

## Cobalt Publications Rejected as Not Acceptable for Plants and Invertebrates

Published literature that reported soil toxicity to terrestrial invertebrates and plants was identified, retrieved and screened. Published literature was deemed Acceptable if it met all 11 study acceptance criteria (Fig. 3.3 in section 3 “DERIVATION OF PLANT AND SOIL INVERTEBRATE ECO-SSLs” and ATTACHMENT J in Standard Operating Procedure #1: Plant and Soil Invertebrate Literature Search and Acquisition). Each study was further screened through nine specific study evaluation criteria (Table 3.2 Summary of Nine Study Evaluation Criteria for Plant and Soil Invertebrate Eco-SSLs, also in section 3 and ATTACHMENT A in Standard Operating Procedure #2: Plant and Soil Invertebrate Literature Evaluation and Data Extraction, Eco-SSL Derivation, Quality Assurance Review, and Technical Write-up.) Publications identified as Not Acceptable did not meet one or more of these criteria. All Not Acceptable publications have been assigned one or more keywords categorizing the reasons for rejection (Table 1. Literature Rejection Categories in Standard Operating Procedure #4: Wildlife TRV Literature Review, Data Extraction and Coding).

<b>No Dose</b>	Abdel-Sabour, M. F., El Naggr, H. A., and Suliman, S. M. 1994. Use of Inorganic and Organic Compounds as Decontaminants for Cobalt T-60 and Cesium-134 by Clover Plant Grown on INSHAS Sandy Soil. Govt Reports Announcements & Index (GRA&I) 15, 17 p.
<b>No Control</b>	Adams, S. N. and Honeysett, J. L. 1964. Some Effects of Soil Waterlogging on the Cobalt and Copper Status of Pasture Plants Grown in Pots. Aust.J.Agric.Res. 15, 357-367
<b>OM, pH</b>	Adams, S. N., Honeysett, J. L., Tiller, K. G., and Norrish, K. 1969. Factors Controlling the Increase of Cobalt in Plants Following the Addition of a Cobalt Fertilizer 38333. Aust.J.Soil Res. 7, 29-42
<b>No Dose</b>	Agarwala, S. C., Bisht, S. S., and Sharma, C. P. 1977. Relative Effectiveness of Certain Heavy Metals in Producing Toxicity and Symptoms of Iron Deficiency in Barley. Can J Bot 55, 1299-1307
<b>Media</b>	Ahmed, M. B. and Twyman, E. S. 1953. The Relative Toxicity of Manganese and Cobalt to the Tomato Plant. J.Exp.Bot.(London) 4[11], 164-172
<b>Media</b>	Ahmed, S. and Evans, H. J. 1959. Effect of Cobalt on the Growth of the Soybeans in the Absence of Supplied Nitrogen. Biochem.Biophys.Res.Comm. 1[5], 271-275
<b>Media</b>	Ahmed, S. and Evans, H. J. 1960. Cobalt: A Micronutrient Element for the Growth of Soybean Plants Under Symbiotic Conditions. Soil Sci 90, 205-210
<b>Mix</b>	Alberici, T. M., Sopper, W. E., Storm, G. L., and Yahner, R. H. 1989. Trace Metals in Soil Vegetation and Voles from Mine Land Treated with Sewage Sludge. J Environ Qual 18, 115-120
<b>Mix</b>	Alegria, A., Barbera, R., Boluda, R., Errecalde, F., Farre, R., and Lagarda, M. J. 1992. Relationship Between Cobalt, Copper and Zinc Content of Soils and Vegetables. Nahrung 36[5], 451-460
<b>FL</b>	Aleshin, E. P., Sheudzhen, A. K., Doseeva, O. A., and Rymar, V. T. 1987.

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	Photosynthetic and Respiratory Activity in Rice Leaves as a Function of Cobalt Supply to the Plants. Dokl.Vses.Akad.Sel'skokhoz.Nauk 2, 15-17
<b>Media</b>	Amir, Hamid and Pineau, Rene. 1998. Effects of metals on the germination and growth of fungal isolates from new caledonian ultramafic soils. Soil Biology & Biochemistry 30[14], 2043-2054
<b>Mix</b>	Anderson, A. J., Meyer, D. R., and Mayer, F. K. 1973. Heavy Metal Toxicities: Levels of Nickel, Cobalt, and Chromium in the Soil and Plants Associated with Visual Symptoms and Variation in Growth of an Oat Crop. Aust.J.Agric.Res. 24, 557-571
<b>Mix</b>	Andreae, H. Verteilung Von Schwermetallen In Einem Forstlich Genutzten Wassereinzugsgebiet Unter Dem Einfluss Saurer Deposition Am Beispiel Der Soesemulde (Westharz). (Distribution Of Heavy Metals In A Wood Culture Water Catchment Area Under The Influence Of Acid De. Govt-Reports-Announcements-&-Index-(GRA&I),-Issue-21,-1995
<b>OM, pH</b>	Askew, H. O. and Dixon, J. K. 1937. Influence of Cobalt Top-Dressing on the Cobalt Status of Pasture Plants. N.Z.J.Sci.Technol. 18, 688-693
<b>FL</b>	Astapovich, N. I. and Grel, M. V. 1975. Effects of Various Cobalt Salts and Their Concentrations on the Activity of Pectolytic Enzymes Systemized by Microscopic Fungi. Biol.Akt.Veshchestva Mikroorg. 36-39
<b>FL</b>	Austenfeld, F. A. 1979. Effects of Nickel, Cobalt and Chromium on Net Photosynthesis of Primary and Secondary Leaves of Phaseolus vulgaris L. (Nettophotosynthese der Primarund Folgeblätter von Phaseolus vulgaris L. unter dem Einfluss von Nickel, Kobalt und Chrom). Photosynthetica 13[4], 434-438
<b>Media</b>	Baker, A. J. M., Brooks, R. R., Pease, A. J., and Malaisse, F. 1983. Studies on Copper and Cobalt Tolerance in Three Closely Related Taxa Within the Genus Silene L. (Caryophyllaceae) from Zaire. Plant Soil 73, 377-385
<b>Media</b>	Barker, A. V. and Corey, K. A. 1991. Interrelationships of ammonium toxicity and ethylene action in tomato. Hortscience. 26[2], 177-180
<b>Media</b>	Berry, W. L. 1978. Comparative Toxicity of VO <sub>3</sub> , CrO <sub>2</sub> -4, Ni <sup>2+</sup> , Cu <sup>2+</sup> , Zn <sup>2+</sup> , and

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	Cd2+ to Lettuce Seedlings. In: D.C.Adriano and I.L.Brisbin,Jr.(Eds.), Environmental Chemistry and Cycling Processes, Proc.Symp.Held at Augusta, Georgia, April 18-May 1, 1976, Tech.Info.Center, U.S.Dep of Energy (U.S.NTIS CONF-760429) , 582-589
<b>Media</b>	Bittell, J., Koeppe, D. E., and Miller, R. J. 1974. Sorption of Heavy Metals Cations by corn Mitochondria and the Effects on Electron and Energy Transfer Reactions. <i>Physiol Plant</i> 30, 226-230
<b>Species</b>	Blankenship, M. L. and Wilbur, K. M. 1975. Cobalt Effects on Cell Division and Calcium Uptake in the Coccolithophoroid <i>Cricosphaera carterae</i> (Haptophyceae) 38589. <i>J.Physiol.</i> 11, 211-219
<b>Media</b>	Bobak, M. 1974. Influence of Exogenous Added Cobalt upon the Submicroscopic Structure and the Chromosomes of Meristematic Cells of the Horse Bean ( <i>Vicia faba</i> L.,C.V. Zborovicky). <i>Physiol.Plant.</i> 8, 17-24
<b>Media</b>	Bolle-Jones, E. W. and Mallikarjuneswara, V. R. 1957. A Beneficial Effect of Cobalt on the Growth of the Rubber Plant ( <i>Hevea brasiliensis</i> ). <i>Nature</i> 179, 738-739
<b>Rev</b>	Bozhenkov, V. P. 1968. Effect of Aluminum and Cobalt on the Nucleic Acid Content and Ribonuclease Acitivity in the Growth Points of Sunflower Under Water Deficit Conditions 37728. <i>Russ.J.Plant Physiol.(Transl.of Fiziol.Rast.</i> 15(1):116-122) 68, 94-99
<b>Media</b>	Brenchley, W. E. 1938. Comparative Effects of Cobalt, Nickel and Copper on Plant Growth. <i>Ann.Appl.Biol.</i> 25[4], 671-694
<b>Dup</b>	Brenchley, W. E. 1938. Comparative Effects of Cobalt, Nickel, and Copper on Plant Growth 40004. <i>Ann.Appl.Biol.</i> 25[4], 671-694
<b>No Control</b>	Brooks, R. R. 1977. Copper and Cobalt Uptake by Haumaniastrum Species. <i>Plant Soil</i> 48, 541-544
<b>Rev</b>	Brooks, R. R., Reeves, R. D., Morrison, R. S., and Malaisse, F. 1980. Hyperaccumulation of Copper and Cobalt: A Review. <i>Bull.Soc.R.Bot.Belgique</i> 113, 166-172
<b>FL</b>	Burca, S., Cachita-Cosma, D., Craciun, C., and Trifu, M. 1984. Modifications

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	Caused by the Trace Elements Manganese and Cobalt in the Ultrastructure of the Roots of Tomato Seedlings (Modificari Cauzate de Microelementele Mangansi Cobalt in Ultrastructura Radacinilor Plantulelor de Tomate). Stud.Univ.Babes-Bolyai.Biol. 29, 27-34
<b>No Dose</b>	Cataldo, D. A. and Wildung, R. E. 1978. Soil and Plant Factors Influencing the Accumulation of Heavy Metals by Plants. Environ.Health Perspect. 27, 149-159
<b>No Dose</b>	Cataldo, D. A., Fellows, R. J., and Harvey, S. D. 1996. Evaluation of the Metabolic Fate of Munitions Material (TNT RDX) in Plant Systems and Initial Assessment of Material Interaction with Plant Genetic Material. Govt Reports Announcements & Index (GRA&I), (8):
<b>FL</b>	Celardin, F. and Landry, J. C. 1988. Bioindicators of pollution earthworms and heavy metals in soil. ARCH SCI (GENEVA).Archives des Sciences (Geneva).41 (2).1988.225-228. 41[2], 225-228
<b>No Dose</b>	Chatterjee, J. and Chatterjee, C. 2000. Phytotoxicity of Cobalt, Chromium and Copper in Cauliflower. Environ.Pollut. 109[1], 69-74
<b>No Tox</b>	Clapp, R. B. Annual Report Of The Environmental Restoration Monitoring And Assessment Program At Oak Ridge National Laboratory For Fy 1992. Environmental Restoration Program. Govt-Reports-Announcements-&-Index-(GRA&I),-Issue-09,-1993
<b>Media</b>	Clark, R. B., Pier, P. A., Knudsen, D., and Maranville, J. W. 1981. Effect of Trace Element Deficiencies and Excesses on Mineral Nutrients in Sorghum. J.Plant Nutr. 3[1-4], 357-374
<b>Rev</b>	Cole, C. J. and Carson, B. L. 1981. Cobalt in the Food Chain. In: I.C.Smith, and B.L.Carson (Eds.), Trace Metals inthe Environment, Volume 6, Cobalt, Ann Arbor Science Publ.Inc., Ann Arbor, MI , 777-924
<b>No Control</b>	Crossley, D. A. J., Blood, E. R., Hendrix, P. F., and Seastedt, T. R. 1995. Turnover of Cobalt-60 by Earthworms (Eisenia foetida) (Lumbricidae, Oligochaeta). Appl.Soil Ecol. 2[2], 71-75
<b>FL</b>	Danilova, T. A. and Demkina, E. N. 1967. The Role of Cobalt in Nitrogen

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	Accumulation by Leguminosae. Dokl.Akad.Nauk 172[2], 487-490
<b>FL</b>	Danilova, T. A., Tishchenko, I. V., and Demikina, E. N. 1969. Some Characteristic Effects of Cobalt on Peas. Agrokhimiya 1, 85-89
<b>Media</b>	Dekock, P. C. 1956. Heavy Metal Toxicity and Iron Chlorosis. Ann.Bot. 20[77], 133-141
<b>Media</b>	Doncheva, S. 1992. Qualitative and structural changes in maize plant root cells under increased concentrations of manganese and cobalt. Dokl.Bulg.Akad.Nauk. 45[8], 119-122
<b>OM, pH</b>	Fischer, Erno and Molnar, Laszlo. 1997. Growth and reproduction of Eisenia fetida (oligochaeta, lumbricidae) in semi-natural soil containing various metal chlorides. Soil Biol Biochem 29[3/4], 667-670
<b>Media</b>	Gabbrielli, R., Mattioni, C., and Vergnano, O. 1991. Accumulation Mechanisms and Heavy Metal Tolerance of a Nickel Hyperaccumulator. J.Plant Nutr. 14[10], 1067-1080
<b>Media</b>	Gerendas, J., Polacco, J. C., Freyermuth, S. K., and Sattelmacher, B. 1998. Co does not replace Ni with respect to urease activity in zucchini (Cucurbita pepo convar. giromontiina) and Soybean (Glycine max). Plant Soil 203[1], 127-135
<b>No Control</b>	Gerzabek, M. H., Mohamad, S. A., Mueck, K., and Horak, O. 1994. 60Co, 63Ni and 94Nb Soil-to-Plant Transfer in Pot Experiments. J.Environ.Radioact. 25, 205-212
<b>No Dur</b>	Gheesling, S. E., Gideon, J. C., Gregory, S. M., Hamilton, L. V., and Horwedel, B. M. Environmental Surveillance Data Report For The First Quarter Of 1993. Govt-Reports-Announcements-&-Index-(GRA&I),-Issue-16,-1994
<b>No Dur</b>	Gheesling, S. E., Gideon, J. C., Gregory, S. M., Hamilton, L. V., and Loffman, R. S. Environmental Surveillance Data Report For The Second Quarter Of 1993. Govt-Reports-Announcements-&-Index-(GRA&I),-Issue-15,-1994
<b>FL</b>	Godnev, T. N. and Leshina, A. V. 1967. After Effects of Molybdenum and Cobalt on Peas. Dokl Akad.Nauk Beloruss. 11[4], 359-361

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<b>No Dur</b>	Goldberg, P. Y., Cooper, R. C., Hamilton, L. V., Hughes, J. F., and Horwedel, B. M. Environmental Surveillance Data Report For The First Quarter Of 1992. Govt-Reports-Announcements-&-Index-(GRA&I),-Issue-15,-1993
<b>FL</b>	Gorid'ko, I. V. 1967. The Effect of Cobalt on Water Content, Water Retention, and Transpiration of Potato Leaves. Nauchn.Dokl.Vyssh.Skh.Biol.Nauki 3, 84-87
<b>Media</b>	Gorsuch, J. W., Kringle, R. O., and Robillard, K. A. 1990. Chemical Effects on the Germination and Early Growth of Terrestrial Plants. In: W.Wang, J.W.Gorsuch., and W.R.Lower (Eds.), Plants for Toxicity Assessment, ASTM STP 1091, Philadelphia, PA , 49-58
<b>Media</b>	Grover, S. and Purves, W. K. 1976. Cobalt and Plant Development Interactions with Ethylene in Hypocotyl Growth. Plant Physiol. 57, 886-889
<b>Mix</b>	Grummitt, W. E. 1976. Transfer of Cobalt-60 to Plants from Soils Treated with Sewage Sludge. In: C.E.Cushing,Jr.(Ed.), Radioecology and Energy Resources, Dowden, Hutchinson, and Ross, Stroudsburg, PA , 331-335
<b>Media</b>	Halsall, D. M. 1977. Effects of Certain Cations on the Formation and Infectivity of Phytophthora Zoospores. 2. Effects of Copper, Boron, Cobalt, Manganese, Molybdenum, and Zinc Ions. Can.J.Microbiol. 23[8], 1002-1010
<b>Media</b>	Handreck, K. A. and Riceman, D. S. 1969. Cobalt Distribution in Several Pasture Species Grown in Culture Solution. Aust.J.Agric.Res. 20, 213-226
<b>Mix</b>	Hewitt, E. J. and Bolle-Jones, E. W. 1951. Investigations on Possible Micronutrient Elements for Higher Plants. I. Experiments with Cobalt, Nickel and Gallium in Sand Culture. Ann.Rep.Agric.Hortic.Res.Sta., Long Ashton, Bristol, England , 62-66
<b>Species</b>	Hodgson, J. F. 1969. Effect of Iron Removal on Cobalt Sorption By Clays. Soil Sci. 108[6], 391-396
<b>Media</b>	Howard, B. and Simkiss, K. 1981. Metal Binding by Helix aspersa Blood. Comp Biochem Physiol 70A, 559-561
<b>Media</b>	Imai, I. and Siegel, S. M. 1973. A Specific Response to Toxic Cadmium Levels in Red Kidney Bean Embryos. Physiol.Plant. 29, 118-120

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<b>FL</b>	Ishchenko, G. S. and Butnik, A. S. 1991. The influence of cobalt and cadmium on the growth, development and crops of the basic cultivated plants in central Asia. Uzb.Biol.Zh. [5], 30-33
<b>Media</b>	Jacobs, E. E., Jacob, M., Sanandi, D. R., and Bradley, L. B. 1956. Uncoupling of Oxidative Phosphorylation by Cadmium Ion. Journal of Biological Chemistry 223, 147-156
<b>Species</b>	Jardine, P. M. and Jacobs, G. K. 1991. Unsaturated Transport Of Inorganic Cations In Undisturbed Soil Columns. Gov.Rep.Announce.Index Issue 14
<b>Media</b>	Jarosik, J., Zvara, P., Konecny, J., and Obdrzalek, M. 1988. Dynamics of Cobalt-60 Uptake by Roots of Pea Plant ( <i>Pisum sativum</i> ). Sci.Total Environ. 71, 225-229
<b>Media</b>	Jaworska, M., Gorczyca, A., Sepiol, J., and Tomasik, P. 1997. Effect of Metal Ions on the Entomopathogenic Nematode <i>Heterohabditis bacteriophora</i> poinar (Nematode: Heterohabditidae) Under Laboratory Conditions. Water Air Soil Pollut 93, 157-166
<b>FL</b>	Kalashnikova, E. V. Cobalt and cadmium accumulation in the yield of several crops in plant irradiation carried out on soils polluted with heavy metals. Agrokhimiya.Agrokhimiya.0 (9).1991.77-82.
<b>FL</b>	Kamenova, S. M. Y., Kudrev, T. G., and Shakhpazova, L. K. A. 1983. Effect of Cobalt and Mercury on Some Maize Plant Reactions. Fiziol.Rast. 9, 78-82
<b>OM, pH</b>	Khan, M. R., Singh, S. K., and Khan, M. W. 1988. Response of Lentil to Cobalt as a Soil Pollutant. Ann.Appl.Biol. 112[Suppl], 104-105
<b>OM, pH</b>	Khan, M. R., Khan, M. W., and Nabi, S. T. 1994. Effect of cobalt, a soil-pollutant, on hatching, mortality and penetration of root-knot nematode, <i>Meloidogyne incognita</i> . Chem.Enviro.Res. 3[3/4], 265-269
<b>OM, pH</b>	Khan, M. W. and Salam, M. A. 1990. Interactions of <i>Meloidogyne-javanica</i> <i>Fusarium-udum</i> and <i>Rhizobium</i> on pigeon pea in the presence of nickel and cobalt as pollutants. Ann.Appl.Biol. 116[3], 549-556
<b>Media</b>	Khan, Mujeebur Rahman, Khan, M. Wajid, and Singh, Kamal. 1996. Growth performance of chickpea under the influence of nickel and cobalt as soil pollutants.

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J.Indian Bot.Soc. 75[3/4], 193-196

- OM** Kloke, A. and Egels, W. 1976. Effect of Excess Fertilization with Boron, Cobalt, Copper Manganese, and Zinc on the Content of These Elements in Soil and Plants 38813. Dokl.Zarub.Uchastnikov-Mezhdunar.Kongr.Mineral.Udobr., 8th 2[4/5], 115-121
- Media** Komczynski, L., Nowak, H., and Rejniak, L. 1963. Effect of Cobalt, Nickel and Iron on Mitosis in the Roots of the Broad Bean (*Vicia faba*). Nature 198[4884], 1016-1017
- No Control** Kramer, James R., Adams, Nicholas W. H., Manolopoulos, Helen, and Collins, Pamela V. 1999. Silver at an old mining camp, Cobalt, Ontario, Canada. Environ.Toxicol.Chem. 18[1], 23-29
- OM, pH** Kubota, J., Lemon, E. R., and Allaway, W. H. 1963. The Effect of Soil Moisture upon the Uptake of Molybdenum, Copper and Cobalt by Alsike Clover. Soil Sci.Soc.Am.Proc. 27, 679-683
- Media** Lane, I. and Puckett, K. J. 1979. Responses of the Phosphatase Activity of the Lichen *Cladonia rangiferina* to Various Environmental Factors Including Metals. Can.J.Bot. 57, 1534-1540
- FL** Leshina, A. V. 1969. Effect of the Presowing Treatment of Seeds with Cobalt and Molybdenum Salts on Some Physiological and Biochemical Indexes of Leguminous Crops. Botanika 11, 179-183
- FL** Lipskaya, G. A. 1970. Anatomico-Cytological Features of Cucumber Leaves in the Presence of Cobalt and Manganese in the Nutrient Mixture 37794. Fiziol.Rast. 17[5], 997-1003 (RUS)
- FL** Lipskaya, G. A. 1970. Accumulation of Chlorophyll in Sugar Beet Chloroplasts Under the Influence of Cobalt Applied Separately and Together with Boron, Manganese, Copper, Zinc, and Molybdenum. Agrokhimiya 2, 105-110
- FL** Lipskaya, G. A. 1971. Accumulation of Chlorophyll in Chloroplasts of Cucumber Leaves Under the Effect of Cobalt and Manganese Applied Separately and Together. Biol.Nauki 15[1], 14-20



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<b>FL</b>	Lipskaya, G. A., Matvyeyentsava, V. S., and Sergeichik, S. A. 1972. Effect of Cobalt on Accumulation of Various Forms of Chlorophyll. Dokl.Akad.Nauk.B SSR 116, 70-72
<b>FL</b>	Lipskaya, G. A., Matvyeyentsava, V. S., and Charkaskaya, S. K. 1973. Effect of Various Combination of Cobalt with Other Trace Elements on the Change of Activity of the Hill Reaction. Vysti.Akad.Nauk.B.SSR Syer.Biyal.Navuk. 2[2], 32-36
<b>FL</b>	Lipskaya, G. A. 1974. Effect of Cobalt and Heteroauxin on the Morphology and Structure of a Barley Leaf. Vestsi Akad.Navuk Belaruski , Ser.Biyal.Navuk, No.2 , 121-123
<b>FL</b>	Lipskaya, G. A. 1988. Morphofunctional Characteristics of the Photosynthetic Apparatus of the Growing Barley Leaf Under the Effect of Cobalt and Auxin. Fiziol.Biokhim.Kul't.Rast. 20[3], 241-246
<b>FL</b>	Lipskaya, G. A. 1988. Effect of cobalt and auxin on morphological and functional characteristics of the photosynthetic apparatus of growing barley leaves. Fiziol.Biokhim.Kul't.Rast. 20[3], 241-245
<b>FL</b>	Lipskaya, G. A. 1990. Development of the Photosynthetic Apparatus in Barley Grown from Seeds Varied in Cobalt Content Under Sterile and Non-Sterile Conditions. Fiziol.Rast. 37[4], 668-674
<b>Media</b>	Lui, Donghua, Jiang, Wusheng, Wang, Wei, and Zhai, Lin. 1995. Evaluation of metal ion toxicity on root tip cells by the allium test. Israel Journal of Plant Sciences 43, 125-133
<b>OM</b>	McKenzie, R. M. 1978. The Effect of Two Manganese Dioxides on the Uptake of Lead, Cobalt, Nickel, Copper and Zinc by Subterranean Clover. Aust.J.Soil Res. 16[2], 209-214
<b>Mix</b>	Memon, A. R., Ito, S., and Yatazawa, M. 1980. Taxonomic Characteristics in Accumulating Cobalt and Nickel in the Temperate Forest Vegetation of Central Japan. Soil Sci.Plant Nutr. 26[2], 271-280
<b>Media</b>	Millikan, C. R. 1948. Effect of Molybdenum on the Severity of Toxicity Symptoms

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in Flax Induced by an Excess of Either Manganese, Zinc, Copper, Nickel or Cobalt in the Nutrient Solution. *J.Aust.Inst.Agric.Sci.* 5, 180-186

<b>Media</b>	Millikan, C. R. 1949. Effects of Flax of a Toxic Concentration of Boron Iron, Molybdenum, Aluminum, Copper, Zinc, Cobalt, or Nickel in the Nutrient Solution. <i>R Soc Victoria Proc</i> 61, 25-42
<b>No Control</b>	Mitchell, R. L. 1945. Cobalt and Nickel in Soils and Plants. <i>Soil Sci.</i> 60, 63-70
<b>Media</b>	Moreno-Caselles, J., Perez-Espinosa, A., Perez-Murcia, M. D., Moral, R., and Gomez, I. 1997. Effect of Increased Cobalt Treatments on Cobalt Concentration and Growth of Tomato Plants. <i>J.Plant Nutr.</i> 20[7/8], 805-811
<b>Media</b>	Moreno-Caselles, J., Perez-Espinosa, A., Perez-Murcia, M. D., Moral, R., and Gomez, I. 1998. Cobalt-Induced Stress in Soilless Lettuce Cultivation: I. Effect on Yield and Pollutant Accumulation. <i>Acta Hortic.</i> 458, 239-242
<b>Media</b>	Moreno-Caselles, J., Perez-Espinosa, A., Perez-Murcia, M. D., Moral, R., and Gomez, I. 1998. Cobalt-induced stress in soilless lettuce cultivation: II. Effect on nutrient evolution. <i>Acta Hortic.</i> , V458, NWater Quality and Quantity in Greenhouse Horticulture , 243-246
<b>No Control</b>	Morrison, R. S., Brooks, R. R., Reeves, R. D., and Malaisse, F. 1979. Copper and Cobalt Uptake by Metallophytes from Zaire. <i>Plant Soil</i> 53, 535-539
<b>OM, pH</b>	Neuhauser, E. F., Meyer, J., Malecki, M. R., and Thomas, J. M. 1984. Impact of Dietary Cobalt Supplements on Growth and Reproduction in the Earthworm <i>Eisenia foetida</i> . <i>Soil Biol Biochem</i> 16[5], 521-523
<b>Media</b>	Okamoto, K., Suzuki, M., Fukanim, M., Toda, S., and Fuwa, K. 1977. Heavy Metal Tolerance of <i>Penicillium Ochro-Chloron</i> II. Uptake of Heavy Metals by Copper Tolerant Fungus <i>Penicillium Ochro-Chloron</i> . <i>Agric.Biol.Chem.</i> 41, 17-22
<b>Media</b>	Paliouris, G. and Hutchinson, T. 1991. Arsenic, Cobalt and Nickel Tolerances in Two Populations of <i>Silene vulgaris</i> (Moench) Garcke from Ontario, Canada. <i>New Phytol.</i> 117, 449-459
<b>Rev</b>	Palit, S., Sharma, A., and Talukder, G. 1994. Effects of Cobalt on Plants. <i>Bot.Rev.</i>

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60[2], 149-181

<b>Media</b>	Patel, P. M., Wallace, A., and Mueller, R. T. 1976. Some Effects of Copper, Cobalt, Cadmium, Zinc, Nickel, and Chromium on Growth and Mineral Element Concentration in Chrysanthemum. <i>J. Am. Soc. Hortic. Sci.</i> 101[5], 553-556
<b>OM, pH</b>	Patterson III, W. A. and Olson, J. J. 1982. Effects of Heavy Metals on Radicle Growth of Selected Woody Species Germinated on Filter Paper, Mineral and Organic Soil Substrates. <i>Can J For Res</i> 13, 233-238
<b>OM</b>	Patterson III, W. A. and Olson, J. J. 1983. Effects of Heavy Metals on Radicle Growth of Selected Woody Species Germinated on Filter Paper, Mineral and Organic Soil Substrates. <i>Can. J. For. Res.</i> 13, 233-238
<b>FL</b>	Poletaeva, V. F. 1969. Effect of Cobalt on Fusarium Cotton Wilt. <i>Izv. Akad. Nauk Turkm. SSR, Ser. Biol. Nauk</i> , 71[3], 73-74
<b>Media</b>	Puckett, K. J., Nieboer, E., Gorzynski, M. J., and Richardson, D. H. S. 1973. The Uptake of Metal Ions by Lichens: A Modified Ion-Exchange Process. <i>New Phytol</i> 72, 329-342
<b>Media</b>	Rausser, W. E. 1978. Early Effects of Phytotoxic Burdens of Cadmium, Cobalt, Nickel and Zinc in White Beans. <i>Can. J. Bot.</i> 56, 1744-1749
<b>Media</b>	Rausser, W. E. and Dumbroff, E. B. 1981. Effects of Excess Cobalt, Nickel and Zinc on the Water Relations of <i>Phaseolus vulgaris</i> . <i>Environ. Exp. Bot.</i> 21[2], 249-255
<b>Media</b>	Reisenauer, H. M. 1960. Cobalt in Nitrogen Fixation by a Legume. <i>Nature (London)</i> 186[4722], 375-376
<b>Media</b>	Reisenauer, H. M. 1960. Cobalt in Nitrogen Fixation by a Legume. <i>Nature</i> 186, 375-376
<b>No Control</b>	Romney, E. M. and Toth, S. J. 1954. Plant and Soil Studies with Radioactive Manganese. <i>Soil Sci.</i> 77, 107-117
<b>No COC</b>	Rosolem, C. A. and Caires, E. F. 1998. Yield and Nitrogen Uptake of Peanuts as Affected by Lime, Cobalt, and Molybdenum. <i>J. Plant Nutr.</i> 21[5], 827-835

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<b>OM</b>	Rossiter, R. C., Curnow, D. H., and Underwood, E. J. 1948. The Effect of Cobalt Sulphate on the Cobalt Content of Subterranean Clover ( <i>Trifolium subterraneum</i> L. var. <i>Dwalganup</i> ) at Three Stages of Growth 20464. <i>J.Aust.Inst.Agric.Sci.</i> 14[1], 9-14
<b>Mix</b>	Sanglimsuwan, Sarunya, Yoshida, Naoto, Morinaga, Tsutomu, and Murooka, Yoshikatsu. 1993. Resistance to and uptake of heavy metals in mushrooms. <i>Journal of Fermentation and Bioengineering</i> 75[2], 112-114
<b>Media</b>	Sarada, R. L. and Polasa, H. 1992. Effect of Manganese, Copper and Cobalt on the In Vitro Growth of <i>R. leguminosarum</i> -2001 and on the Symbiotic Nitrogen Fixation in Lentil Plants. <i>Indian J.Agric.Res.</i> 26[4], 187-194
<b>FL</b>	Semina, P. M. 1967. The Action of Cobalt on Chlorophyll Accumulation, the Intensity of Photosynthesis, and the Seed Crop of Buckwheat. <i>Nauchn.Dokl.Vyssk.Shk.Biol.Nauki</i> 3, 80-83
<b>FL</b>	Semina, P. M. 1970. Effect of Cobalt on the Water Regime of Buckwheat. <i>Biol.Nauki</i> No.6 , 69-72
<b>Media</b>	Shaukat-Ahmed. and Evans, H. J. 1961. The Essentiality of Cobalt for Soybean Plants Grown Under Symbiotic Conditions. <i>Proc.Natl.Acad.Sci.</i> 47, 24-36
<b>OM</b>	Sheppard, M. I. and Sheppard, S. C. 1985. Concentrations and Concentrations Ratios of U, As and Co in Scots Pine Grown in a Waste-Site Soil and an Experimentally Contaminated Soil 47149. <i>Water Air Soil Pollut</i> 26[1], 85-94
<b>OM, pH</b>	Sheppard, M. I., Thibault, D. H., and Sheppard, S. C. 1985. Concentrations and Concentration Ratios of U,As and Co in Scots Pine Grown in a Waste-Site Soil and an Experimentally Contaminated Soil 47150. <i>Water Air Soil Pollut</i> 26[1], 85-94
<b>Mix</b>	Shinonaga, Taeko and Ambe, Shizuko. 1998. Multitracer study on absorption of radionuclides in atmosphere-plant model system. <i>Water Air and Soil Pollution</i> 10[1-4], 93-103
<b>FL</b>	Shklyayev, Y. N. 1978. Effect of Top Dressing with Cobalt-60 and Carbon-14

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	Distribution in Vetch Plants (Vliyanie Nekornevoi Podkormki Kobal'tom na Raspredelenie 60co i 14C v Rastenyakh Viki). <i>Agrokimiya</i> 1, 115-118
<b>In Vit</b>	Siegel, S. M. 1977. The Cytotoxic Response of Nicotiana Protoplast to Metal Ions: A Survey of the Chemical Elements. <i>Water Air Soil Pollut</i> 8[1-4], 293-304
<b>Rev</b>	Suttle, N. F. 1988. The Role of Comparative Pathology in the Study of Copper and Cobalt Deficiencies in Ruminants. <i>J Comp Pathol</i> 99, 241-258
<b>FL</b>	Tanaka, A., Tadano, T., and Ebine, Y. 1978. Comparison of Adaptability to Heavy Metals Among Crop Plants. III. Adaptability to Nickel and Cobalt. <i>Nippon Dojo Hiriyogaku Zasshi</i> 49[4], 314-320
<b>Media</b>	Tiffin, L. O. 1967. Translation of Manganese, Iron, Cobalt and Zinc in Tomato. <i>Plant Physiol.</i> 42, 1427-1432
<b>Mix</b>	Tolle, Duane A., Arthur, Mickey F., Chesson, Jean, and Van Voris, Peter. 1985. Comparison of pots versus microcosms for predicting agroecosystem effects due to waste amendment. <i>Environ.Toxicol.Chem.</i> 4[4], 501-509
<b>FL</b>	Torshin, S. P., Yagodin, B. A., Klinskii, G. D., Goncharuk, E. A., Kalashnikova, E. A., and Udel'nova, T. M. 1997. Effects of selenium and cobalt on chemical composition, seed germination and formation of seedlings in lettuce. <i>Agrokimiya</i> [1], 36-42
<b>Media</b>	Tso, T. C., Sorokin, T. P., and Engelhaupt, M. E. 1973. Effects of Some Rare Elements on Nicotine Content of the Tobacco Plant. <i>Plant Physiol</i> 51, 805-806
<b>FL</b>	Uesaka, S., Takahashi, H., and Chang, T. Y. 1953. Importance of Trace Elements in Farm Animal Feeding. II. Effect of Addition of Iron, Cobalt, and Fluorine on Propagation of Antinomycetes. <i>Bull.Res.Inst.Food Sci., Kyoto Univ.</i> 12, 15-23
<b>Rev</b>	Vanselow, A. P. 1966. Cobalt. In: H.D.Chapman (Ed.), <i>Diagnostic Criteria for Plants and Soils</i> , University of California, Berkeley, CA , 142, 153-142, 156
<b>Media</b>	Veltrup, W. 1979. The Effect of Ni <sup>2+</sup> , Cd <sup>2+</sup> , and Co <sup>2+</sup> on the Uptake of Copper by Intact Barley Roots. <i>Z.Pflanzenphysiol.</i> 93, 1-9

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<b>Media</b>	Venkatarayappa, T., Tsujita, M. J., and Murr, D. P. 1980. Influence of Cobaltous Ion (Co <sup>2+</sup> ) on the Postharvest Behavior of 'Samantha' Roses. <i>J.Am.Soc.Hortic.Sci.</i> 105[2], 148-151
<b>Media</b>	Venkateswerlu, G. and Sastry, K. S. 1973. Interrelationships in Trace-Element Metabolism in Metal Toxicities in a Cobalt-Resistant Strain of <i>Neurospora crassa</i> . <i>Biochem.J.</i> 132[4], 673-680
<b>Media</b>	Vergnano, O. and Hunter, J. G. 1952. Nickel and Cobalt Toxicities in Oat Plants 20391. <i>Ann.Bot.(London)</i> 17[66], 317-328
<b>OM</b>	Vernano, O. and Hunter, J. G. 1952. Nickel and Cobalt Toxicities in Oat Plants. <i>Ann.Bot.</i> 17, 317-328
<b>FL</b>	Volkorezov, V. I. 1968. Pretreatment of <i>Pinus sylvestris</i> with Cobalt Sulfate 38625. <i>Uch.Zap.Gor'k Univ.</i> 90, 114-117
<b>Media</b>	Von Rosen, G. 1964. Mutations Induced by the Action of Metal Ions in <i>Pisum</i> . II. Further Investigations on the Mutagenic Action of Metal Ions and Comparison with the Activity of Ionizing Radiation. <i>Hereditas</i> 51, 89-134
<b>FL</b>	Von Scharrer, K. and Schropp, W. 1933. Sand and Water Culture Experiments with Nickel and Cobalt (Sand- und Wasserkulturversuche mit Nickel und Kobalt) 20392. <i>Z.Pflanzenernaehr.Dung.Bodenkd.</i> 31A, 94-113 (GER)
<b>OM</b>	Wallace, A. and Mueller, R. T. 1973. Effects of Chelated and Nonchelated Cobalt and Copper on Yields and Microelement Composition of Bush Beans Grown on Calcareous Soil in a Glasshouse 38352. <i>Soil Sci.Soc.Am.Proc.</i> 37, 907-908
<b>No Dose</b>	Wallace, A., Mueller, R. T., and Alexander, C. V. 1976. High Levels of Four Heavy Metals on the Iron Status of Plants. <i>Comm.Soil Sci.Plant Anal.</i> 7[1], 43-46
<b>Media</b>	Wallace, A., Alexander, G. V., and Chaudhry, F. M. 1977. Phytotoxicity of Cobalt Vanadium Titanium Silver and Chromium. <i>Comm.Soil Sci.Plant Anal.</i> 8[9], 751-756
<b>Media</b>	Wallace, A., Alexander, G. V., and Chaudry, F. M. 1977. Phytotoxicity of Cobalt, Vanadium, Titanium, Silver, and Chromium. <i>Commun.Soil Sci.Plant Anal.</i> 8[9],

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751-756

<b>Meth</b>	Wallace, A., Romney, E. M., and Patel, P. M. 1978. Role of Synthetic Chelating Agents in Trace Metal Uptake by Plants. In: D.C.Adriano and I.L.Brisbin,Jr.(Eds.), Environmental Chemistry and Cycling Processes, Proc.Symp.Held at Augusta, Georgia, April 18-May 1, 1976, Tech.Info.Center, U.S.Dep of Energy (U.S.NTIS CONF-760429) , 645-657
<b>No Dose</b>	Wallace, A. 1989. Phytotoxicity of Cobalt when Uniformly Mixed in Soil Versus Localized Spot Placement in Soil. Soil Sci. 147[6], 449-450
<b>Media</b>	Wettlaufer, S. H., Osmeloski, J., and Weinstein, L. H. 1991. Response of polyamines to heavy metal stress in oat seedlings. Environ Toxicol Chem 10[8], 1083-1088
<b>Mix</b>	Wild, S. R. and Jones, K. C. 1992. Organic Chemicals in the Environment. Polynuclear Aromatic Hydrocarbon Uptake by Carrots Grown in Sludge-Amended Soil. J Environ Qual 21, 217-225
<b>Mix</b>	Wilson, D. O. and Reisenauer, H. M. 1970. Effects of Some Heavy Metals on the Cobalt Nutrition of Rhizobium meliloti. Plant Soil 32, 81-89
<b>Media</b>	Wilson, S. B. and Reisenauer, H. M. 1963. Cobalt Requirements of Symbiotically Grown Alfalfa. Plant Soil 19[3], 364-373
<b>OM, pH</b>	Wilson, S. B. and Hallsworth, E. G. 1965. Studies on the Nutrition of Forage Legumes. IV. The Effect of Cobalt on the Growth of Nodulated and Non-Nodulated Trifolium subterraneum. Plant Soil 22[2], 260-279
<b>Media</b>	Wilson, S. B. and Nicholas, D. J. D. 1967. A Cobalt requirement for Non-Nodulated Legumes and for Wheat. Phytochemistry 6, 1057-1066
<b>FL</b>	Wojciechowska, B. and Kocik, H. 1987. Effect of Cadmium, Cobalt and Bismuth Nitrate on the Root Meristem of Vicia faba L. (Wplyw Azotanow Kobaltu, Kadmu i Bizmutu na Merystem Korzeniowy Vicia faba L.). Pr.Nauk.Univ.Slask.Katowicak. 7[24], 74-91
<b>FL</b>	Yagodin, B. A. and Zhiznevskaya, G. Y. 1969. Variations in Protein Composition of Vicia faba Leaves During Chlorosis Induced by Excessive Cobalt

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37858. Fiziol.Rast. 16[3], 505-511 (RUS)

- FL** Yagodin, B. A., Ovcharenko, G. A., Vasil'eva, V. Y., and Ivanova, M. A. 1970. Effect of Cobalt on Nitrate Reductase Activity in Legumes. S-kh.Biol. 5[1], 134-136
- FL** Yagodin, B. A. and Sablina, S. M. 1981. Effect of Cobalt on Buckwheat Yield and on the Content of Mineral Elements and Rutin. Izv.Timiryazev.S-Kh.Akad. 6, 68-72
- FL** Yagodin, B. A. and Romanova, L. P. 1982. Yield and Quality of Chinese Cabbage is Seed Treatment with Trace Elements. Izv.Timiryazev.S-Kh.Akad. 2, 98-104