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O. H. M. S.

W. J. Gerald
Deputy Minister.

LABORATORY
OF THE
INLAND REVENUE DEPARTMENT
OTTAWA, CANADA

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BULLETIN No. 192
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Copper in Vegetables.

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Copper in Vegetables.

OTTAWA, November 9, 1909.

W. J. GERALD, Esq.,
Deputy Minister of Inland Revenue.

SIR,—I beg to hand you, herewith, a report upon the Copper content of 70 samples of tinned vegetables, chiefly peas, and of French origin. One sample (Mushrooms) was purchased through a mistake on the part of the inspector. This contains no copper.

A decision of the United States Department of Agriculture, dated May 1, 1908, is as follows :—

FOOD INSPECTION DECISION 92.

THE USE OF COPPER SALTS IN THE GREENING OF FOODS.

As provided in Food Inspection Decision 76, the Secretary of Agriculture has considered the question of foods greened with copper salts. It has been decided that foods so treated are not entitled to entry into the United States under the provisions of section 11 of the Food and Drugs Act. Inasmuch as contracts have already been made for the present year's pack, until January 1, 1909, all vegetables greened with copper salts, but which do not contain an excessive amount of copper and which are otherwise suitable for food, will be allowed entry into the United States, if the label bears the statement that sulphate of copper or other copper salts have been used to colour the vegetables. On and after January 1, 1909, no foods greened with copper salts will be allowed entry into the United States.

GEO. B. CORTELYOU,
Secretary of the Treasury.

JAMES WILSON,
Secretary of Agriculture.

OSCAR S. STRAUS,
Secretary of Commerce and Labour.

WASHINGTON, D.C., May 1, 1908.

It will be noted that the phrase 'an excessive amount of copper,' occurs in this document, as well as in F.I.D., 76, of June 18th, 1907. It is evidently desirable, to ascertain what constitutes an excessive amount of copper in vegetables. The decision quoted evidently conditions the total absence of copper, after January 1, 1909.

So high an authority as Dr. Tunncliffe (British Food Commission, 1899) holds that 'in a proportion not exceeding half a grain of metallic copper per pound, the presence of copper is quite harmless.' This corresponds to 71 parts per million, as a maximum. I am not aware of any other recognized authority having definitely stated a permissible limit for copper.

If we accept this limit, for purposes of comparison, it is found that 42 samples of the present collection exceed the amount named: i.e., 60 per cent of the collection.

The copper has been determined electrolytically, and is stated as parts by weight per million on the drained, but not dried vegetables.

All of these were found in good condition; and it is interesting to note that decided anti-putrescent effects are claimed for copper by Dr. Springer, (Journal of Industrial and Engineering Chemistry; 1909, p. 676).

The interior of the can was slightly rusted in two cases, but not to such a degree as to affect the colour of the contents. In the case of four samples, viz.: 40347, 40348, 40349 and 40350, the copper was determined separately in the drained vegetables and in the liquid content of the tin. The liquid contained no copper in solution, except in the case of No. 40348 where 30 parts copper per million were obtained.

I am unable, at present, to advise definitely as regards small amounts of copper in vegetables; but would respectfully recommend that medical opinions on the subject be obtained. The present report will serve the purpose of furnishing material for opinion; and I beg to recommend its publication as Bulletin No. 192.

I have the honour to be, sir,

Your obedient servant,

A. MCGILL,
Chief Analyst.

NOTE.—While this bulletin is in press, a highly important article on the coppering of vegetables appears in the current number of the *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel*. From this article by Dr. G. Stein, the following is abstracted:—

It is particularly important to the keeping of tinned vegetables that they should be thoroughly sterilized. Sterilization under pressure at 120° C. destroys the chlorophyll, and the vegetables become yellow-brown unless previously treated with copper. Copper was formerly introduced by boiling in copper vessels, which yielded copper to solution in the acids naturally present in the vegetables; it is now introduced as salts of copper, mainly as the sulphate. The coppering of vegetables was first practised in France; but popular appreciation of the product has caused the innovation to be adopted by other countries. No other method of giving a desirable green to the preserved vegetable has proved a success; and although it is possible by using selected material and working with special care, to retain much of the natural green of peas in the preserved article, the process would be too costly to be worked profitably on the large scale.

It is recognized that certain copper salts are poisonous; but that copper may be present in harmless combinations would appear from the fact that many vegetables naturally contain copper. Tschirch has shown that in coppered peas the copper exists as *phytyoglyanate* (green) or as *legumininate*, which is colourless, and is only formed when the process of coppering is carried too far. Neither of these compounds is soluble in water; and the watery fluid in the tin (*Einbettungsflüssigkeit*) may be quite free from copper.

Well known investigators have shown that most copper compounds are either harmless, or cause vomiting and diarrhoea only, in quantities of 100 to 200 milligrams daily, even when continued for weeks. When excess of copper is employed in greening

peas, the excess appears as leguminate which has been proved to be harmless to rabbits, fed for weeks on peas containing 0.126 per cent of copper. Copper salts of the fatty acids (stearates, o'eates, &c) are however known to be poisonous, and it is not certain that, by the simultaneous use of coppered vegetables and fatty foods, copper salts of the fatty acids may not be formed, and poisoning result.

K. Spiro has shown that it is only in the liquid content of the tin that copper salts, capable of reacting with fatty acids, may be present. The copper of the peas themselves does not so react. The imbedding fluid should contain no dissolved copper; and usually contains none.

In France, the prohibition of copper in colouring vegetables, was rescinded in 1889. In Italy and Switzerland only such are prohibited as contain more than 100 parts of copper per million. Austria forbade both the manufacture and the importation of coppered vegetables until 1899, since which date a maximum of 55 parts copper per million is tolerated. Belgium forbids the use of copper, as 'useless and harmful.' Russia also forbids coppering, while England has no legislation on the subject. Germany, since 1896, permits the presence of 55 parts copper per million.

It becomes a serious question for the manufacturer, in the light of above named legislation, to ascertain whether or not he can satisfactorily green his vegetables with so small an amount of copper as 55 parts per million. The work of Graff and others indicates that it is for the most part impossible to give a uniform and satisfactory greening with so small an amount of copper. The question of exact methods of analysis is also one of importance, where a limit of 55 parts per million is to be worked to. Stein approves of the Electrolytic method, for both accuracy and convenience.

From Dr. Stein's analyses, I quote the following interesting figures:—

COPPER CONTENT (PARTS PER MILLION).

In the Drained Vegetables.	Imbedding fluid.	Total.
84	11	95
78	13	91
86	17	103
48	5	53
46	5	51
75	4	79
76	20	96

BULLETIN No. 192—FRENCH PEAS (IMPORTED).

Date of Collection.	Nature of Sample.	Number of Samples.	Name and Address of Vendor.	Cost.		Name and Address of Manufacturer or Furnisher as given by the Vendor.	Inspector's Report. (Is not an expression of opinion).	RESULTS OF ANALYSIS.	
				Quantity.	Cents.			Condition.	Copper Parts per Million.

DISTRICT OF NOVA SCOTIA—R. J. WAUGH, INSPECTOR.

1900.										
Oct.	5	French Peas	41841	Dillon Bros., Halifax, N.S.	3 tins.	54	C. H. Feyosimeau, Bordeaux, France.		Good	80
"	6	"	41842	Bauld Bros., Halifax, N.S.	3 "	45	Alp. Pinard, Bordeaux, France.	Imported by Vendors, guaranteed under Food Act, Serial Number 1754.	"	80
"	6	"	41843	John Tobin & Co., Halifax, N.S.	3 "	68	Brun Freres, France	"	"	100
"	8	"	41844	W. A. Smith, Kentville, N.S.	3 "	51	Morceau & Co., France	"	"	90
"	12	"	41845	Black & Co., Truro, N.S.	3 "	40	Francios Petit & Co., Paris, France.	Imported by Vendors	Can slightly rusted.	90

DISTRICT OF NEW BRUNSWICK—J. C. FERGUSON—INSPECTOR.

Sept.	9	French Peas (Imported).	39578	H. W. Cole, Ltd., St. John, N.B.	3 tins.	40	Chas. Binks, Montreal		Good	90
"	13	"	39579	Baird & Peters, St. John, N.B.	3 "	40	Lafurie Freres, Paris and Bordeaux, France.		"	70
"	14	"	39580	McPherson Bros., St. John, N.B.	3 "	75	F. Delory, Lorient, France.		"	60
"	21	"	39581	Geo. T. Whelpley Estate, Fredericton, N.B.	3 "	75	"		"	80
Oct.	6	"	39582	F. P. Reid & Co., Moncton, N.B.	3 "	33	Chas. H. Binks, Montreal	Direct importation through Chas. H. Binks, "Millionaire" Brand.	"	90

DISTRICT OF QUEBEC—E. BELAND, INSPECTOR.

Sept. 9	French Peas	36647	J. S. Hogue, St. Paulin	3 tins.	45	L. Chaput fils & Co., Montreal.	Good	60
" 10	"	36648	J. V. Milot, St. Alexis	2 "	25	" " "	"	100
" 13	"	36649	Charle Heaton, Louiseville	3 "	60	Hudon Hebert, Montreal	"	70
" 14	"	36650	L. P. St. Pierre, Trois Riviere	3 "	90	Whitead & Turner, Quebec	"	60
" 14	"	36651	L. P. Peltier, Trois Riviere	3 "	90	Hudon Hebert, Montreal	"	100

DISTRICT OF ST. HYACINTHE—J. C. ROULEAU, INSPECTOR.

Sept. 17	French Peas (Imported)	1245	L. Moreau, St. Jean	3 bxs.	45	L. A. Price, Bordeaux, France	Good	80
" 22	"	1246	J. O. McDonald, Lac Megantic	3 "	60	Edgar & Cie	"	80
" 24	"	1247	V. Archambault, Sherbrooke East	3 "	60	B. Leforest, Périgumx	"	70
" 27	"	1248	R. O. Brodeur, St. Hyacinthe	3 "	54	F. Delorey, Lorient	"	80
" 23	"	1249	C. J. Lane, Lennoxville	3 "	38	Geo. Dalidet & Cie, Bordeaux	"	70

DISTRICT OF MONTREAL—J. J. COSTIGAN, INSPECTOR.

Sept. 8	French Peas (Imported)	40346	J. O. Desrochers, 472 St. Denis St., Montreal	3 tins.	50	F. Delorey, Lorient, France	Good	70
" 8	"	40347	Moquin et frere, 120 St. Denis St., Montreal	3 "	45	Marque "Soleil" Fabrique de Consomes Alimentaire	"	70
" 8	"	40348	Currie Bros., 185 Bleury St., Montreal	3 "	45	Talbot freres, Bordeaux, France	"	90
" 10	"	40349	N. Collin & Co., 310 Notre Dame East, Montreal	3 "	60	"Le Soleil"	"	50
" 17	"	40350	F. Poirier, 24 St. Catherine West, Montreal	3 "	54	Marie Thumas Louvains	"	80

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				Quantity.	Cents.			Condition.	Copper Parts per Million.

DISTRICT OF OTTAWA—J. A. RICKEY, INSPECTOR.

1909.										
Oct.	1	French Peas (Imported).	42826	J. G. Stewart, Ottawa.....	3 tins.	60	Unknown.....	Labelled Talbot freres....	Good.....	80
"	1	"	42827	P. D. Herbert, Ottawa.....	3 "	52	S. J. Major, Ltd., Ottawa...	Le Soleil. Société Anonyme	"	80
"	1	"	42828	"	3 "	45	Henri Jonas, Montreal.....	F. Delorey, Lorient, France	"	140
"	1	"	42829	C. Moreland, Ottawa.....	3 "	75	"	"	"	100
"	1	"	42830	"	3 "	1 05	"	Bayle fils freres, France...	"	80

DISTRICT OF KINGSTON—JAS. HOGAN, INSPECTOR.

Sept.	7	French Peas.....	42741	J. Crawford, Kingston.....	3 tins.	60	Beaumarchand.....		Good.....	100
"	7	"	42742	J. Redden, Kingston.....	3 "	75	Delorey, Lorient, France....		"	80
"	8	"	42743	W. T. Patterson, Belleville..	3 "	45	"	"	"	70
"	8	"	42744	Wallbridge & Clarke, Belle-ville.	3 "	60	"	"	"	100
"	8	"	42745	Guillet Bros., Cobourg.....	3 "	45	Le Lielos.....		"	36

DISTRICT OF TORONTO—H. J. DAGER, INSPECTOR.

"	8	"	42745	Guillet Bros., Cobourg.....	3	"	45	Le Lielos	"	"
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DISTRICT OF TORONTO—H. J. DAGER, INSPECTOR.

2002 Sept. 23	French Peas	41387	Deebles Hobson Co., Ltd., Hamilton.	3 tins.	45	R. Monbadon, Paris and Bordeaux, France.	Good	60
	"	41388	A. R. McLachlin, Hamilton.	3 "	40	Geo. Dalidet & Co., Bordeaux, France.	"	40
	"	41389	W. J. Nichol, Toronto.	3 "	30	Unknown.	"	60
	"	41390	A. White, Toronto.	3 "	45	R. S. McIndoe, Toronto.	"	110
	"	41391	R. Barron, Ltd., Toronto.	3 "	45	R. Monbadon, Paris and Bordeaux, France.	"	70

DISTRICT OF LONDON—T. KIDD, INSPECTOR.

Sept. 14	French Peas	30820	A. Beattie & Co., St. Mary's	3 tins.	35	Unknown.	Good	70
"	"	30823	Beattie & Co., Stratford	3 "	50	"	"	60
"	"	30842	Jackson & Sons, Guelph	3 "	38	Henri Jonas, Montreal	"	80
"	"	30847	Chas. Eweng, Goderich	3 "	45	W. G. Patrick, Toronto	"	50
"	"	30862	A. J. Groom, Guelph	3 "	45	Balfour Smye, Hamilton	"	110

DISTRICT OF WINDSOR—JNO. TALBOT, INSPECTOR.

Oct. 4	French Peas	42606	Burmise & Co., Chatham	3 tins.	38	F. Delorey, Lorient, France.	Good	110	
"	"	42631	T. J. Salmoni, Kingsville	3 "	75	Beaumarchand, Paris	Moyens	80	
"	"	42644	Birehell & Vansickle, Thomas.	St. 3 "	45	Dandicolle & Genden, Bor- deaux.	Dandicolle & Genden, Petit Pois. Moyens.	Can slightly rusted. Good	120
"	"	42645	Butler Bros., St. Thomas.	3 "	45	Beaumarchand, France	Packed in Italy. Coloured with sulphate of copper.	"	100
"	"	42646	T. A. Rowat, London	3 "	60	G. Dalidet & Co., Bordeaux	Labelled Ste. Bordelais.	"	90

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				Quantity.	Cents.			Condition.	Copper Parts per Million.

DISTRICT OF MANITOBA—A. C. LARIVIERE, INSPECTOR.

1900.									
Sept. 13	French Peas	39816	A. Macdonald & Co., Winni-peg.	3 tins.	40	Ch. Teyssonseau, jnr, Bordeaux, France.	Pet Pois. Moyne a la anglaise.	Good	70
" 13	"	39817	E. B. Nixon, Winnipeg.	3 "	60	" " "	" " "	"	60
" 13	"	39818	The T. Eaton Co., Winni-peg.	3 "	55	" " "	Pet Pois. Extra fine.	"	50
" 13	"	39819	The Hudson Bay Co., Winni-peg.	3 "	90	R. Monbadon, Paris and Bordeaux, France.	Packed for the Hudson Bay Co.	"	40
" 13	"	39820	" " "	3 "	45	F. Delorey, Lorient, France.	Pois Demi Fine.	"	100

DISTRICT OF CALGARY—R. W. FLETCHER, INSPECTOR.

Sept. 10	French Peas (Imported).	35627	Hudson Bay Co., Lethbridge	3 tins.	75	F. Delorey, Lorient, France.		Good	80
" 10	"	35628	Bentley Co., Lethbridge	3 "	75	Grosut Beaud, Lorient, France.		"	30
" 11	"	35629	Spencer & Tudd, Medicine Hat.	3 "	75	J. R. Teyssonseau, Lorient, France.		"	80
" 11	"	35630	H. W. Ireland & Co., Medicine Hat.	3 "	75	A. Roger & Co., Bordeaux, France.		French m & h rooms, not peas	
" 14	"	35631	Hudson Bay Co., Calgary	3 "	75	R. Monbadon, Paris.		Good	100

DISTRICT OF VANCOUVER—J. F. POWER, INSPECTOR.

DISTRICT OF VANCOUVER—J. F. POWER, INSPECTOR.

Sept. 17	French Peas (Imported)..	37753	W. T. Walker, Steveston...	3 tins.	75	V. V. E. Savaris, Bordeaux.....	Good.....	90
" 18	" " "	37754	H. W. Chapman, Vancouver	3 "	60	Lafaurie freres, Bordeaux.....	"	90
" 20	" " "	37755	Hudson Bay Co., Vancouver	3 "	75	R. Monbadon, Bordeaux.....	"	70
" 20	" " "	37756	H. A. Edgett & Co., Van- couver.	3 "	75	Gea. Dalidet & Co., Bordeaux.....	"	90
" 21	" " "	37757	London Grocery, Vancouver	3 "	1 05	" "	"	80

DISTRICT OF VICTORIA—D. O'SULLIVAN, INSPECTOR.

Oct. 14	French Peas (Imported)..	41574	Windsor Grocery Co., Vic- toria, B.C.	3 tins.	75	R. Monbadon, France.....	Extra fine.....	Good.....	80
" 15	" " "	41575	The West End Grocery Co., Ltd., Victoria, B.C.	3 "	60	George Dalidet & Co., Bor- deaux, France.	Moyens	"	80
" 15	" " "	41576	Copas & Young, Victoria, B.C.	3 "	1 05	The Hudson Bay Co., Vic- toria, B.C.	Extra fine	"	60
" 15	" " "	41577	Saunders Grocery Co., Ltd., Victoria, B.C.	3 "	75	George Dalidet & Co., Bor- deaux, France.	"	"	80
" 18	" " "	41578	Erskine & Co., Victoria, B.C.	3 "	75	J. H. Todd & Son, Victoria, B.C.	"	"	50