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Green Pepper Mulch Studies

David K. Wildung

In the July, 1987, **North Central Quarterly** (Volume 57:3) I mentioned several types of mulches and potential reasons for using them in vegetable and small fruit production. In this article I would like to present the results of two pepper studies that were conducted at North Central Experiment Station during the 1987 season. The results presented hopefully will help you decide if some of the intensive cultural practices used will be beneficial in your own growing situation.

Cultivar-Cultural Comparison Study

In this study 29 green pepper cultivars were evaluated for yield and response to both normal and intensive cultural systems. The normal culture was flat beds, no polyethylene bed cover and no row cover. The intensive culture treatment included growing plants on a raised bed, use of black polyethylene bed cover and use of clear polyethylene row cover over the plants. All plots were fertilized the same and irrigated using trickle irrigation. Raised beds were made on May 19. Each bed was two feet across and 5 inches high. Beds were on 4 foot centers. Black poly was applied on May 23. The planting date was June 9. The clear row covers were applied after planting on June 9 and removed on July 7 which was close to the time of first bloom. A moderate plant density of 13,900 plants per acre was used (double rows on the beds, the rows were 12 inches apart, plants in the row were 18 inches apart). The 1987 growing season was both warmer and longer than average. Harvest began on August 4 and lasted until October 1.

Specific cultivar results have been reported in our "1987 Commercial Vegetable Trial Report" which is available upon request. Based on these results and previous trials the following cultivars are suggested for north central Minnesota: 'Green Boy', 'Summer Sweet 820', 'Crispy', 'Whopper', 'Lady Belle', 'Blockbuster', 'Super Set', 'Early Thickset', and 'Early Prolific'.

Table 1 compares the average yield components of all 29 cultivars grown under the normal and intensive cultural systems. In addition, a value for percent of normal culture was calculated for each yield component. A value of over 100 in this comparison meant that the intense culture was better than normal culture. As Table 1 indicates nearly every yield component had a value between 132 and 146 meaning that the component showed from 32 to 46 percent better production under intensive culture. For example, normal culture plants averaged 0.71 pounds of fruit per plant while intense culture plants averaged 1.04 pounds per plant (46 percent greater weight per plant). There were two exceptions to this trend — average fruit weight (lb/fruit) and early yield (lb/acre). Fruit weight for intensive culture was only slightly larger than normal culture (4 percent). This fact is probably to be expected because more fruit was produced per plant with intensive culture. Typically when a plant produces more fruit each individual fruit is smaller. In this case fruit was about equal or slightly larger in size. In both cases fruit size over 0.25 pounds each for all harvested fruit is a very respectable size. The other component that was different was the amount of early yield which had a value of 270. Intensive culture plots produced over 2½ times more yield per acre than normal culture in the early season (the first two weeks of harvest, 8/4 to 8/19). This early production difference is very dramatic. Normally a grower can get a premium for early season fruit so intensive cultural management could provide this advantage.

In comparing all 29 cultivars for total yield, 20 of them produced at least 10 percent greater yield with intensive culture (up to 80 percent greater yield). Five cultivars produced 10 percent less yield with intensive culture and four cultivars produced yields fairly close with both cultural systems.

Intensive Cultural Comparison Study

In this study the cultivar 'Lady Belle' was used to compare the effect of raised beds and flat beds; clear, black or no poly bed cover; and row cover or no row cover. All

Table 1. Pepper cultivar comparison of intense culture and normal culture.

Treatment	Fruit/ plant	Lb/ plant	Lb/ fruit	% extra large	Lb/ 23 ft	Yield 1000 Lb/acre Early	Market	Total
Normal culture	2.7	0.71	0.26	9	20.6	1.56	4.76	9.52
Intense culture	3.9	1.04	0.27	13	29.4	4.22	6.26	13.63
Percent of normal culture	144	146	104	144	143	270	132	143

Table 2. Comparison of clear, black and no poly bed cover on 'Lady Belle' pepper production.

Treatment	Fruit/ plant	Lb/ plant	Lb/ fruit	% extra large	Lb/ 23 ft	Yield 1000 Lb/acre Early	Market	Total
Black poly	6.9	2.0	0.28	26	57.8	10.4	16.2	26.8
Clear poly	6.4	1.8	0.27	21	51.5	7.5	13.5	23.8
No poly	4.6	1.2	0.26	17	35.2	3.9	8.2	16.3
Level of significance	1%	1%	5%	1%	1%	1%	1%	1%

Table 3. Comparison of raised bed and flat bed (normal culture) on 'Lady Belle' pepper production.

Treatment	Fruit/ plant	Lb/ plant	Lb/ fruit	% extra large	Lb/ 23 ft	Yield 1000 Lb/acre Early	Market	Total
Normal culture	5.7	1.5	0.26	17	44.9	6.2	11.4	20.8
Raised bed	6.2	1.8	0.28	26	51.4	8.3	14.0	23.8
Level of significance	15%	12%	NS*	NS	13%	11%	NS	13%

* NS - not significant

Table 4. Comparison of row cover and no row cover on 'Lady Belle' pepper production.

Treatment	Fruit/ plant	Lb/ plant	Lb/ fruit	% extra large	Lb/ 23 ft	Yield 1000 Lb/acre Early	Market	Total
Row cover	5.8	1.6	0.27	23	47.2	7.0	12.0	21.8
No row cover	6.1	1.7	0.27	20	49.1	7.5	13.3	22.7
Level of significance	NS*	NS	NS	5%	NS	NS	15%	NS

* NS - not significant

(continued on next page)

Green Pepper Mulch Studies *continued*
possible treatment combinations of these factors were evaluated. There were four replications of each treatment. The dates of cultural treatment application were the same as described above for the cultivar comparison study. Tables 2, 3 and 4 describe the results of this study.

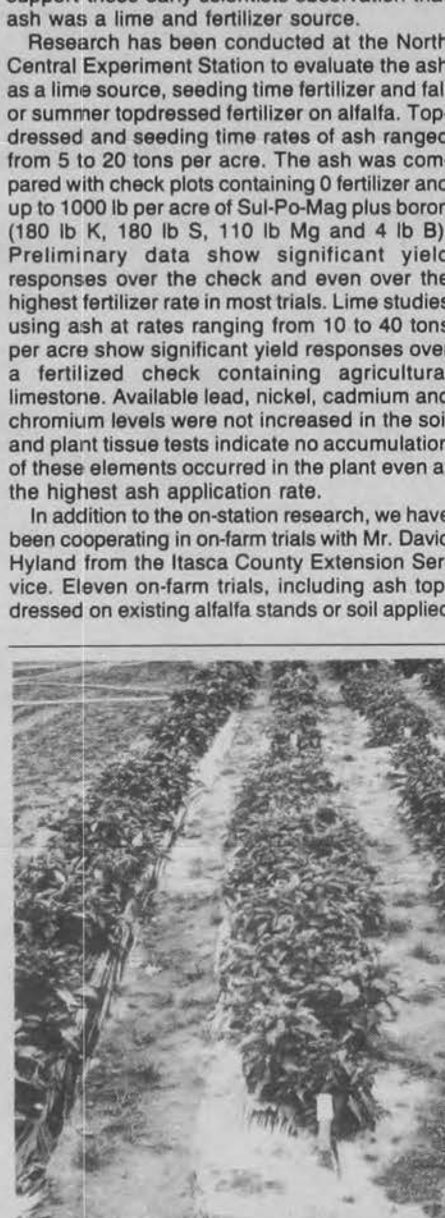
Table 2 shows the comparison of clear, black and no poly bed cover. For all yield comparisons black poly bed covers produced the greatest yields while the no poly (normal culture) produced the smallest yields. Clear poly was intermediate in its response. In all cases there was a highly significant statistical difference or advantage of poly bed covers over no bed covers.

In comparing the raised beds and flat bed (normal culture) there was a distinct yield advantage toward the raised bed treatments for each yield component (Table 3). While there was increased yield for each component, the differences were not statistically highly significant. Comparison of yield components with and without row covers shows variable results (Table 4). For some yield components the row cover yielded slightly better, for other components the yields were slightly better for the no row cover treatment. None of the yield component differences were highly significant and there was no clear advantage of using or not using row covers.

The results of this experiment show that the greatest increase in pepper yields can be expected by using a poly bed cover. Use of black poly resulted in the greatest yield increase but clear poly bed covers also resulted in significantly greater yields compared to no bed cover (normal culture). The poly bed covers create a warmer soil environment which probably accounts for the greatest yield increase. In weedy situations the black poly will also exclude light resulting in less weed competition.

Use of raised beds also seemed to be beneficial. Two of the biggest advantages of using raised beds are that they promote and maintain warmer soils and allow for better drainage during wet parts of the season. The 1987 season was warmer and drier than average. In a more average cooler season the benefit of raised beds would probably be greater. Beds put up in the fall would allow a grower to plant earlier and further increase yield potential. The use of row covers seemed to be of least benefit in increasing yields in this study. Again since 1987 was warmer than average the benefit of row covers probably was not as great as it would be in a cooler season. Row covers probably will give their greatest benefit on peppers when used for early plantings both for warming the plant environment and providing slight frost protection. Pepper flower bud development is highly dependent on temperature. Temperatures over 90 degrees F are not uncommon under row covers. Pepper flowers will abort at these temperatures. For this reason time of removal of row covers is extremely critical. If row covers are used they should be removed when the first pepper flowers begin to open.

Should you use any of these cultural techniques to increase yield? If you do, your management level will have to become more intense. The systems by themselves will not overcome poor management. All of the techniques outlined above are expensive and labor intensive. You will have to carefully consider their cost-benefit for your own situation. Their value will be different each year probably exhibiting their greatest value during cooler than average growing seasons. Their greatest value is with high value crops like green peppers where earlier production of a better quality product can be obtained and allow for a premium price at the market place.



Green peppers, black poly row cover, flat bed.

Ash Research Update

David L. Rabas

In the fall of 1985 the North Central Experiment Station at Grand Rapids began a project to evaluate the agronomic value and environmental safety of using ash from the Blandin Paper Company CoGeneration Plant as a lime and/or fertilizer source. The project was partially funded by a grant from the Blandin Foundation.

The use of ash as a fertilizer or lime source is not new. Early scientists reported that applying ashes seemed to "enrich and sweeten" the soil. The chemical analysis of ash from the Blandin Paper Company presented in Table 1 would support these early scientists observation that ash was a lime and fertilizer source.

Research has been conducted at the North Central Experiment Station to evaluate the ash as a lime source, seeding time fertilizer and fall or summer topdressed fertilizer on alfalfa. Topdressed and seeding time rates of ash ranged from 5 to 20 tons per acre. The ash was compared with check plots containing 0 fertilizer and up to 1000 lb per acre of Sul-Po-Mag plus boron (180 lb K, 180 lb S, 110 lb Mg and 4 lb B). Preliminary data show significant yield responses over the check and even over the highest fertilizer rate in most trials. Lime studies using ash at rates ranging from 10 to 40 tons per acre show significant yield responses over a fertilized check containing agricultural limestone. Available lead, nickel, cadmium and chromium levels were not increased in the soil and plant tissue tests indicate no accumulation of these elements occurred in the plant even at the highest ash application rate.

In addition to the on-station research, we have been cooperating in on-farm trials with Mr. David Hyland from the Itasca County Extension Service. Eleven on-farm trials, including ash topdressed on existing alfalfa stands or soil applied prior to spring seeding, were established in the fall of 1986 or spring of 1987. Ash was applied at various rates to one acre on-farm plots. Soil test and plant tissue data were collected. The soil test results from one on-farm trial presented in Table 2 show the potential of ash as a potassium, sulfur, magnesium, boron and lime source.

Blandin CoGeneration plant supplies ash for area farms.

All the ash from the Blandin Paper Company is currently being applied on farms. The company has worked with area farmers and the Minnesota Extension Service to set up guidelines for the safe and efficient utilization of the ash. The fertilizer and lime value of the ash to farmers is about 200 to 400 thousand dollars annually.

The Minnesota Extension Service, in cooperation with the Agricultural Experiment Station and the Minnesota Pollution Control Agency, began a new project in the summer of 1987 to evaluate ash from six additional major ash producers in north central and northeastern Minnesota. This new study is funded in part by a grant from the Legislature Commission on Minnesota Resources (LCMR). Extension agents and others will be establishing on-farm research trials in 12 to 14 Minnesota counties.

The on-farm utilization of ash represents an example of adding value to an industrial by-product and at the same time removing the need to store the ash in already overcrowded landfills.

Table 1. Chemical analysis of ash from the Blandin Paper Company[1].

Element	Lb/ton	Element	Lb/ton
Phosphorous	4	Sodium	4
Potassium	36	Zinc	.80
Calcium	220	Copper	.08
Magnesium	16	Boron	.50
Iron	3	Lead	.02
Manganize	2	Nickel	.01
Sulfate	40	Cadmium	.01
Aluminum	20	Chromium	.01

Approximate Soil Amendment Activity
2.5 T ash = 1 T ag lime

[1] Total extractable with 1 N nitric acid

Table 2. Soil test results from an on-farm ash trial.

Tons of ash/A	pH	lb/A P	lb/A K	lb/A Mg	ppm SO_4	ppm B
0	5.3	55	127	94	4	.3
10	6.9	85	311	143	21	1.2
20	7.1	100	419	124	46	1.4
Minimum[1]	6.5	40	300	100	7	.9

[1] Indicates minimum soil test level required for maximum yield.

Note: Soil lead, nickel, cadmium or chromium levels on treated plots were equal to or lower than the check plot.

Control of Sapstain in Cut Logs and Lumber

F. Thomas Milton

This is part two of a two-part article. Part one appeared in the February 1988 issue. Tom Milton is a University of Minnesota state extension specialist, forest products. Portions of this article were published previously in Milton's publication "Forest Products Marketing Bulletin."

Stains and discoloration from fungal infections or chemical reactions can cause serious degrade and profit loss in otherwise high grade lumber. Following are suggestions for the control of sapstain.

With sawlogs and veneer logs, sapstain can be minimized by processing the logs within one to two weeks from the time they are felled. Controlling storage time in the log yard, by processing logs on a first in — first out basis, is usually sufficient. When longer storage times are unavoidable, and/or high-value logs are processed, sapstain can be controlled by: 1) sprinkler systems, 2) pond storage, or 3) sapstain chemicals. Log yard sprinkler systems and log storage ponds though not common in Minnesota, prevent sapstain by cooling the logs and preventing the stain fungi's contact with oxygen.

Prompt drying can reduce staining on fresh sawn untreated green lumber. However, when the weather is very warm and humid, even the best air drying practices will not prevent staining. The following practices promote rapid drying and reduce staining:

1) Reduce the width of piles to approximately 4 feet or less.
2) Increase the thickness of stickers (¾ inch minimum) and align them carefully.
3) Place piles at least 12 to 18 inches off the ground on supports that permit air movement beneath them.
4) Eliminate weeds, old stickers and other debris to promote air flow near the ground and minimize sources of fungal growth.
5) Space lumber slightly apart to enhance vertical air movement through piles.
6) Cover piles to avoid rainfall.
7) Top-load piles to keep upper courses of lumber flat.
8) Design and grade yards to provide drainage and load bearing capacity for forklifts during seasonal wet periods.
9) Place piles in a line-type arrangement for accessibility and promotion of air movement through yard area.

When rapid drying cannot be accomplished either by air drying or prompt kiln drying, then a sapstain control chemical should be applied immediately.

Sapstain chemicals, when applied to the ends of logs and to openings in the bark, will prevent sapstain for 1 to 6 months, depending upon the chemical, its concentration and the wood species. Log home builders should apply sapstain chemicals to peeled logs and sawn timbers during warm weather (even on winter-cut logs) to prevent sapstain until the logs are dried sufficiently. A garden sprayer works well for applying chemicals. Reapplication may be necessary as drying checks develop. Penta formulations should not be used on logs or timbers used in log homes.

If sawmills or green lumber buyers and users do not want to lose any value on their lumber, then sapstain control chemicals should be applied during the summer months (generally May 15 to September 15 in Minnesota). In most years, lumber cut before May 15 will have dried sufficiently (especially on the surface) before temperatures are high enough for stain fungi to be active. However, timbers, thick lumber, and building logs cut during the winter may need an application of sapstain chemical in the spring to prevent staining while the interior of the product dries. Solid-piled lumber, if treated with a sapstain chemical, can be stored safely for at least one month during warm weather while awaiting shipment or drying.

Sapstain chemicals can be applied by either spraying or dipping. In the southern United States individual boards are dipped in a dipping tank as they proceed along the green chain. In Minnesota at least two mills dip-treat entire lumber packages in a large treating tank. This is an efficient and safe way to minimize handling of treated stock. Garden-type sprayers work well for treating small amounts of lumber.

Anti-stain chemicals are pesticides which poison the wood and inhibit fungal growth. For the last 40 years, the chlorinated phenols have been the most effective and economical anti-stain formulations, and the standard by which other stain chemicals were measured. In 1986, penta and the other chlorophenols were reclassified by the EPA as "Restricted Use" pesticides. This was in response to growing health and environmental concerns relating to the presence of dioxins in their formulations. A restricted use pesticide is one which could cause some human injury or environmental damage even when used as directed on the label. Only licensed applicators can purchase and apply restricted use pesticides.

Fortunately, in the last few years a number of alternative chemicals have been developed and evaluated. Table 1 lists chemicals labeled for sapstain control on softwood and hardwood logs and lumber. All of these chemicals are shipped as liquid concentrates except Permatox 10-S. All are mixed with water in a concentration dependent on the species being treated. Some chemicals will corrode iron tanks so it is important to know if the water needs to be treated for hardness and pH, and if special corrosion-resistant equipment is required. How effective these chemicals are in preventing sapstain on Minnesota wood species is not well documented. However, depending on the concentration of chemical used in the treating solution, each of these chemicals should predictably be effective.

Table 1. Chemicals labeled for sapstain control on logs and lumber in Minnesota, 1987.

Trade Name	Manufacturer	Common Acronym for Active Ingredients	Pesticide Applicator License Required	EPA Registration Number
Busan 1009	Buckman	MBT - 10% / TCMBT - 10%	No	1448-81
Mitrol PQ - 8	Chapman	Cu-8Q - 5.4%	No	1022-476
Permatox 10-S	Chapman	NaPCP - 31.6% / Borax - 57%	Yes	1022-8
Permatox 101	Chapman	NaPCP - 20.4%	Yes	1022-465
Permatox 181	Chapman	NaPCP - 21.4%	Yes	1022-481
NP-1	Koppers	AAC - 64.8% / IPBC - 7.6%	No	453-297
M-Gard W553	Mooney	Zn-Nap - 8%	No	9630-10

Buckman Laboratories, Inc., 1256 N McLean Blvd, Memphis, TN 38108, 901/278-0330.
Chapman Chemical Co., P.O. Box 9158, Memphis, TN 38109, 901/396-5151.
Koppers Company, Inc., Protection Products Depts., 5137 SW Ave., St. Louis, MO 63110, 314/772-2200.
Mooney Chemicals, Inc., 2301 Scranton Road, Cleveland, OH 55113, 216/781-8383.

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North Central School of Agriculture All Class Reunion

On Saturday, July 23, 1988, all former students, staff members and employees are invited to the North Central School of Agriculture all class reunion. The reunion will be held at the Sawmill Inn in Grand Rapids. The social hour and registration will be at 5:00 p.m., the dinner at 6:00 p.m. and the dance at 9:00 p.m. An open house will be held at the North Central Experiment Station on Saturday afternoon from 12:00 to 3:00 p.m.

Please return the registration form to:
Tom Carpenter
1861 Hwy 169 East
Grand Rapids, MN 55744.

REUNION REGISTRATION

Name ______________________ Class Year ________

Address ______________________

Please include your check in the following amounts.
Make checks payable to NORTH CENTRAL ALUMNI ASSOCIATION.

_____ Dinner(s) at $11.00 each $ ________

Alumni Association Dues $ 2.00

Total Amount Enclosed $ ________

Are you interested in a morning coffee get-together? Yes ☐ No ☐

Robert F. Nyvall

It has occurred to me that many of our readers are not familiar with many of the people who work on the Experiment Station. Dr. Robert Nyvall is the station superintendent. Our very fine office staff (who really run the station) are secretaries Faye Mostoller and Carolyn Frings. Carolyn is also our receptionist and the first person you talk to when you phone the Station. Sue Mutchler is providing temporary secretarial help. Jim Anderson is our station accountant and is assisted by Marian Mutchler. Our farm foreman is John Teske; Dan Carey and John Sucher are our farm equipment operators. Our maintenance crew is headed by lead worker Gordon Bickford; Tom Carey is station carpenter, Harold Hannay is station mechanic, Danny Swenson is our building and grounds worker and Dick Oberfoell is part time building and grounds worker.

Dr. Dave Wildung is the station horticulturist, Kay Sargent assistant scientist and Tom Carpenter research plot coordinator. Dave Trinka is assistant extension specialist on the blueberry project.

Dr. Joe Rust is station animal scientist. Dan Brown is junior scientist. Ray Steffen is farm animal attendant for beef; Ray Graupman, Todd Hammerlund and Darin Huot for dairy. Doug Hendrickson, Todd Lovdahl and Terry Hanson are animal attendants for swine.

Dr. Dave Rabas is station agronomist. Russell Mathison is associate scientist for agronomy and Henry Schumer is research plot coordinator for the wild rice project.

Dr. Howard Hoganson is our station forester. Tim O'Brien is research plot coordinator for forestry. Dr. Jim Boedicker is station agricultural engineer. Dr. Larry Simonson is extension specialist in tourism and Tom Milton is extension specialist in forest products.

In the not too distant future we hope to have a marketing specialist and a post doctorate in wild rice breeding. These people will be hired for a 2½ year period.

Speaking of outstanding personnel, Regents Awards for Outstanding Civil Service personnel have been presented to Kay Sargent, Faye Mostoller and Henry Schumer. Although we have many people who deserve this award these people have distinguished themselves the past year through their contributions to the Station and the University. The awards are monetary.

The Station Advisory Committee met at the Station on March 30. The committee consists of Bart Heitke, chairman, Mora; Mimi Barzen, Deer River; Jim Berkeland, Aurora; Rick Blodgett, Baudette; Russell Carter, Park Rapids; Diane Felde-Finke, Carlton; Lyle Gustafson, Blackduck; Allen Jackson, Grand Rapids; Elise Krueger, Mahtowa; Lois Lewis, International Falls; Robert Marquiss, Brook Park; Myron Midthun, Deerwood; Craig Pross, Marcell; Dave Radford, Cloquet; and George "Joe" Shetka, Aitkin. Dr. Roy Thompson, assistant director of the University experiment station also attended. We at the station thank the committee members for their time and advice. It is deeply appreciated.

Alumni News

Time is sure flying by. Spring is here and our reunion is only three months away. I have been very busy the past few months looking for Alumni staff and former employees and have sent out a total of 205 registration forms. I have received 32 replies with early registrations. Please help by returning your forms as early as possible and sending me names of anyone you think I may have missed.

The program for the evening is taking shape. I have found music (good ol' time music) and I also have class pictures and annuals and a large number of Mr. Clem Griffith's scrapbooks.

See you July 23. Please send in your registrations as soon as possible. Use the form on page three.

ALL CLASS REUNION c/o Tom Carpenter, 1861 Hwy 169 East, Grand Rapids, MN 55744

COMING EVENTS

Visitors Day, Thursday, July 21
All Class School of Agriculture Reunion, Saturday, July 23
Horticulture Night, Wednesday, August 31

Harold W. "Doc" Stuneck
1906 - 1988

Harold W. Stuneck, who was employed at the North Central Experiment Station for over 45 years, died on February 23, 1988. Doc is survived by his wife, Helen; two daughters, Eleanor Holm and Lynn Mehelich; six grandchildren; a sister Lucille Kruchoski and a brother Raymond. A memorial service was held in Grand Rapids at the First Evangelical Lutheran Church.

Doc began his employment at the North Central School and Experiment Station on April 28, 1929, shortly after the school of agriculture was established. During his tenure he worked for five superintendents; Bergh, Donovan, Dailey, Cole and Matalamaki. In addition to his regular duties as the principal account clerk, he also recorded the weather for over 40 years at this location. Doc officially retired in January of 1974 and had lived since his retirement in Elk River, Minnesota. Mrs. Helen Stuneck is residing at 502 NW 51½ Street in Elk River, Minnesota 55330.

Doc is respectfully and affectionately remembered by thousands of people who were students and employees of the experiment station during his many years of dedicated service.

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DR. ROBERT F. NYVALL
Superintendent

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