

Martin John Bukovac: Career and Concepts

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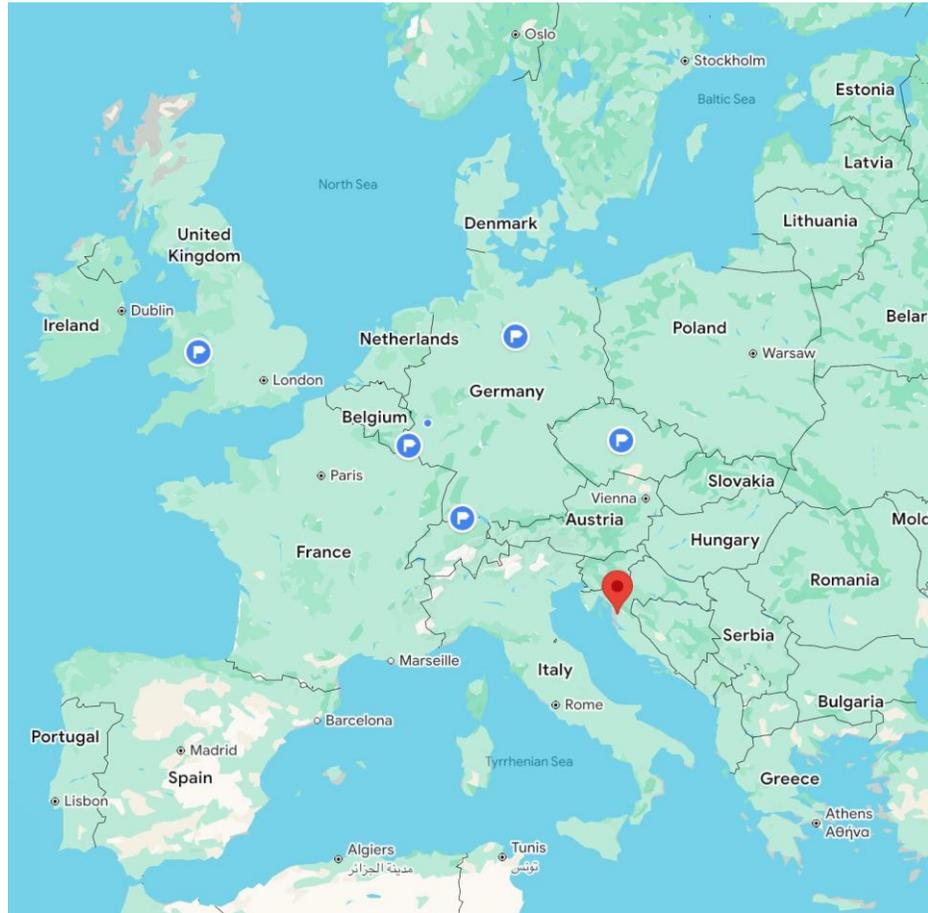
1. Early Life, Formal Education, Military Service

2. Research

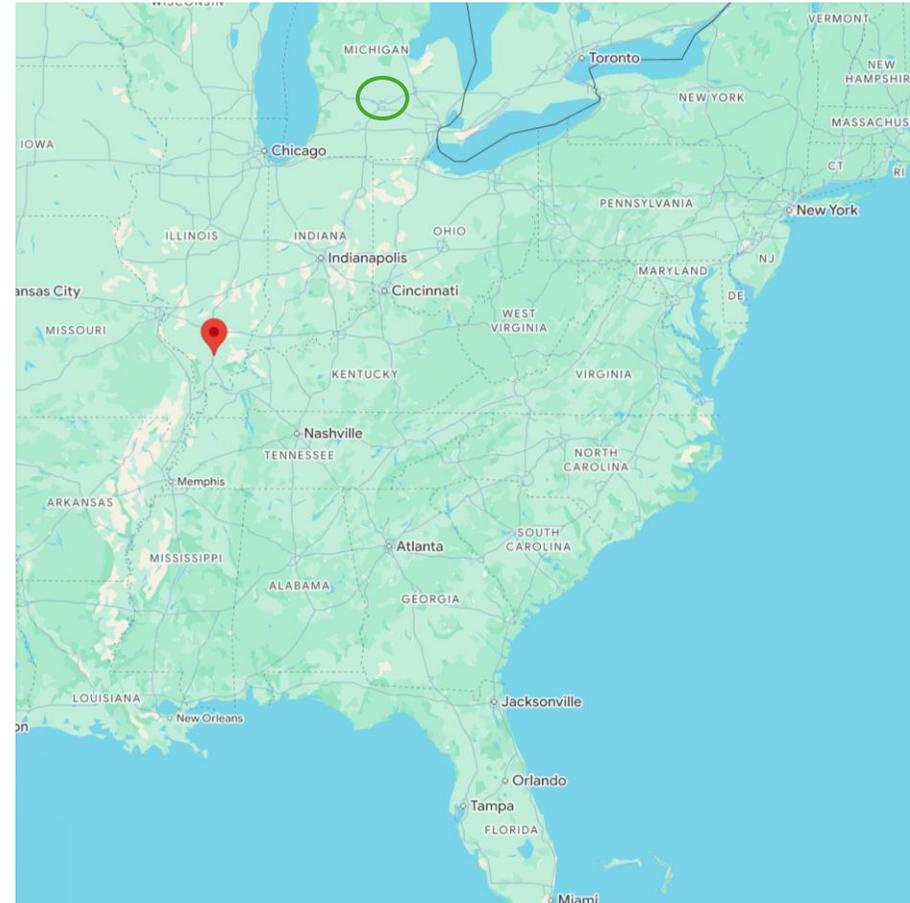
- **Radioisotope: Uptake Research**
- **PGRs: Gibberellin and Ethephon**
- **Plant Cuticles**
 - **The “Black Magic” Story**

3. Bukovacian Concepts

Kuterevo Croatia



Johnston City Illinois



Johnston City, Illinois: 1920s / 1930s

Bukovac's parents arrived in Johnston City in the 1920s. His father worked in the coal mines as an engineer in charge of blasting coal.

Martin John Bukovac was born November 12, 1929 in Johnston City Illinois.

At that time and place:

Secret Societies: Ku Klux Klan attacked immigrants and Catholics. Black Hand Society reportedly incited riots.

Bootleggers: Charlie Birger Gang vs. Shelton Brothers Gang. Machine guns and tanks and airplanes and bombs.

The Great Depression

- Coal mining slowed down.
- Work 2 to 3 days a week.
- Teachers paid by promissory notes.
- Large gardens.

In May 1939, the Bukovac's bought a farm in Paw Paw Michigan and they left Johnston City.

1939: Consolidated Coal Company in Johnston City

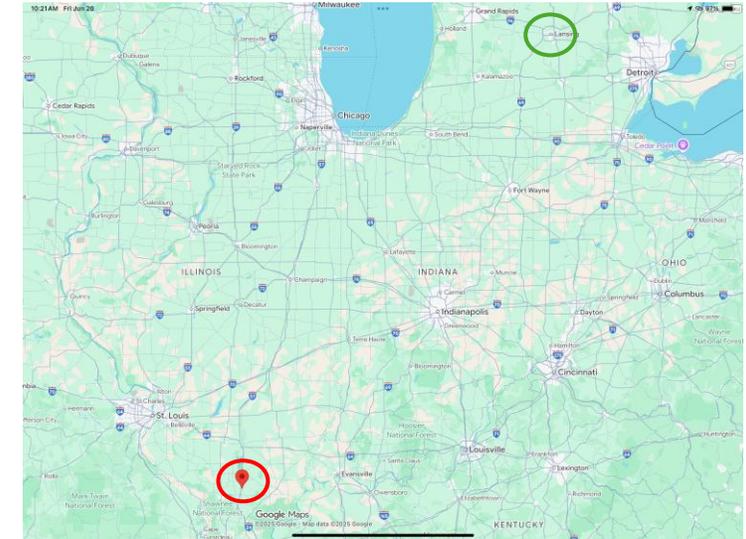


Consolidated Coal Company, Lake Creek Mine, Johnston City, (Jan. 1939 Arthur Rothenstein photo)

1939: Unemployed miners in Johnston City



Unemployed miners on street corner in Johnston City, (Jan. 1939 Arthur Rothenstein photo)



Paw Paw Michigan

They bought a Farmall Tractor and sold the horses.

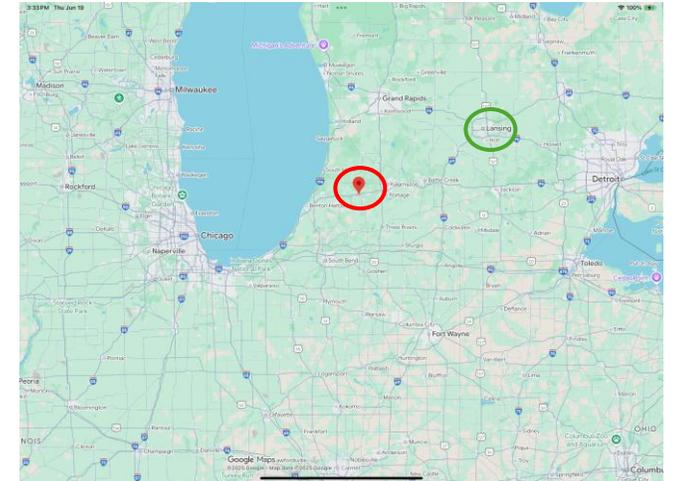
Small farming:

- Sour cherry, peach. First year had a freeze.
- Also: Asparagus, grapes, strawberries, black raspberries.
- Raised cucumbers for Paw Paw Canning.
- Harvesting cucumbers motivated John to leave home and get educated.

1940s: Paw Paw Fruit Farming



1940s: Downtown Paw Paw



Paw Paw Michigan Education

- His dad wanted him to take over the family farm.
- His mother drove his formal education.
- Paw Paw High School classes
 - “His manners alone would have gained him our hearts.”
 - Good history and shop teachers
 - Poor English teacher
 - Poor basic science class (math, physics, chemistry) in high school
 - Did not take enough of basic science courses in college. John was always plagued by his lack of basic science education.

SENIORS

<p><u>CHARLES ANDREWS</u> "When do we eat?"</p> <p>Band 9 11 12 Choir 10 12 Football 9 10 11 12 Letter Club 12 Orchestra 9 11 12 Pep Band 12 Radio Club 12</p>		<p><u>VERNA JEAN SHODMAN</u> "Silence is deep as Eternity-- speech is shallow as Time."</p> <p>Transferred 11 Choir 12</p>
<p><u>ROBERT ANDREWS</u> "A man convinced against his will, is of his own opinion still."</p> <p>Baseball 9 10 Football 12 Interclass Sports 9 10 11 12 Letter Club 11 12 Radio Club 12 Student Council 9 Track 11 12 Wappaw Staff, Photography 10 War Board 10</p>		<p><u>WILSON WOOD</u> "He'll be out an' tharrest look!"</p> <p>Baseball 9 Choir 10 11 12 Librarian 12 Football 9 10 11 12 H.M.S. Pinafore 11 Interclass Sports 10 Junior Play, Cast Letter Club 11 12 National Thespians 11 12 Radio Club 12</p>
<p><u>GEORGIA BENWIRE</u> "If you can't find anything to laugh about, just giggle."</p> <p>Interclass Sports 11 Junior Play, Cast National Thespians 11 12 Senior Play Asst. Director Wappaw, Typist</p>		<p><u>IRENE BUDZEN</u> "All nature is but art."</p> <p>Transferred 11 Interclass Sports 11 12 Wappaw Staff, Art</p>
<p><u>HILMA BLAESING</u> "Quiet to those who know her not; jolly to those who do."</p> <p>Choir 10 11 12 Secretary 11 12 Accomp. 12 Class Secretary 11 H.M.S. Pinafore, Make-up 11 Glee Club 10 11 Secretary 11 Accomp. 11 High School Comm., Secy. 10 Junior Play, Cast National Thespians 11 12 Senior Play, Make-up J-Hop, Refreshments Student Council 9 Wappaw Staff, Features</p>		<p><u>JOHN BUKOVAC</u> "His manners alone would have gained him our hearts."</p> <p>F.F.A. 10 11 12 High School Comm. 11 Radio Club 12 Student Council 9 Wappaw Staff Assistant Editor</p>
<p><u>PHYLLIS BRADLEY</u> "True to her work, her words, her friends."</p> <p>Transferred 10 Interclass Sports 10 11 National Thespians 12</p>		<p><u>DONA CARLSON</u> "Tis education forms the common mind, Just as the twig is bent, the tree's inclined."</p> <p>Band Drum Major 9 10 11 12 Class President 9 Cheer Leader 9 10 11 12 Choir 10 11 Interclass Sports 10 Junior Play, Cast J-Hop, Decorations National Thespians 11 12 Orchestra 9 Red Cross Comm. 9 Senior Play, Cast Student Council 9</p>

Michigan State College Education

- John received a scholarship from Michigan Tech on a branch campus in Sault Ste Marie, but the campus was too far from home.
- He changed his mind after staying a week in an agriculture fraternity in Michigan State College.
- In Fall 1947 John enrolled at MSC in the Forestry Department.
- John's financial situation in 1947:
 - \$47 for tuition
 - \$280 in his checking account, received a \$300 scholarship.
 - Mucked dishes for \$0.30 an hour.
- Junior year: First scientific research.
 - Worked in Alvin Kenworthy's Spectroscopy Lab on leaf sample analysis.
 - Helped Ed Proebsting master's field work.



Military Service

- John received his bachelor's degree at MSC in horticulture in 1951.
- He enlisted in the Army and chose to be in the tank division since tanks are not sent to Korea.
- He served as Tank Commander for 21 months in during the Cold War patrolling the border between West and East Germany.
- Key skills John learned in the US Army:
 - Making on-site decisions.
 - Teaching directly and clearly.
 - In the Army, you are obligated to make people understand.
 - Simplicity, review, examples.
- John became a Distinguished Military Candidate and was recruited to become an aide to General Van Houton.



Michigan State College

- **Harold B Tukey, the horticulture department chair at MSC. Tukey was interested in rebuilding the reputation of the department.**
- **Tukey was impressed with John as an undergraduate. They remained in contact during John's service in the Army.**
- **Tukey strongly encouraged John to come back to Michigan for graduate school.**
- **Because of Tukey's encouragement, John went on to a career in science rather than the military.**



Michigan State University

- John received his BS, MS, and PhD from Michigan State.
- He was a faculty member from 1957 to 1997.



Michigan State Horticulture Faculty c. 1962

Radioisotope: Uptake Research

- Tukey encouraged John to write a proposal to the AEC (Atomic Energy Commission).
- In the early 1950's, the AEC had a program called "Atoms for Peace". The AEC was looking for ways to use radioactivity for science and technology.
- The proposal John wrote was about using radioactivity to trace the movement of atoms and molecules through plants. The 1954 proposal was well received.
- The subsequent research with radioisotopes established the uptake and movement of nutrients.



Bukovac, M. J., & Wittwer, S. (1957). Absorption and mobility of foliar applied nutrients. *Plant physiology*, 32(5), 428.

PGR Research: Gibberellins

- John went to the University of Tokyo in 1957 as an invited speaker to discuss his radioisotope work.
- During his free time, John asked to meet people working in plant science. He met Prof. Sumiki who was active in fundamental research on gibberellic acid (GA3).
- Sumiki gave John purified GA3.
- Sylvan Wittwer was John's advisor and was open to testing GA3 on many crops that flowering control and growth promotion.

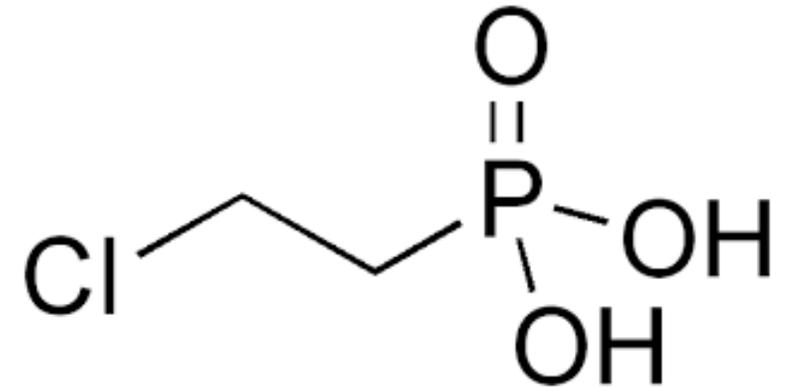
Sylvan Wittwer c. 1957: GA3 on Lettuce



Wittwer, S. H., & Bukovac, M. J. (1957). Gibberellin effects on temperature and photoperiodic requirements for flowering of some plants. *Science*, 126(3262), 30-31.

PGR Research: Ethephon

- In the mid 1960s, Michigan cherry growers did not have enough people to harvest their cherries.
- Harvesting machines were available, but these shakers damaged the fruit as well as the trees.
- John figured a loosening agent was needed to promote abscission. John found out that Amchem Products was screening their chemicals in a leaf abscission assay.
- Amchem Products gave John three chemicals from their screening program.
- John's Lab developed abscission bioassays and characterized the effects ethephon (ethylene releasing compound) on cherry abscission.



Wittenbach, V. A., & Bukovac, M. J. (1974). Cherry fruit abscission: evidence for time of initiation and the involvement of ethylene. *Plant physiology*, 54(4), 494-498.

Plant Cuticles

- **Early in John's career, Bob Bandursky (MSU Botany) convinced John to focus on more basic research.**
- **In the early 1960s, John received fellowship money to study at the Long Ashton Experiment Station in England.**
- **In Long Ashton, he worked with plant physiologists and chemists like JT Martin and Ted Baker on fundamentals of cuticle biochemistry.**
- **John was interested in studying plant cuticles because they are the primary barrier to applied chemical uptake.**

The “Black Magic” Story

The Formulation of the Commercial Cytokinin 6-Benzyladenine

- John worked with agricultural chemical companies such as Amchem, EliLily, and Abbott.
- Industry chemists used design goals for creating commercial formulations.
- Design goals for Agchem fomulations:
 1. Solubility
 2. Stability
 3. Cost of Goods
 4. Regulatory
 5. Flammability
 6. Rheology
 - 7 to 13. ETC
 14. Improved Performance.
- Goal Number 14: Improved Performance.
 - AgChem industry formulation chemists included adjuvants (e.g. surfactants, urea, and ammonium nitrate) to enhance product performance.
 - How do adjuvants in formulation or tank mix affect performance? Better wetting, better coverage, better deposits, better cuticular permeability?
 - John’s concept: There may be an optimal formulation for each active ingredient.

Plant Cuticles: The Role of Adjuvants on Foliar Applied Chemical Performance

- The cuticle is the primary barrier to uptake and eventually performance of foliar applied chemicals.
- Enzymatically isolated tomato fruit cuticles can be used as a model system (Bukovac and Petracek 1993):
 - Enzymatically extracted
 - Effectively astomatous.
 - Can be handled and used in diffusion cells
- In the mid 1980s, the Bukovac lab focused on adjuvants. 1. Uptake (Stevens) 2. Sorption (Shafer) 3. Phytotoxicity (Lownds). Key concept: Surfactants can penetrate the cuticle.



Stevens, P. J., & Bukovac, M. J. (1987). Studies on octylphenoxy surfactants. Part 2: Effects on foliar uptake and translocation. *Pesticide science*, 20(1), 37-52.

Shafer, W. E., & Bukovac, M. J. (1987). Studies on Octylphenoxy Surfactants: III. Sorption of Triton X-100 by Isolated Tomato Fruit Cuticles. *Plant physiology*, 85(4), 965-970.

Lownds, N. K., & Bukovac, M. J. (1989). Surfactant-induced ethylene production by leaf tissue. *Journal of the american society for horticultural science*, 114(3), 449-454.

Bukovac, M. J., & Petracek, P. D. (1993). Characterizing pesticide and surfactant penetration with isolated plant cuticles. *Pesticide Science*, 37(2), 179-194.

Plant Cuticles: The Role of Adjuvants on Foliar Applied Chemical Performance

- My PhD program with Bukovac in the late 1980s focused the interaction of the adjuvant Triton X-100 and isolated tomato fruit cuticles.
- Desorption
 - Cuticular sorption and desorption of Triton X-100 are not directly reversible processes. Hysteresis is a drag and somethings just stay stuck.
- Rheology (cuticle stretching)
 - Water increases the elasticity of the cuticle.
 - Triton X-100 has no effect on cuticular rheology.

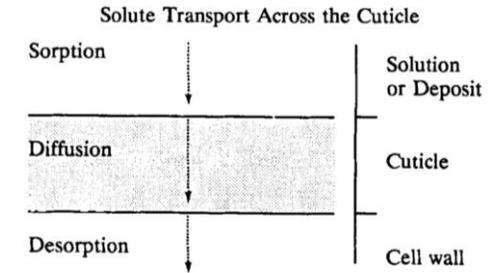
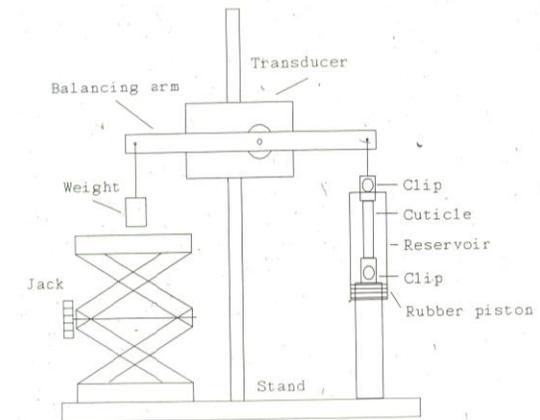
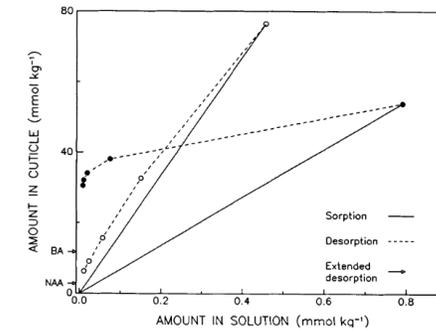


Fig. 1. Component processes of pesticide diffusion across the cuticle.



Petracek, P. D., & Bukovac, M. J. (1995). Rheological properties of enzymatically isolated tomato fruit cuticle. *Plant Physiology*, 109(2), 675-679.

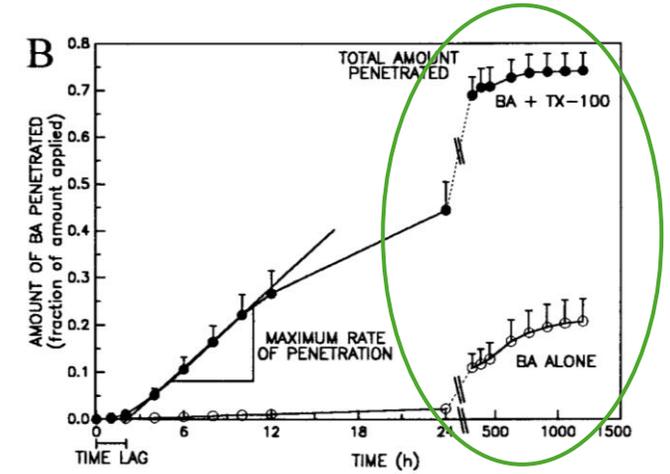
Plant Cuticles: The Finite Dose Diffusion Cell

In the late 80s / early 90s, Moritz Knoche was a visiting scholar in Bukovac's lab. Moritz was to work on foliar active ingredient uptake.

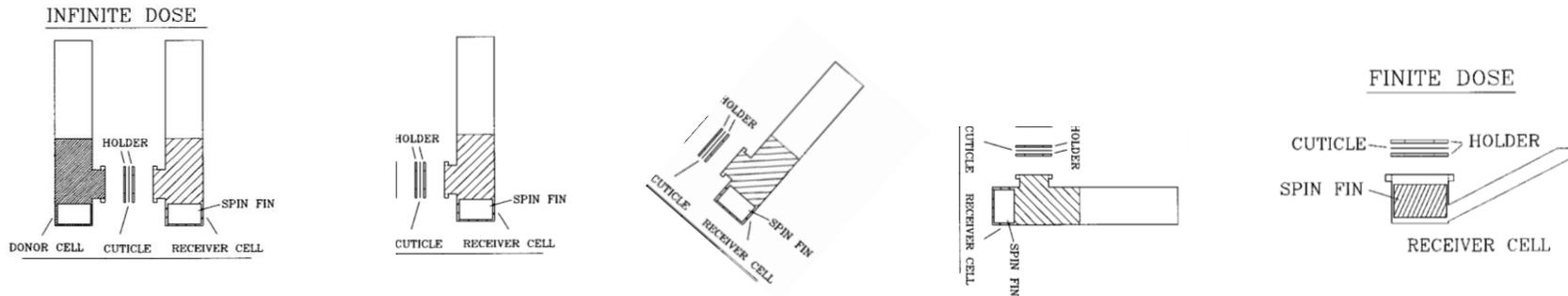
To understand uptake, a method was needed to examine adjuvant effects on active ingredient cuticular penetration from a droplet / drying deposit.



Result: Cuticular penetration by benzyladenine (BA) was great increased by Triton -100 (TX-100) (!)



So early one morning, I drew the design for the Finite Dose Diffusion Cell.



Petracek, P. D., Fader, R. G., Knoche, M., & Bukovac, M. J. (1998). Surfactant-enhanced penetration of benzyladenine through isolated tomato fruit cuticular membranes. *Journal of agricultural and food chemistry*, 46(6), 2346-2352.

The “Black Magic” Story

The Formulation of the Commercial Cytokinin 6-Benzyladenine

1. In Fall 1998, I joined Abbott Laboratories.
2. At the same time, the Triton X-100 / benzyladenine paper from the Bukovac Lab was published in J. Agric. Food Chem.
3. Days later formulation chemist Bala Devisetty saw the paper and had me present the paper in an internal seminar to Abbott scientists.
4. Formulation chemist Yueh Wang saw the seminar and went back to his lab and made a benzyladenine formulation with a Triton X-100 analog.
5. This formulation had improved benzyladenine performance in a series of lab and field studies.
6. The product MaxCel was launched in 1993 .

So what is the “black magic” in this story?

- The mighty luck that we worked with Triton X-100 with benzyladenine in our cuticular studies?
- The entire process: Of concept to design model to testing to formulation to lab and field testing to active sourcing to registration to marketing?
- Collaboration between public researchers and industry?

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J. Agric. Food Chem. 1998, 46, 2346-2352

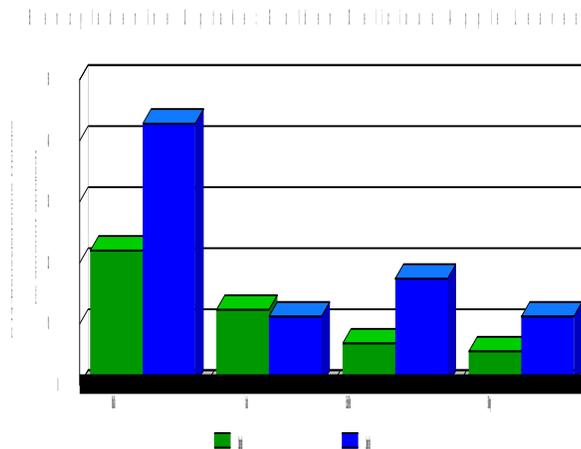
Surfactant-Enhanced Penetration of Benzyladenine through Isolated Tomato Fruit Cuticular Membranes

Peter D. Petracek,¹ Royal G. Fader, Moritz Knoche,² and Martin J. Bukovac*

Department of Horticulture, Michigan State University, East Lansing, Michigan 48824-1325

The effect of Triton X-100 (TX-100) on the penetration of benzyladenine (BA) through isolated tomato (*Lycopersicon esculentum* Mill.) fruit cuticular membranes was studied using finite and infinite dose diffusion and sorption/desorption systems. Finite dose penetration of BA (18 and 160 μ M, pH 2 and 6) from donor droplets (3 μ L) was characterized by an initial time lag, a maximum rate of penetration, and total penetration. TX-100 (0.1% w/v) increased maximum BA penetration rates 1.5–40-fold (pH 6, 18 and 160 μ M) and total penetration 1.5–3-fold (pH 2 and 6, 18 and 160 μ M BA). In infinite dose studies, rates of BA penetration (20 μ M, pH 6.0) were increased ~2-fold by TX-100. Surfactant effects were greatest when the surfactant was presented to the outer morphological surface of the cuticle (both native and dewaxed) regardless of whether TX-100 was penetrating in the same or opposite direction to BA. Sorption/desorption of BA was not affected by TX-100.

Keywords: Cuticle; cytokinin; diffusion; Triton X-100; sorption; *Lycopersicon esculentum*



maxCel
Plant Growth Regulator

The Bigger Thinner™

Bukovac's Role in Commercial PGR Product Development

No.	Activity	Year(s)	Contribution(s)	Reference
1	Ethephon: Promotion of cherry abscission to allow mechanical harvesting.	1960-1970s	Research with industry actives, effects on ethylene, temperature / dose responses.	1971 HortScience 6:385
2	Gibberellic Acid (GA3): Promotion of vegetative bud differentiation to overcome effects of cherry yellow virus.	Early 1990s	Research and publication (1990) on reducing flowering to increase vegetative growth.	1991 Gibberellins (Takahasi ed.)
3	6-Benzyladenine (6BA): Formulation benefits.	Late 1980s-1990s	Research and publication on effects of adjuvant on 6BA penetration of isolated cuticles.	1998 JAF 46: 2346
4	Abscisic Acid (ABA): Promotion of grape color development.	2003	Key knowledge about ABA supply and demand. The Smugglers Story.	Personal communication
5	Aminocyclopropane Carboxylic Acid (ACC): Flowering and fruit thinning.	2003	Key knowledge about ethephon temperature effect and flower and fruit thinning.	Personal communication
6	Gibberellic Acid (GA3): Breaking break low temperature dormancy of pasture grass.	1958 and 2009	Research on the effects of spring application.	1958, Quarterly Bulletin, MSU Ag Exp Station 39: 682.



John and Me (Peter), 1988

Bukovacian Concepts

No.	Concept	Context
1	The three things that make a great scientist: 1. Good organizational skills, 2. Strong work ethic, and 3. High integrity.	Focus on fundamentals, not genius.
2	Fix problems but try to not act like a firefighter	Serve the people who hired you, but do not chase everything you see. Do not get distracted. Instead identify key problems of your industry, break down the problem into parts that you can resolve, and execute experiments to resolve the problem. Most importantly, focus your work and focus on your work.
3	Give me a “yes” or give me “no” answer, but do not give me a “maybe”.	Design, execute, and analyze your experiments to get specific answers.
4	Get a good negative.	Editing poor images or fixing poor experiments wastes time. Carefully plan and execute your work.
5	Make sure your numbers are correct.	Avoid making silly mistakes. Double check your calculations and cross check them with someone else. This is especially important to do prior to spray applications since so much can be ruined by silly mistakes.
6	Convey your message clearly.	Be clear. There is little benefit in being oblique in science. Organize your data package before you write. Work intensely on titles, abstracts, and short talks.
7	Do not use “loose” language in formal presentations.	Avoid slang and jargon in papers or talks. Your audience may be outside your area of research or non-native English speakers. If they are, they will not understand you readily. Put no barriers between you and your audience.
8	Dress at least one step above your audience.	Remove a perception element.
9	Go for quality.	This refers to both your research and the people you hire.
10	Travel as much as you can.	Keep your eyes, ears, and mind open. You can learn a lot in other places from other people.
11	Give yourself blocks of time to read, think, and write.	You need time to think and focus on science.
12	Do not write book chapters and do not chase patents.	Chapters and patents absorb time and yield a poor return on investment.
13	Be careful when you listen to your peers.	Peers are often too close to the problem to have a clear perspective.
14	Ask your committee if they have any questions before you defend your thesis.	A premeeting can reduce confusion.
15	When you apply for a job, there is a “push” and a “pull”. Focus on the “pull”.	The reasons you leave a job may be very important to you, but the reasons you want a job are far more important to the people who are hiring you.
16	Do not give in to anger and always be helping.	

No.	Concept	Context
1	The three things that make a great scientist: <ol style="list-style-type: none"><li data-bbox="293 511 930 564">1. Good organizational skills<li data-bbox="293 578 751 631">2. Strong work ethic<li data-bbox="293 645 649 698">3. High integrity	Focus on fundamentals, not genius.

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2	Fix problems but try to not act like a firefighter	<p>Serve the people who hired you, but do not chase everything you see.</p> <p>Do not get distracted.</p> <p>Instead identify key problems of your industry, break down the problem into parts that you can resolve, and execute experiments to resolve the problem.</p> <p>Most importantly, focus your work and focus on your work.</p>

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Bukovac Philosophy

- **New staff members should be advised by the chair or by their mentors as to their job descriptions and encouraged to develop a basic component that complements their work.**
- **All researchers should be asked to relate to the citizens how what they are doing with public funds will ultimately help society.**

Frank Dennis interview transcript: 23, 24, and 28 January 2002

Transcript of Bukovac Interview by Frank Dennis in the MSU Archives.

M. John Bukovac. Interviewed by Frank Dennis 23, 24, and 28 January 2002. Not verbatim.

I was born in Johnston City, Williamson County, Ill. As I'll mention later, this area was stressful and the quality of life was poor. My parents were immigrants from Croatia, which was then a part of the Austro-Hungarian Empire. My father was a "technician" in the coal mining industry in Johnston City. Times were difficult during the Depression; job opportunities were limited, and if you had a job, you worked 1 -2- 3 days a week at most; it was a very poor environment for making a living and raising a family. Also, the KKK was active, along with a group known as the Charlie Birger gang – a self-appointed local law authority with its own rules. These groups harassed foreign people and Catholics. We were never hurt, but they entered our home and "visited" several times, and we were always concerned. At the same time John L. Lewis was organizing coal miners, which created some violent situations. But we survived the Depression. Dad was able to maintain employment for 2-3 days per week. Also, we had a large lot where he grew almost everything imaginable. My older sister and I helped; everything was done by hand. One of our jobs was picking horn worms off tomato plants and Colorado potato beetles off potatoes. Mother did a fantastic amount of canning. Dad was a very clever and capable individual. Occasionally he butchered hogs for neighbors and brought home meat. He also had an acquaintance who had a small farm where he often helped when he wasn't working, and would bring home eggs and a chicken. Fruit was not plentiful, but wild persimmons grew everywhere, and were good if harvested just as they were about to fall from the trees – otherwise they were bitter. They didn't last long, but we collected -- and ate -- a lot of them.

Mother and her sister invited their father, who was an elderly man, to come from Croatia to stay with them.. One afternoon my grandfather was shot by intruders – no one knows who they were -- in my aunt's house, which was a few houses away. He survived, but that convinced him that he didn't want to stay in America. He returned to Europe and died there after infection set in. There was a lot of discussion between Mother and Father about conditions and our future in Illinois; as a result, we moved to Michigan. I was about 10 years old when we moved to Paw Paw, Mich.

We moved to Michigan because, soon after my father immigrated, he was drafted into the U.S. Army in World War I, and was sent to Camp Custer near Battle Creek for basic training. He was assigned to an engineering unit, and trained in demolition, which was similar to what he was doing in the coal mines. In the fall fruit growers in the Lawton and Paw Paw area used soldiers from Camp Custer to help harvest fruit, and Dad became acquainted with a family in Paw Paw. He maintained contact with them on returning to Illinois after the war ended. He contacted them, and told them he would like to move to Michigan and buy a farm there. One day in early spring, this gentleman contacted Dad and he "went North". He bought a 42-acre farm with grapes, asparagus, and a small cherry orchard, and he planted peaches. It was not much more than subsistence, and was

Society Activities

- **President of American Society of Horticultural Sciences (ASHS)**
 - **Established the working group concept to increase participation of young scientists.**
- **Member of the National Academy of Sciences (NAS)**
 - **As new members of the NAS, John and Conrad “Bud” Weiser requested that agricultural researcher membership should be increased. They questioned the discrimination and threatened to form a new branch of the NAS for applied sciences.**
 - **1983: 2 horticulturists in the NAS.**
 - **2025: 2 horticulturists in the NAS.**
 - **40 plus years down the road, still the same. What happened?**

Awards

- **John in time received many awards including the Hatch Memorial Medallion and the Alexander von Humboldt Preis.**
- **Curiously, the memorabilia he appreciated most were the letters that people wrote to him that either congratulated some event or thanked him for his contributions to their research programs.**

William and Sarah E. Hinman Scholarship, 1950
Fellow, American Association for Advancement of Science, 1963
National Science Foundation Senior Postdoctoral Fellowship, 1965
Sigma Xi Junior Award for Meritorious Research, Kedzie Chapter, Michigan State University, 1967
Joseph Harvey Gourley Award, American Society for Horticultural Science, 1969
Citation for Meritorious Research, American Horticultural Society, 1970
Fellow, American Society for Horticultural Science, 1970
Distinguished Faculty Award, Michigan State University 1971
Distinguished Service Award, Michigan State Horticultural Society, 1974
President, American Society for Horticultural Science, 1974-75
M.A. Blake Award for Distinguished Graduate Teaching, American Society for Horticultural Science, 1975
Marion W. Meadows Award, American Society for Horticultural Science, 1975
Citation of Appreciation, American Society for Horticultural Science, 1975
Joseph Harvey Gourley Award, American Society for Horticultural Science, 1976
United States Representative, Council International Society Horticultural Science, 1977-78
President, MSU Chapter of Sigma Xi, 1978-79
Carroll R. Miller Award, American Society for Horticultural Science, 1980
John A. Hannah Distinguished Lecturer, Michigan State Horticultural Society, 1980
Elected Member U.S. National Academy of Sciences, April 26, 1983
Research Service Award, Leelanau County Horticultural Society, 1983
Horticultural Reviews Vol. 6, 1984 dedicated to M.J. Bukovac
Citation Classic, Current Contents - Agriculture, Biology and Environmental Sciences 16(7):16. 1985
Batjer Memorial Lecturer, Washington State Horticultural Association, 1985
Commencement Speaker, Michigan State University, March 8, 1986
Distinguished Faculty Award, Michigan Association of Governing Boards, April 9, 1986
Hatch Memorial Medallion, National Association State Universities and Land-Grant Colleges, March 1987
Presented the William Henry Hatch Centennial Year Lecture, Washington, D.C., March 3, 1987
Industry Man of the Year Award - 1987, National Cherry Festival, Traverse City, Michigan, July 9, 1987
Dennis R. Hoagland Award, American Society of Plant Physiologists, July 11, 1988
Outstanding Researcher Award, American Society for Horticultural Science, August 8, 1988

Paper [Bukovac, M.J. and S.H. Wittwer. 1958. Reproductive responses of lettuce (Lactuca sativa, variety Great Lakes) to gibberellin as influenced by seed vernalization, photoperiod and temperature. Proc. Amer. Soc. Hortic. Sci. 71:407-411.] selected and published in "Classic Papers in Horticultural Science". p. 358-367. In: J. Janick (ed.), Prentice Hall, Englewood Cliffs, NJ. 1989
Fruit Person of the Year, Michigan Association of Pomester Clubs, March 19, 1990
Designated University Distinguished Professor, 1992
Monselise Memorial Lecturer, Hebrew University of Jerusalem, Israel, January 27, 1994
1994 Agricultural Research Service B.Y. Morrison Memorial Lecturer, August 9, 1994
Bukovac Professional Development Endowed Fund established by patron in recognition of contributions to the Michigan Fruit industry
Alexander von Humboldt Preis, Alexander von Humboldt Foundation, Bonn, Germany, April 1, 1995
American Society of Agricultural Engineering outstanding paper award, June 21, 1995
Honorary Doctoral Degree (Dr. agr. *honoris causa*), University of Bonn, Bonn, Germany, June 23, 1995
Bukovac Distinguished Lectureship established by Michigan State Horticultural Society in recognition of contributions to Michigan fruit industry, December 4, 1996
Kermit A. Olson Memorial Lecture, University of Minnesota, March 12, 1997
Distinguished Service Award to Agriculture, Michigan Farm Bureau, December 11, 1997
John Bukovac International Award. Established by the Michigan Agricultural Experiment Station in recognition of his contributions to fostering international cooperative research.
Benzie - Manistee Horticultural Society Distinguished Service Award, March 19, 1998.
Donald L. Reichard Memorial Lecture, Ohio State University, April 13, 1999.
Foreign Scientific Exchange Lecturer, Nara Institute of Science and Technology, Nara, Japan. November, 2000
Horticulture Hall of Fame, American Society for Horticultural Science, July 2001
Hall of Fame, Paw Paw High School, 2002
Gold Veitch Memorable Medal, Royal Horticultural Society, London, June 2003
Spiridon Brusina Medal, Croatian Society of Natural Sciences, Zagreb, 2004

Judith Ann Kelley Bukovac

- Judy met John in 1954.
- Their daughter Dr. Janice Bukovac became a faculty member in the Communications Department at MSU.
- Judy and John were married 58 years.
- In 2016, they established the Martin and Judith Bukovac Professorship in Tree Fruit Physiology in the College of Agriculture and Natural Resources at MSU to support a faculty position focused on the study of applied tree fruit research and outreach to the industry.





John 2017