



Welcome to a whole new world of sustainable agriculture!

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# A comparison of superabsorbent polymers

Natural Starch-Based



versus PAM (polyacrylamide polymer)

Synthetic Petroleum-Based

# This presentation will show...

- **AquaVantage** holds 2x water over PAMs
- **AquaVantage** holds water 'loosely' and gives back easily
- **PAMs** bind-up water tightly
- **AquaVantage** returns more water to the plant
- **AquaVantage** is competitively priced per acre, with greater scientifically proven results

# Two types of superabsorbents

## *AquaVantage*<sup>®</sup>

A unique, patented, and starch-based superabsorbent polymer, made specifically for agricultural applications, biodegradable, with sustainable environmental benefits.

## PAMs

Polyacrylamide polymers, a purely synthetic petroleum-base, primary application is binding-up of moisture in baby diapers, some environmental concerns.

# Two types of superabsorbents



Patented, unique, starch-based  
1,000,000 molecular weight



## PAM

An industrial commodity  
Sold under many brands  
300,000 molecular weight



# Absorbency

AquaVantage *holds twice as much moisture as PAM*



Times weight in water g/g



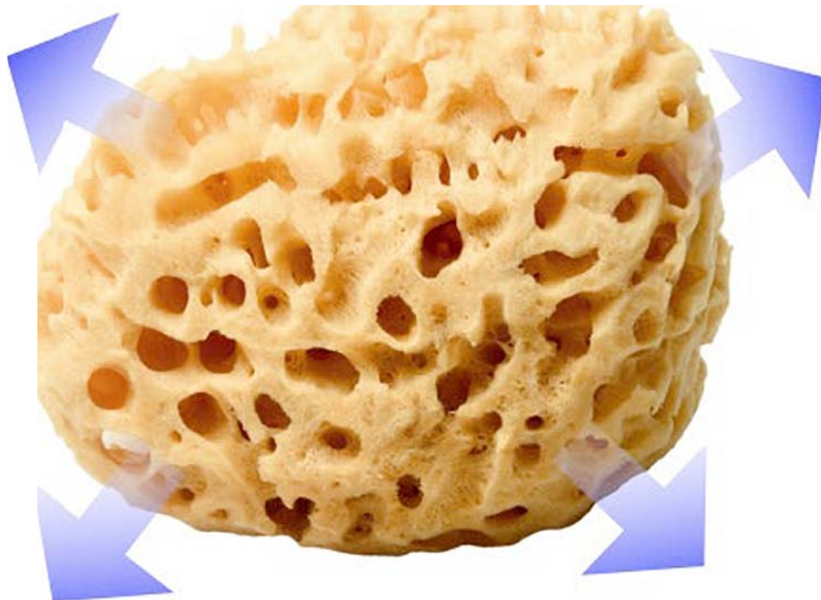
# Water-holding mechanism

## AquaVantage

Holds water 'loosely'

Weak hydrogen bond

Holds water similar to soil



## PAM

Binds water tightly  
Chemical interaction



# Release

AquaVantage returns 95% of water 'on demand'



AquaVantage



PAM



# Physical characteristics

## AquaVantage

is a soft fluid gel,  
expands in the soil

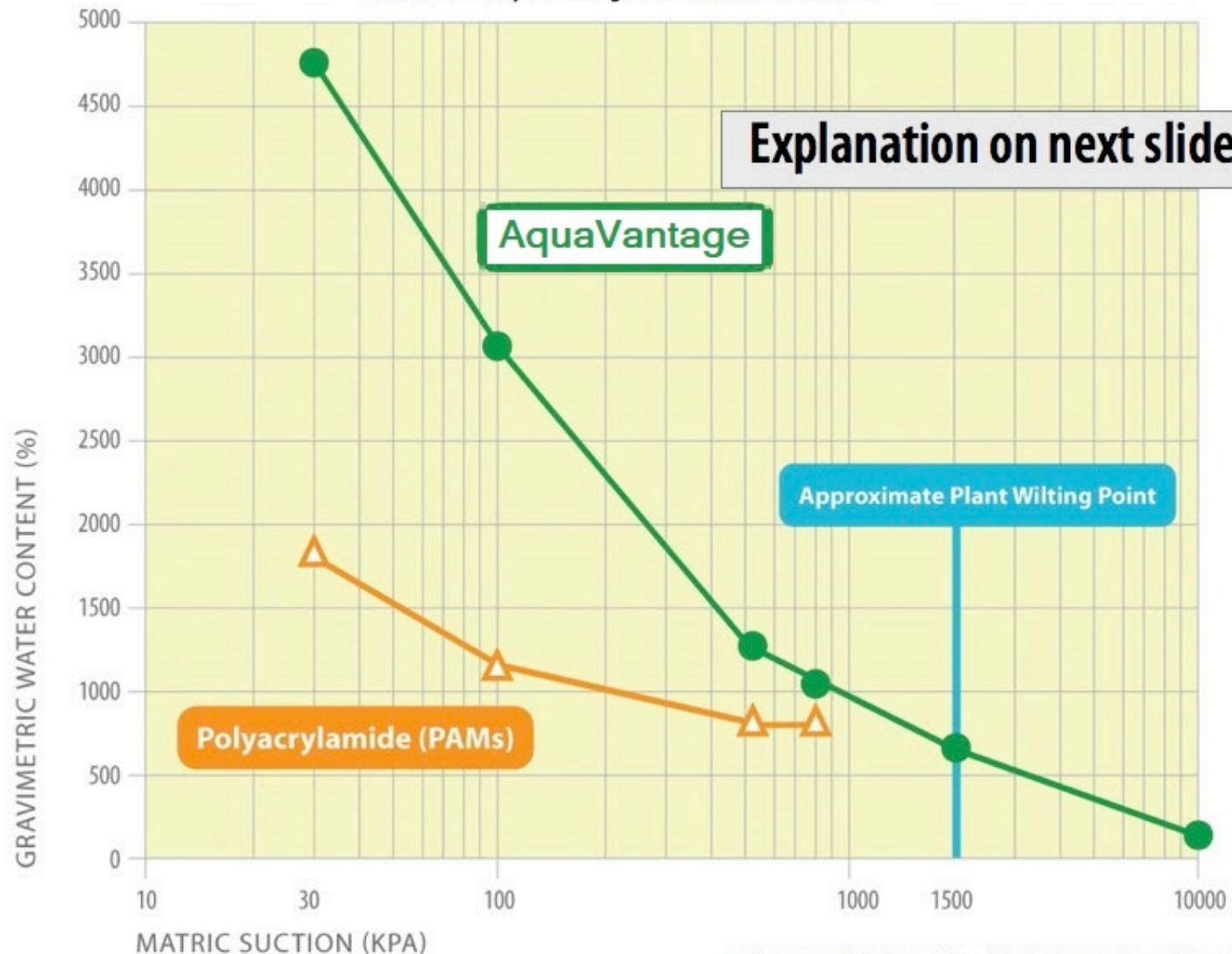


PAM is "rubbery" and locks  
up moisture in the soil



# Absorbent-Water Characteristic Curve Over a 21-Day Period

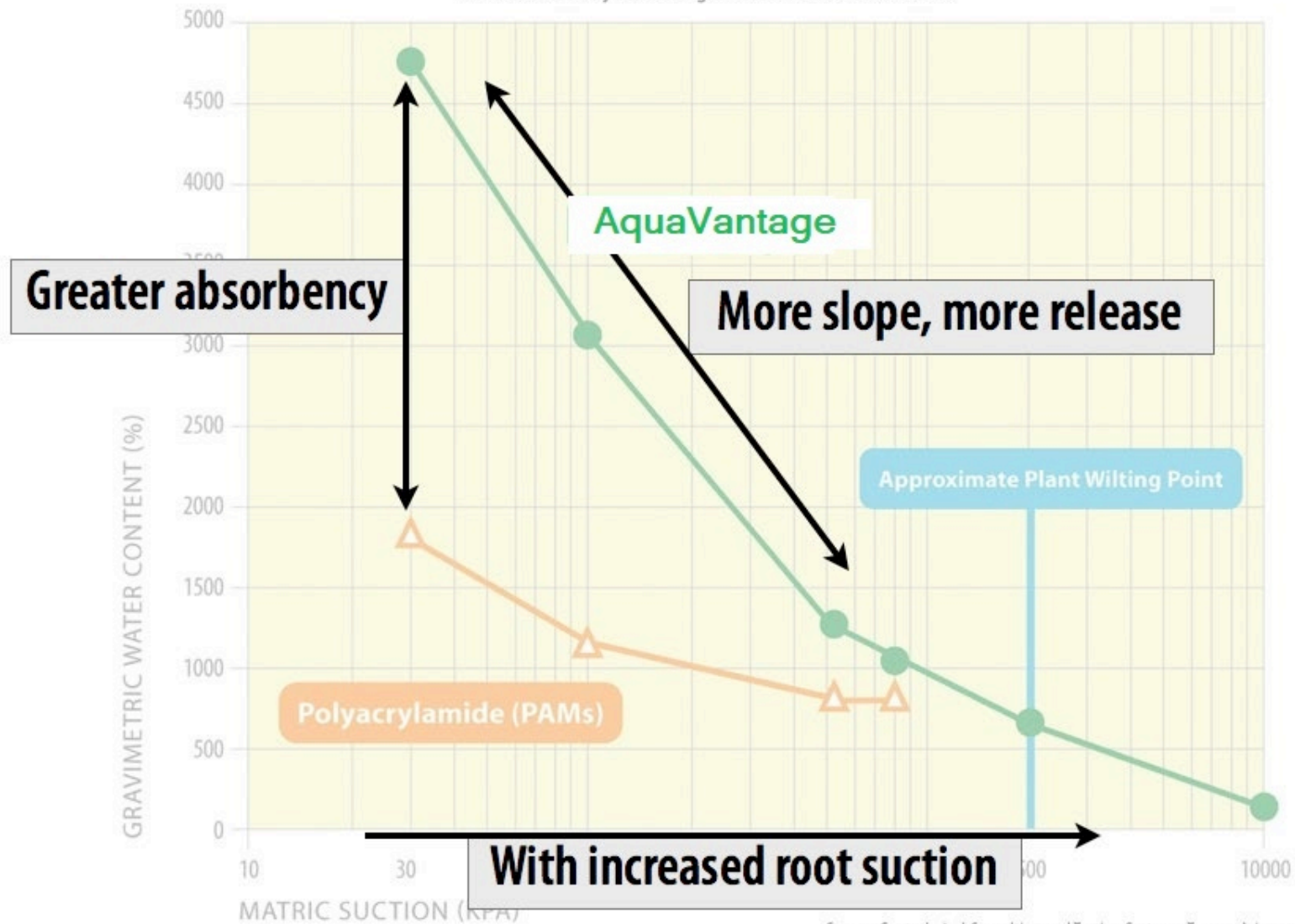
Field capacity .3 ATM Sandy Loam Soil  
American Society for Testing & Materials ASTM D6836-02



Source: Geotechnical Consulting and Testing Systems, Tempe, Arizona

# Absorbent-Water Characteristic Curve Over a 21-Day Period

Field capacity .3 ATM Sandy Loam Soil  
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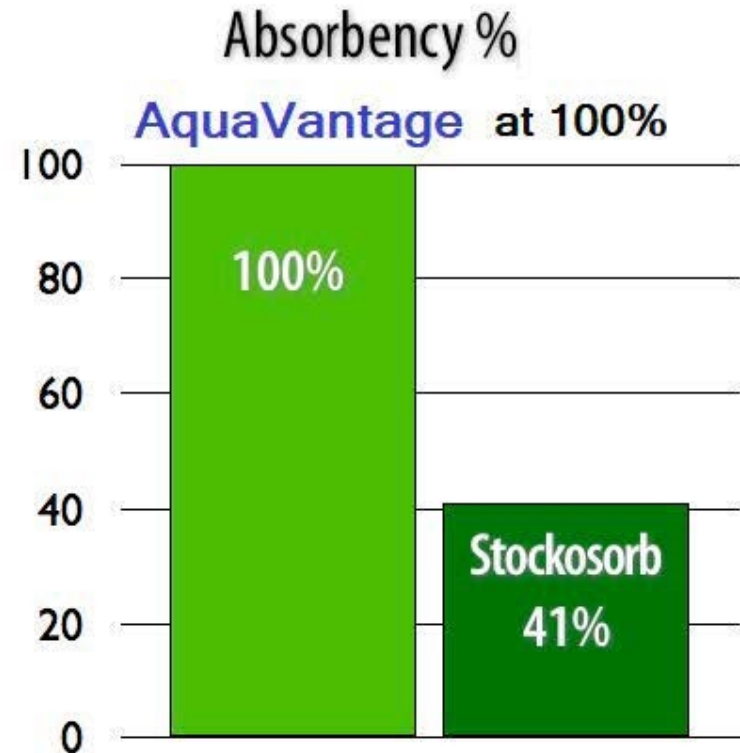
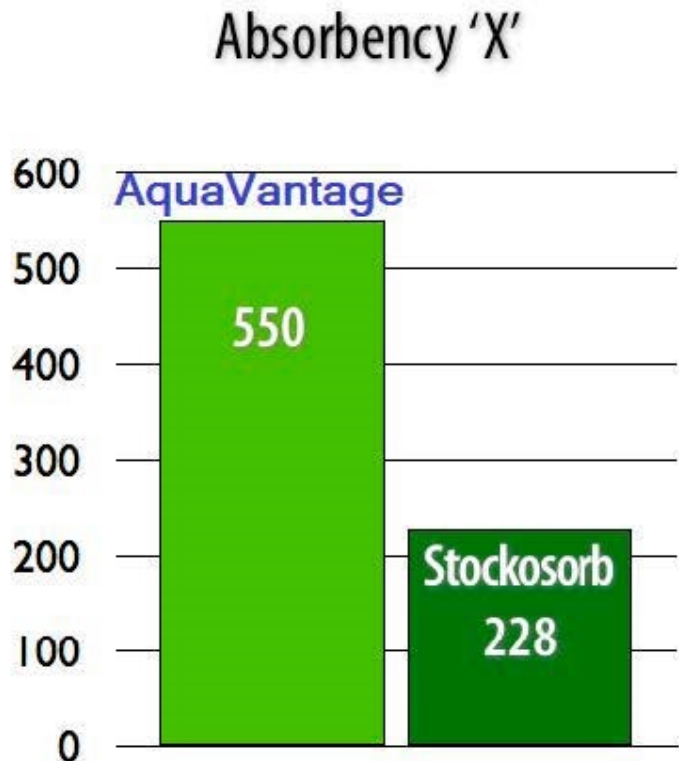


Source: Geotechnical Consulting and Testing Systems, Tempe, Arizona

# Comparison of absorbency

**AquaVantage** *maintains higher absorbency*

*8 hour hydration, distilled water, size: 8-16 mesh / 2380-1190 microns / 2.38-1.19 mm*





# Real performance vs. claims

*Citations from scientific journal articles referenced in Appendix*

**“There is widespread agreement that PAMs do not behave as advertised.” (1)**

**“Results on PAMs to alleviate water stress have been mixed and unpredictable.” (2)**

**“They [PAMs] haven’t proven themselves on a consistent basis.” (3)**



# Real performance vs. claims

*Citations from scientific journal articles referenced in Appendix*

**“The claim that cross-linked PAM conserves water is not justified.”<sup>(4)</sup>**

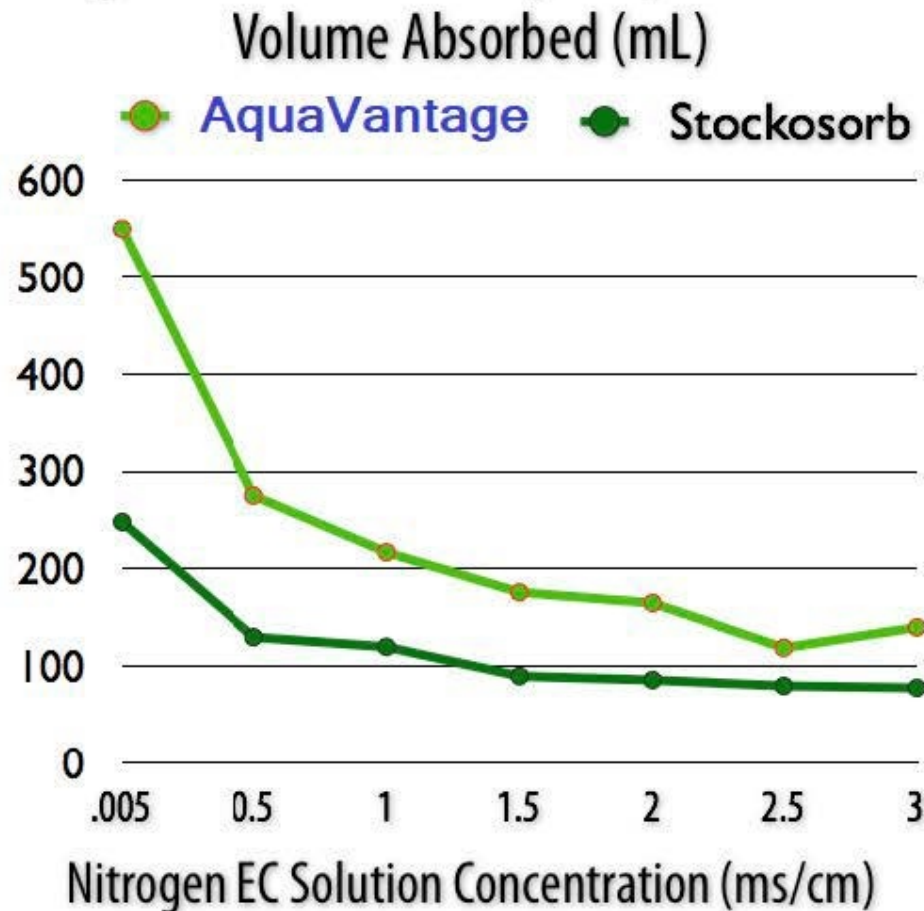
**“[PAM] water is not necessarily transferred to the plant, as companies selling these products would have you believe.”<sup>(5)</sup>**

**“The use of [PAM] provides little influence on plant performance.”<sup>(6)</sup>**

# PAM and fertilizer

**AquaVantage®**

***maintains higher absorbency in presence of fertilizer***

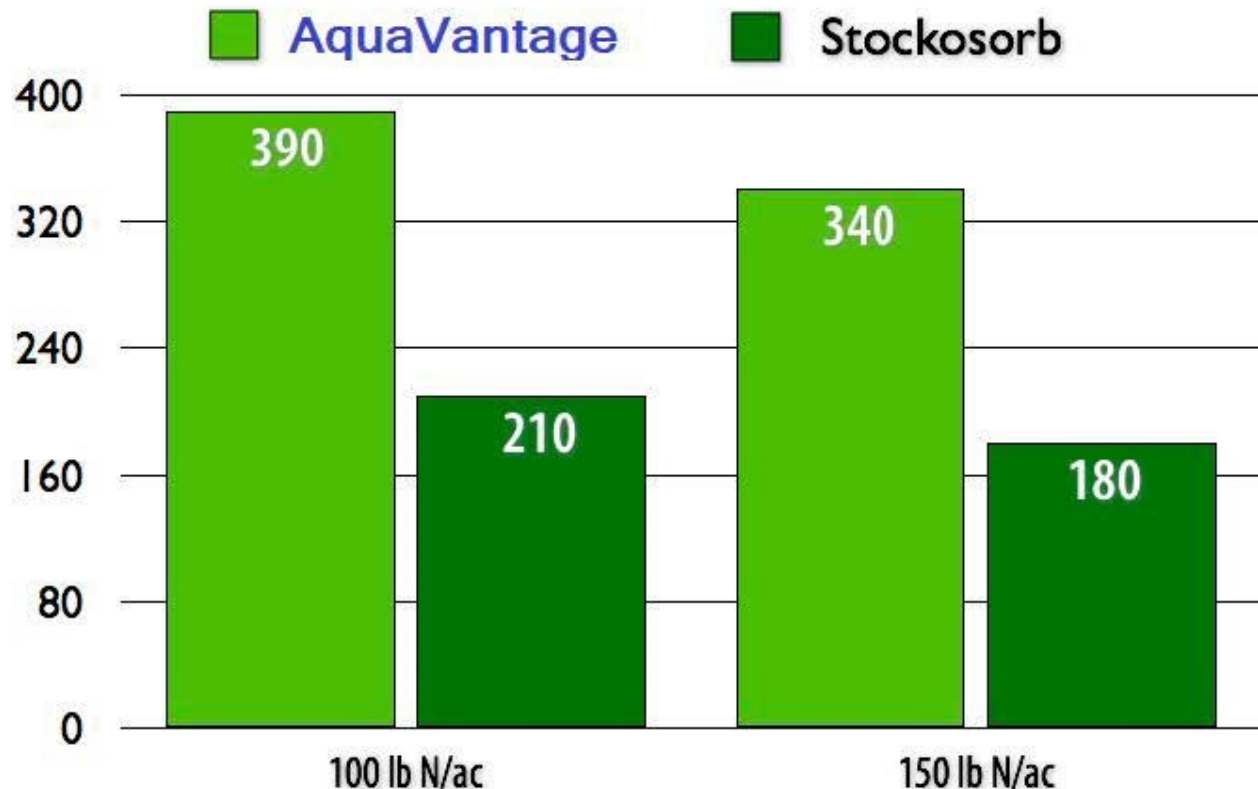


# PAM and fertilizer

**AquaVantage®**

***maintains higher absorbency in presence of fertilizer***

Volume Absorbed (mL)



# PAM and fertilizer

## ***Reduced performance and uptake***

*Citations from scientific journal articles referenced in Appendix*

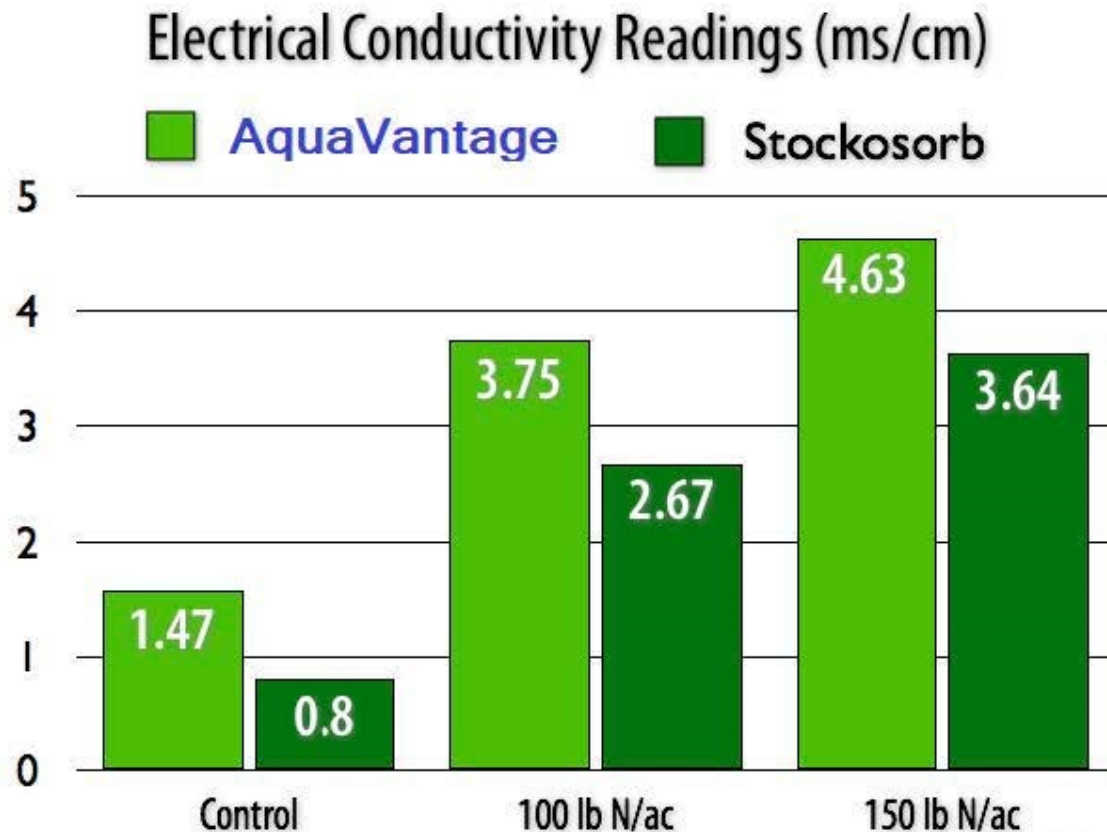
**“[PAMs] decreased plant uptake of several essential nutrients in field studies.” (7)**

**“Water carrying capacity is often substantially reduced when adding nutrients to the water and [PAM] solution.” (8)**

**“The starch [i.e., [AquaVantage®](#)] hydrogels were the least affected by the addition of fertilizer.” (9)**

# PAM and electrical conductivity

**AquaVantage®**  
*provides greater nutrient availability*





# PAM and the environment

*Citations from scientific journal articles referenced in Appendix*

**“The hazards posed by PAM hydrogel degradation are not known. There are agricultural alternatives to PAM hydrogels, including starch-based gels.”<sup>(10)</sup>**

**“Users should avoid exposure to eyes and other mucous membranes, and should be careful not to breathe PAM dust.”<sup>(11)</sup>**

**“PAMs are defined [by MSDS] as NOT readily biodegradable.”<sup>(12)</sup>**

# Application cost

**AquaVantage®** *2.5x more effective*

**AquaVantage®**

**7 lbs/acre\***

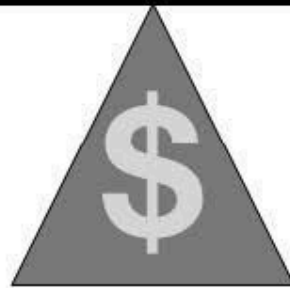
\*Recommended rate

**Agricultural Application**

**PAM**

**15 lbs/acre\***

\*Recommended rate



# Summary

- AquaVantage® holds 2x water over PAMs
- AquaVantage® holds water 'loosely' and gives back easily
- PAMs bind-up water tightly
- AquaVantage® returns more water to the plant
- AquaVantage® is competitively priced per acre, with greater scientifically proven results



*"A Smart New Way to Grow Crops!"*

*For more information, please visit:*

**[www.SunnGlobal.com](http://www.SunnGlobal.com)**

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# Appendix

- <sup>(1)</sup> Frantz, Jonathan M., Locke, James C., Pithcay, Dharmalingam S., University of Toledo and Krause, Charles R., U.S.D.A. Agricultural Research Service, "Actual Performance versus Theoretical Advantages of Polyacrylamide Hyrdogel throughout Bedding Plant Production", HortScience, Vol. 40(7), December 2005.
- <sup>(2)</sup> Green, C.H., C. Foster, G.E. Cardon, G.L. Butters, M. Brick, B. Ogg, 2004. *Water release from cross-linked polyacrylamides*. Department of Soil & Crop Science, Colorado State University.
- <sup>(3)</sup> Gillman, Jeff. Associate Professor of Horticultural Science, Department of Horticultural Science, University of Minnesota. "The Truth About Garden Remedies: What Works, What Doesn't, and Why." Timber Press, 2006, pp. 74-77.
- <sup>(4)</sup> Wu, L. Assistant CE Water Management Specialist, Associate Professor of Soil Science, Department of Environmental Sciences, University of California Riverside. *Polyacrylamide (PAM) — Effective erosion fighter and infiltration enhancer but not a conserver of water*.
- <sup>(5)</sup> Gillman, Ibid.
- <sup>(6)</sup> Citations compiled by Daniel A. Peterson, University of Minnesota Agricultural Department
- <sup>(7)</sup> Chalker-Scott, L. Extension Horticulturalist and Associate Professor, Puyallup Research and Extension Center, Washington State University, "The myth of polyacrylamide hydrogels: polyacrylamide hydrogels are environmentally safe substances that reduce irrigation needs." 2001. And "The myth of polyacrylamide hydrogels revisited." 2004. environment
- <sup>(8)</sup> Bowman, D.C. and R.Y. Evans. 1991. *Calcium inhibition of polyacrylamides gel hydration is partially reversible by potassium*. HortScience 26(8): 1063-1065
- <sup>(9)</sup> Foster, W.J. and G.J. Keever. 1990. *Water absorption of hydrophilic polymers (hydrogels) reduced by media amendments*. Journal of Environmental Horticulture 8(3): 113-114. and Woodhouse, J.M. and M.S. Johnson. 1991. *Effects of soluble salts and fertilizers on water storage by gelforming soil conditions*. Acta Horticulturae 294: 261-269.
- <sup>(10)</sup> Chalker-Scott, ibid
- <sup>(11)</sup> Wu, ibid.
- <sup>(12)</sup> Chalker-Scott, ibid