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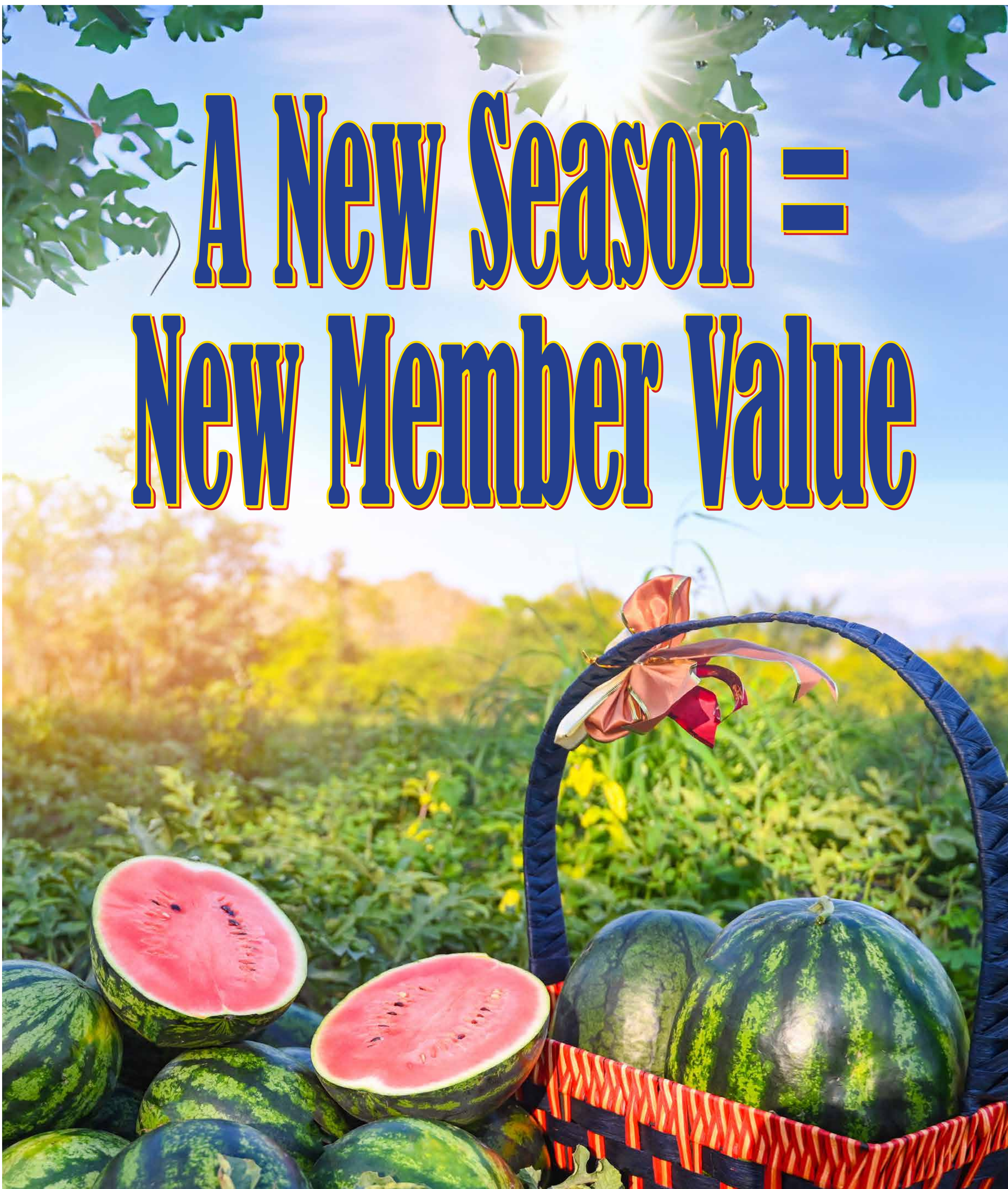

Vineline Research News

Exploring Biostimulant Efficacy Under Limited Fertilizer and Water in Utah`s Watermelon Production

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The western U.S. has recently experienced some of the driest conditions on record, and Utah has been in a multi-year drought (2019-2023) that affected the agricultural sector, including vegetable producers. While vegetables are not a primary agricultural crop in Utah, they are still an important part of the horticultural economy with 763 farms growing 6,138 acres. As the fourth largest acreage vegetable crop in Utah (almost 10% of the acreage) watermelon and related crops in the gourd family Cucurbitaceae (nearly 36% of total vegetable acreage) are important to vegetable growers. Watermelon is a water-intensive crop and requires an adequate supply of water for good yield and fruit quality and is very sensitive to water stress. An additional challenge is that watermelons need access to adequate nutrients for proper growth and high yields, which has become more difficult with the recent rise in fertilizer prices.

To address these challenges, novel solutions must be assessed to increase water and nutrient use efficiency and ensure that watermelon production is sustainable in the state of Utah. An emerging approach to accomplish this is the application of biostimulant products. Biostimulants are any organism or substance applied to a plant to increase abiotic stress tolerance, nutrition efficiency, and/or improve crop quality traits regardless of its nutrient content. Biological (bacteria and fungi) and non-biological products (seaweed extracts and humic substances) alike have shown potential in improving plant growth and yield and mitigating the effects of reduced water and nutrient availability.

Research at Utah State University, initiated in 2023, focused on screening seven locally available biostimulant products (Table 1) on greenhouse-grown watermelon seedlings, using 'Crimson Sweet' as the target cultivar. Emergence and growth were recorded. Seedlings treated with Continuum, Spectrum DS, or Mighty Mycorrhizae, tended to have numerically higher growth than the untreated control, and seedlings treated with Tribus Original or MycoApply Endo tended to have numerically lower growth than the untreated control.

Table 1. Biostimulant products applied to greenhouse-grown watermelon seedlings.

Category	Type	Product	Company	State	Country
Biological	Bacterial	Tribus Original	Impello Biosciences	Colorado	U.S.A.
		Continuum	Impello Biosciences	Colorado	U.S.A.
		Spectrum DS	Tainio Biologicals	Washington	U.S.A.
	Arbuscular Mycorrhizal Fungi	MycoApply Endo	Mycorrhizal Applications	Oregon	U.S.A.
		Mighty Mycorrhizae	Wildroot Organics	Texas	U.S.A.
Non-Biological	Humic Acid	Huma Pro 16	Bio Huma Netics	Arizona	U.S.A.
	Seaweed Extract	Kelpak	Kelp Products International	Cape Town	South Africa

Based on these results, the bacterial products Continuum and Spectrum DS and the fungal product Mighty Mycorrhizae were selected for further field trials. The study was conducted in 2023 and 2024 in North Logan, Utah, to evaluate the impact of selected biostimulants on watermelon growth and yield under reduced fertilizer and irrigation conditions. We used the seedless cultivar Fascination and the seeded cultivar Crimson Sweet. Fertilizer application was reduced to 66% of the recommended rate (140-80-60 lb/acre) over the whole growing season. Irrigation scheduling was 75% of crop evapotranspiration (ETc) model, during the final month of production. The control treatment received no biostimulants.

The two-year analysis showed no significant interaction between biostimulant application, fertilizer reduction, and irrigation levels, indicating that their effects on plant growth and yield were independent of each other (Table 2). Due to poor growing conditions in 2023 and a lack of water deficit due to summer precipitation, only results from 2024 will be shown here. The products tested did not impact yield or quality when compared to the control. Spectrum DS and Continuum showed slight yield increases of 7% and 10%, respectively, vs control, while Mighty Mycorrhizae did not differ from the control. Reduced fertility led to a reduction in yield, though an increase in sugar content was noted. 'Crimson Sweet' had a higher yield than 'Fascination' in both years while a reduction in irrigation for 'Crimson Sweet' led to an increase in sugar content compared to 'Fascination.' This effect is likely due to the plant's natural response to water stress, which can enhance carbohydrate concentration as a survival mechanism, in line with traditional knowledge about concentrating sugars before harvest by reducing irrigation.

Though biostimulant products show promise in increasing the growth, yield, and quality of the studied cultivars, there is much more to understand about the mechanisms by which they promote plant growth. Due to the diversity of products, species to which they are applied, and the conditions in which crops are produced results can vary widely. As technologies, techniques, and knowledge progress, more targeted products may emerge that provide more predictable and uniform results. Further investigation will focus on cultivar-specific responses, physiological responses, microbial colonization success and its long-term effects on-field performance under Utah's challenging conditions.

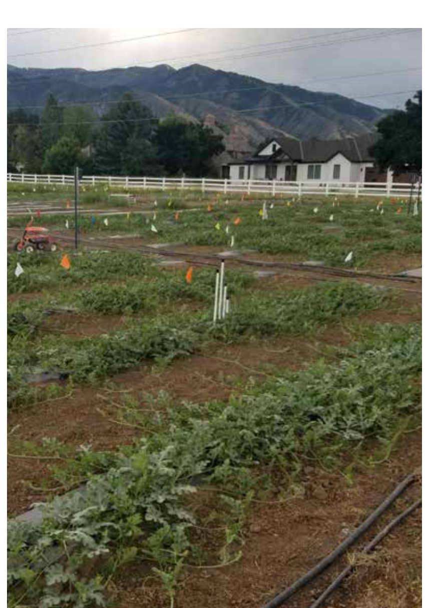

Table 2. Effects of biostimulants under reduced fertility, irrigation and cultivar on yield and quality of field grown watermelons. Logan, UT, 2024.

Treatment	Biostimulants on Irrigation		Biostimulants on Fertility	
	Yield (lb·acre^{-1})	SSC (°Brix)	Yield (lb·acre^{-1})	SSC (°Brix)
Biostimulant				
Control	64,839^{A}	11.4^{A}	70,973^{A}	11.5^{A}
Continuum	65,444^{A}	11.4^{A}	77,353^{A}	11.3^{A}
Spectrum DS	59,512^{A}	11.2^{A}	70,531^{A}	11.3^{A}
Mighty Mycorrhizae	62,358^{A}	11.3^{A}	73,725^{A}	11.3^{A}
Rate				
Recommended	62,665^{A}	11.2^{B}	78,944^{A}	11.7^{A}
Reduced	63,325^{A}	11.5^{A}	67,680^{B}	11.0^{B}
Cultivar				
Crimson Sweet	71,506^{A}	11.5^{A}	78,472^{A}	11.4^{A}
Fascination	55,496^{B}	11.1^{B}	68,087^{B}	11.2^{A}

#Due to poor growing conditions in 2023 and a lack of water deficit due to summer precipitation, only results from 2024 will be shown here.