PVY Treatment	First Mosaic Reading July 7, 2015^a	Second Mosaic Reading July 16, 2015^b	Final Mosaic Reading December 21, 2015^c
Flowering Species Mix, CC	0.5	2.5	30.0 bc
Flowering Species Mix	0.7	3.7	30.8 abc
No Insecticides Used, CC	1.4	4.2	41.8 ab
No Insecticides Used	1.7	3.7	44.0 a
Insecticides Used, CC	1.4	1.4	15.3 d
Insecticides Used	1.6	3.2	19.0 cd
Flower Border, next to field with Insecticides, CC	1.4	2.9	12.5 d
Flower Border, next to field with Insecticides	1.7	2.3	8.3 d
LSD (P=0.05)	NS	NS	13.85
CV	92.64	68.81	37.59
F value	0.7397	0.601	0.0001

High Initial PVY Treatment	First Mosaic Reading July 7, 2015^a	Second Mosaic Reading July 16, 2015^b	Final Mosaic Reading December 21, 2015^c
Flowering Species Mix, CC	3.2	17.3 a	26.3 bc
Flowering Species Mix	4.3	15.6 a	33.0 abc
No Insecticides Used, CC	3.8	12.9 ab	41.3 ab
No Insecticides Used	3.5	12.7 ab	49.0 a
Insecticides Used, CC	5.1	9.8 b	26.0 bc
Insecticides Used	5.1	8.6 b	21.3 c
Flower Border, next to field with Insecticides, CC	5.9	16.3 a	17.3 c
Flower Border, next to field with Insecticides	7.0	17.9 a	27.0 bc
LSD (P=0.05)	NS	5.47	16.27
CV	59.54	26.99	36.81
F value	0.5573	0.0119	0.0101

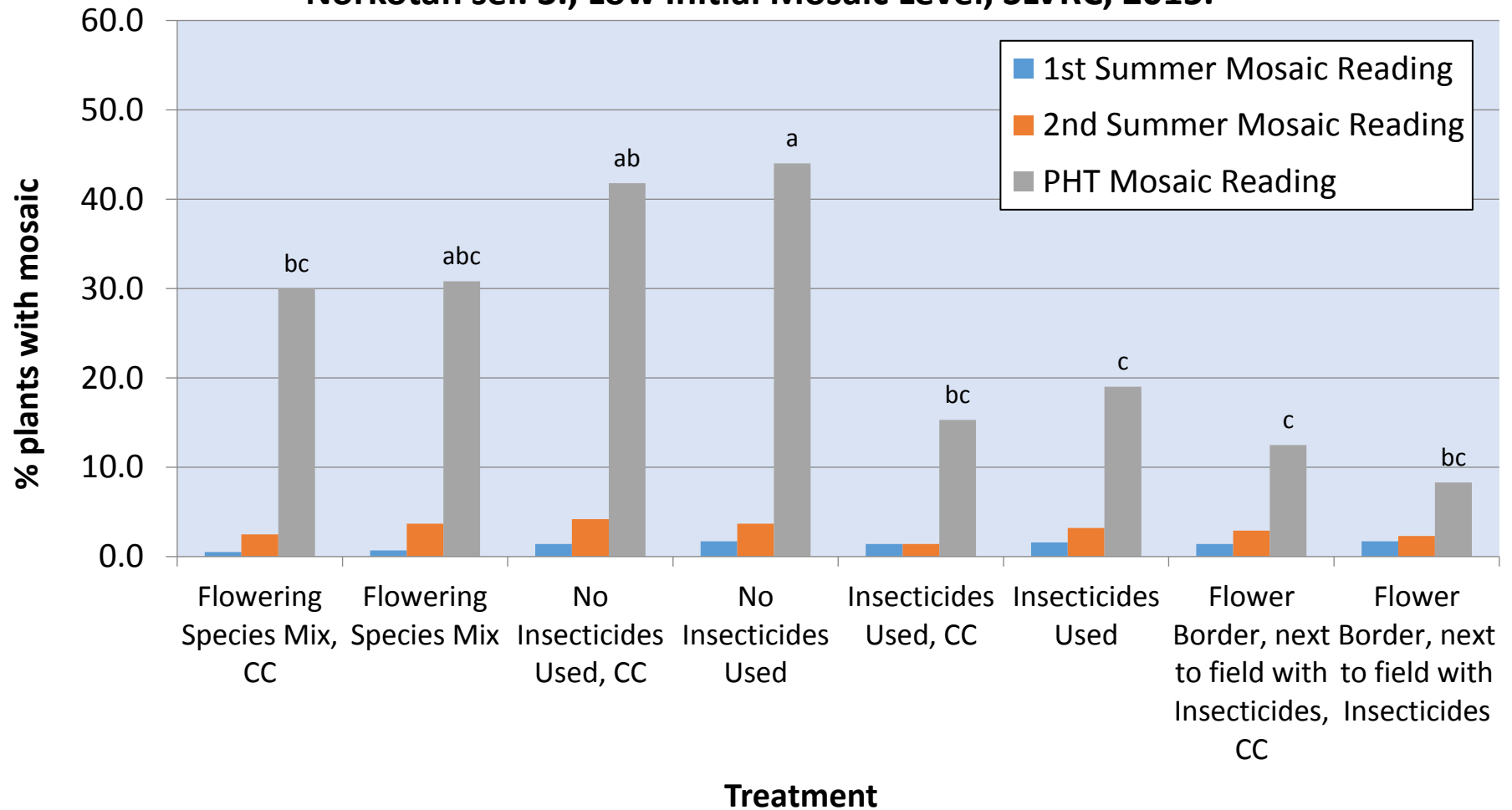
^aPercentage of plants expressing visual mosaic symptoms on July 7, 2015, one 80 foot row per treatment per replication, mean of four replications.

^bPercentage of plants expressing visual mosaic symptoms on July 16, 2015, one 80 foot row per treatment per replication, mean of four replications.

^cA sample of 80 drop seed sized potatoes (3-4 ounces each) was collected from each treatment/replication and were planted in Oahu, HI. The percentage of plants expressing visual mosaic symptoms was recorded on December 21, 2015,

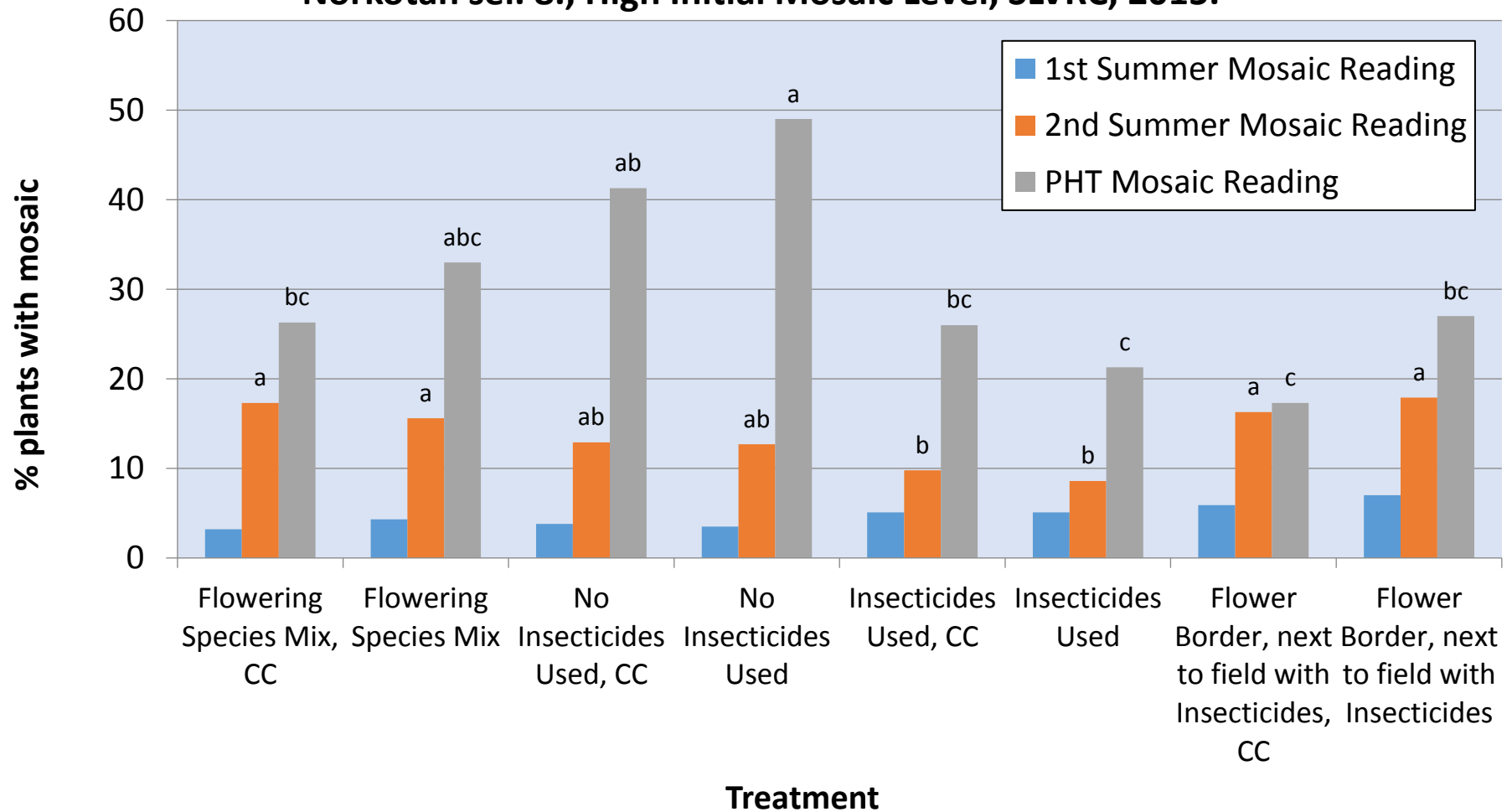
Means followed by the same letters are not significantly different at P=0.05 (LSD).

Evaluation of the Use of a Flowering Plant Species Mix and a Companion Crop to Reduce Mosaic Levels in the Potato Cultivar Russet Norkotah sel. 3., Low Initial Mosaic Level, SLVRC, 2015.



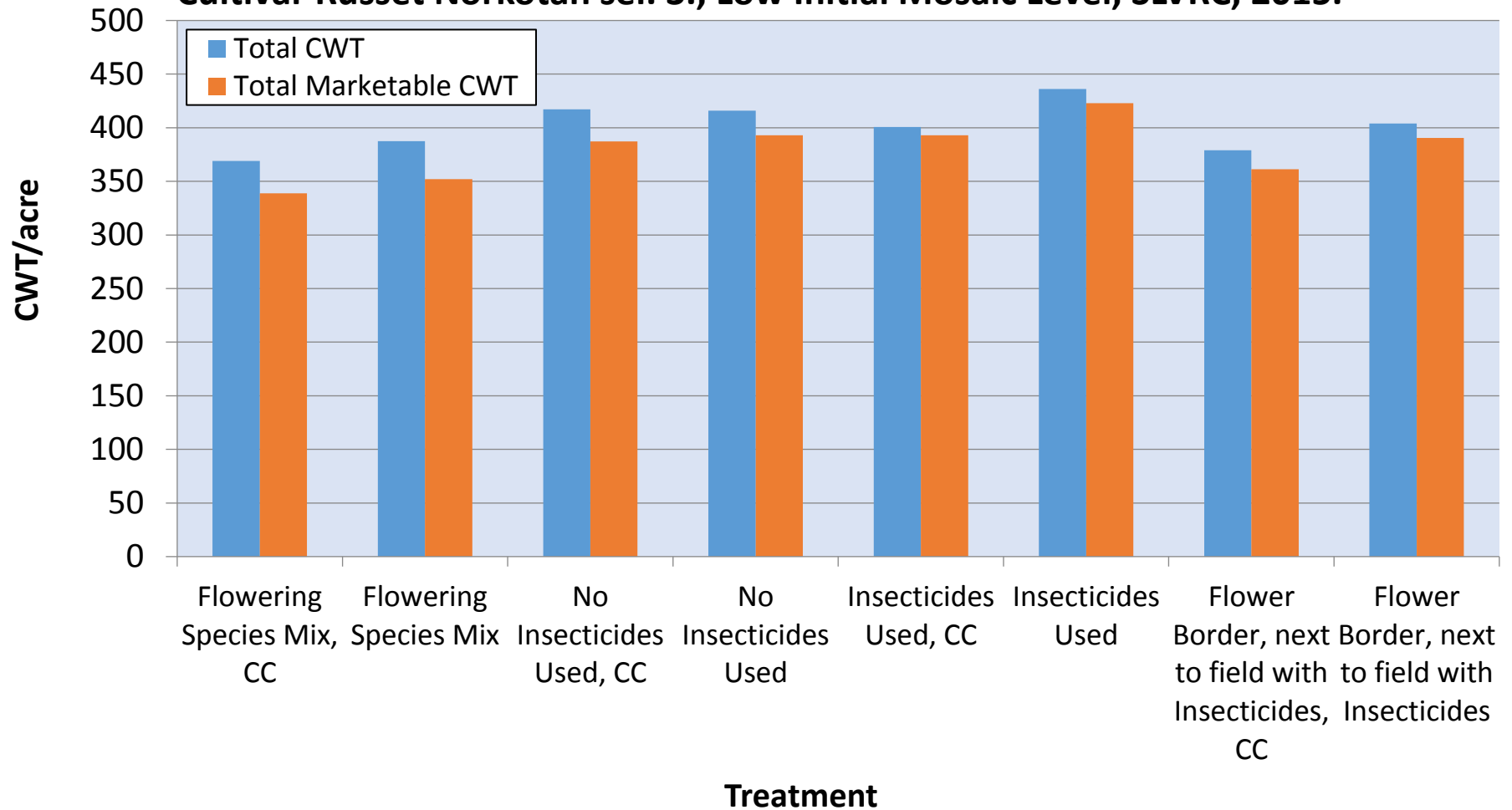
Different letters indicate a statistical difference between means at different reading dates.
LSD Mean Separation, P-value=0.05.

Evaluation of the Use of a Flowering Plant Species Mix and a Companion Crop to Reduce Mosaic Levels in the Potato Cultivar Russet Norkotah sel. 8., High Initial Mosaic Level, SLVRC, 2015.



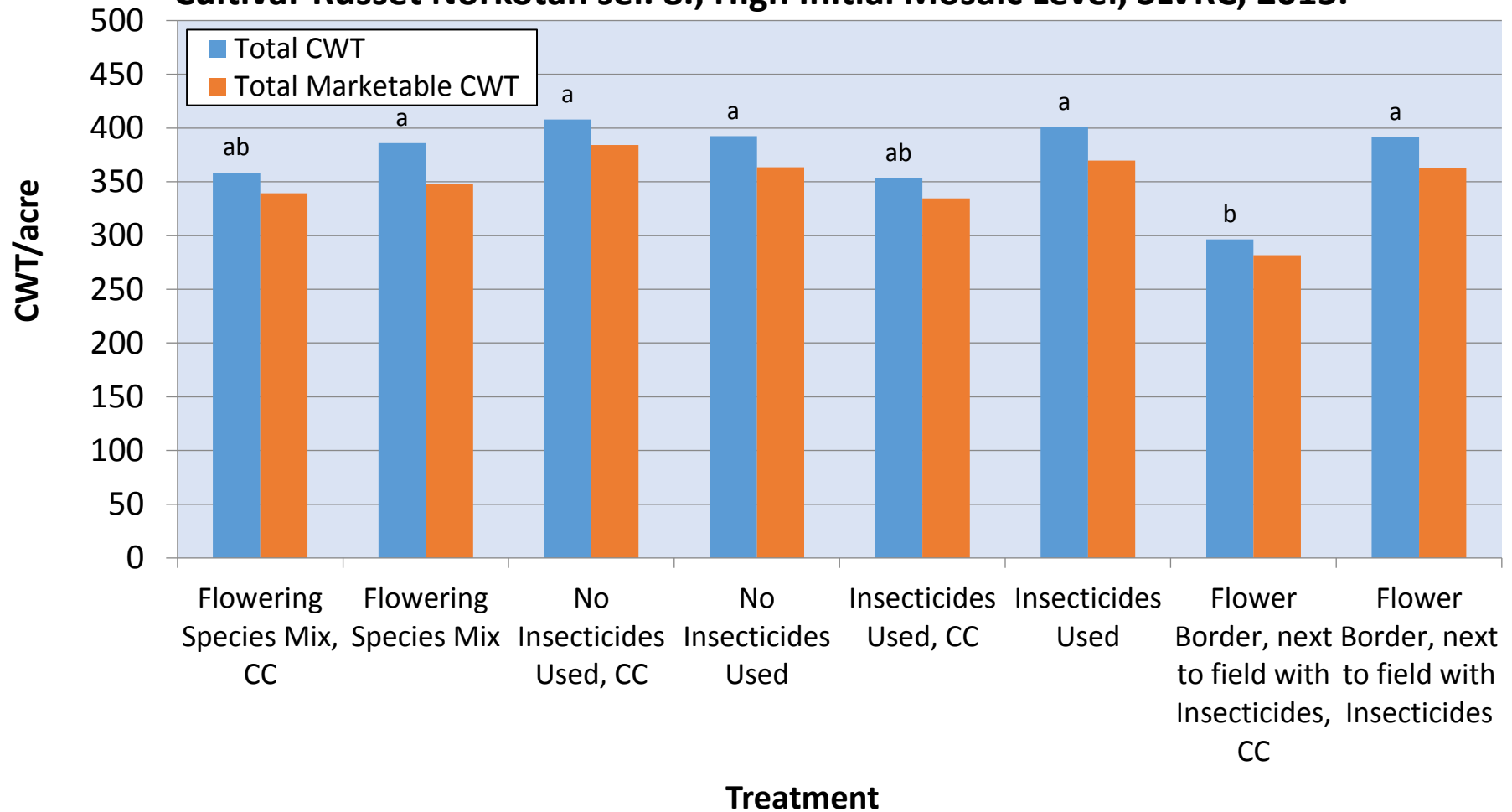
Different letters indicate a statistical difference between means at different reading dates.
LSD Mean Separation, P-value=0.05.

Evaluation of the Use of a Flowering Plant Species Mix and a Companion Crop on Total CWT and Marketable CWT in the Potato Cultivar Russet Norkotah sel. 3., Low Initial Mosaic Level, SLVRC, 2015.



There were no significant differences between treatments at P=0.05, LSD.

Evaluation of the Use of a Flowering Plant Species Mix and a Companion Crop on Total CWT and Marketable CWT in the Potato Cultivar Russet Norkotah sel. 8., High Initial Mosaic Level, SLVRC, 2015.



Different letters indicate a statistical difference between means for different treatments. LSD Mean Separation, P-value=0.05.