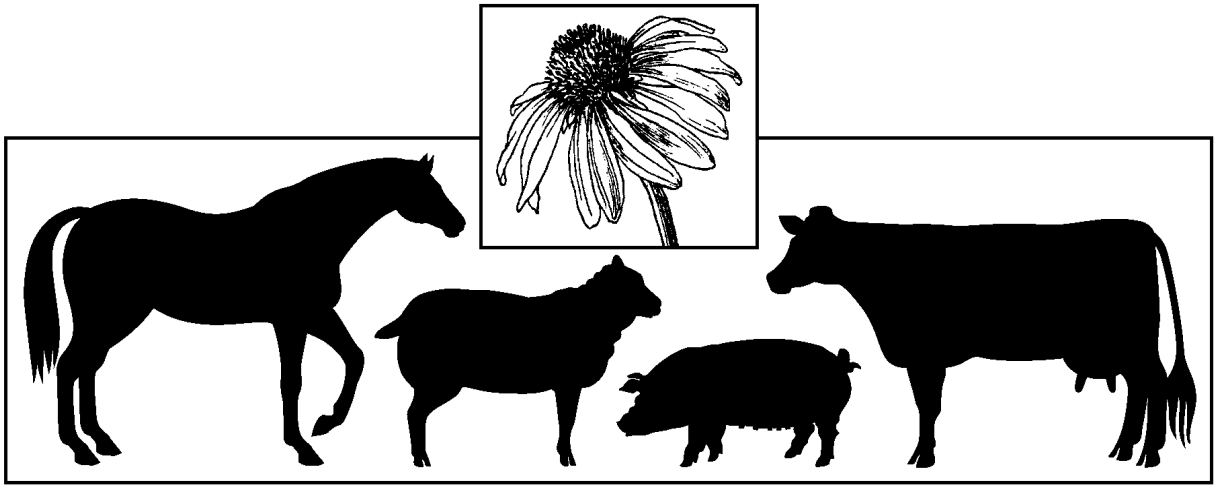
Alternative and Herbal Livestock Health Sourcebook

University of Connecticut
College of Agriculture and Natural Resources
Department of Plant Science



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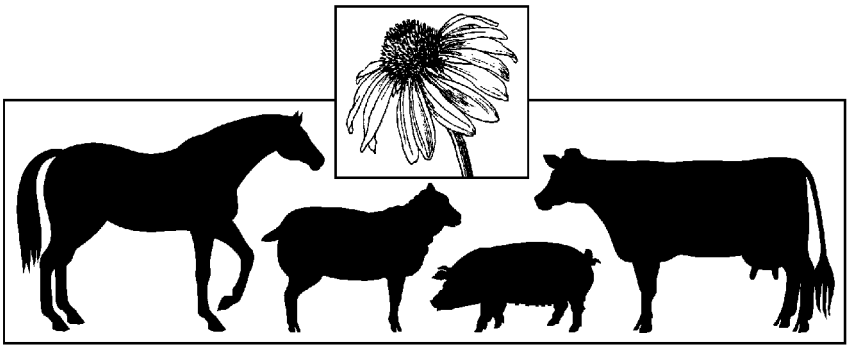
Introduction



Introduction

This sourcebook is meant as a practical guide for extension educators, USDA Natural Resources Conservation personnel, veterinarians, livestock producers and others interested in alternative health care for livestock. We complied this sourcebook because of concerns regarding food safety, particularly antibiotics and chemical residues in meat and milk, have stimulated renewed interest in alternative methods of maintaining livestock health. Extension personnel, like us, often are asked to provide information about alternative health care for livestock or to provide sources of information for the public. This interest in alternative practices for livestock parallels the resurgent interest in alternative medical practices in the human health professionals. An example is the National Institute of Health's establishment of a National Center for Complimentary and Alternative Medicine. Unfortunately, a compilation of alternatives to antibiotic/chemical use for livestock is not available. The lack of a compilation of alternative practices for livestock seriously limits communication among person interested in alternative practices for livestock.

The contents of the sourcebook includes the Proceedings of a conference held at the College of Agriculture and Renewal Natural Resources, University of Connecticut, Storrs, CT on October 20-21, 2000 entitled "Alternative and Herbal Livestock Health: A Scientific Review of Current Knowledge". The objective of the conference was to gather interested agricultural professionals and experts for a structured discussion about alternative health care for livestock. From this discussion, we created the Proceedings, which is a resource for both the scientific community and users of applied information such as extension educators and livestock producers. The Proceedings contains a variety of information that ranges from the opinions of veterinarians about the use of alternative therapies for livestock to the results of scientific experiments documenting the molecular basis for some herbal remedies.

We have also included in the sourcebook lists of useful web sites, a list of reference books and publications, and publications about alternative health care for livestock. Especially interesting is the chapter entitled "Western Herbal Medicine: Traditional Materia Medica", which is copied with permission from the book "Complementary and Alternative Veterinary Medicine Principles and Practices" published by Mosby Inc. This chapter provides an expensive list of the plants used in herbal medicines. The chapter is the best single source of information we could find about the use of herbal medicines for livestock. Most information about the use of herbal medicines is written for humans.

Because of the lack of information available about herbal remedies for livestock, we surveyed the authors of the chapters in our Proceedings to provide us with their opinion about the most useful plants for alternative health care for livestock. From this survey, we complied a list of the ten most recommended plants. The results of the survey are in Section X ‘Monographs’.

Much other useful information is included in the sourcebook. The American Veterinary Medical Association's Guidelines for complementary and alternative medicine provides veterinarians with information to help make informed decision about alternative treatments. The Northeast Organic Farming Association's pamphlet entitled "Organic Livestock & Grazing Resources" contains many sources of information about alternative health care for livestock. If a person wants to grow their own herbs, we have included a Research Bulletin about growth and management of 13 perennial herbs.

We hope that users of this sourcebook find the information useful. Two hundred copies of the sourcebook were produced. We used a three-ring binder so that the book could be easily updated. If users find information that should be included, please email Tom Morris. If the information is not copyrighted and is not too lengthy, I will create a digital image of the information and email it to owners of the sourcebook. Most of the information in this sourcebook is available on the University of Connecticut's web site. The address is http://www.canr.uconn.edu/plsci/

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Northeast Regional Sustainable Agriculture Research and Education program, Burlington, VT and The College of Agriculture and Natural Resources, University of Connecticut

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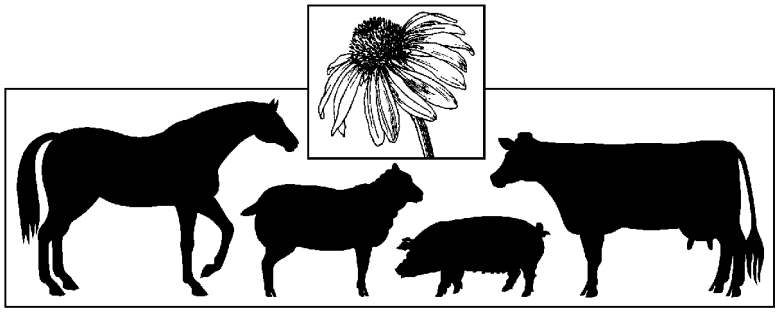
Appendix I
Worldwide Web Sites

Appendix II

Appendix III
Periodicals

Appendix IV
Veterinary Complementary and Alternative Medicine (CAM) Organizations



Appendix I
Worldwide Web Sites

Alternative Medicine
http://www.altmedicine.com/
http://www.pitt.edu/~cbw/altm.html
http://www.altvetmed.com
http://www.choices-in-health.com
http://www.naturalhorse.com
http://www.lser.org/holistichorsekeeping.htm
http://www.ivas.org/Vet.html
http://www/iaath.com
http://www.vbma.org/

Alternative Veterinary Medicine
http://home.earthlink.net/~fourwinds/
http://www.altvetmed.com
http://www.naturalholistic.com
http://www.animalchiropractic.org/default.htm

Herbs
http://chili.rt66.com/hrbmoore/HOMEPAGE/Home-Page.html
http://www.ars-grin.gov/~ngrlsb/
http://www.herbalgram.org/abcmission.html
http://www.herbs.org/index.html

Homeopathy
http://www.lyghtforce.com/HomeopathyOnline/
http://www.holistichorse.com

Oriental Medicine

Traditional/Ethnobotanical Medicine
http://www.itmonline.org/

Resources on Plant Toxicology Web Resources

http://www.vth.colostate.edu/poisonous_plants
http://www.library.uiuc.edu/vex/vetdocs/toxic.htm
http://sis.agr.gc.ca/brd/poisonpl/ (Canadian Poisonous Plants)
http://vm.cfsan.fda.gov/~djw/readme.html (Poisonous Plant Database USDA)
http://vet.purdue.edu/depts/addl/toxic/cover1.htm (Indiana Toxic Plants)
http://toxnet.nlm.nih.gov/ (Toxicology database)
http://www.ces.ncsu.edu/depts/hort/consumer/poison/poison.htm (Poisonous Plants of North Carolina
http://www.agric.gov.ab.ca/agdex/100/3066601.html (Poisonous Plants on Range and Pasture)
http://www.fau.edu/divdept/science/envsci/poison-pl.html (Poisonous Plants of Southern Florida
http://www.caf.wvu.edu/~forage/library/poisonous (Poisonous Plants of the Southern States)
http://ansci.cornell.edu/plants/ (Cornell University Poisonous Plants Informational Database)
http://gateway.library.uiuc.edu/vex/vetdocs/toxic.htm (University of Illinois Veterinary Medicine Library)
http://netvet.wustl.edu/species/goats/goatpois.txt (Extension Goat Handbook)
http://www.botanical.com/botanical/mgmh/poison.html (Index of Poisonous Plants)
http://cal.nbc.upenn.edu/poison/

National Animal Control Center
http://www.napcc.aspca.org/

Appendix II

Complementary and Alternative Veterinary Medicine, Principles and Practice. Allen M. Schoen and Susan G. Wynn. Mosby Press. 1997.

The Complete German Commission E Monographs, Therapeutic Guide to Herbal Medicines. Mark Blumenthal, Werner R. Busse, Alicia Goldberg, Joerg Gruenwald, Tara Hall, Sigrid Klein, Chance W. Riggins and Robert S. Rister. American Botanical Council, Austin, TX. 1998.

A Veterinary Materia Medica and Clinical Repertory with a Materia Medica of the Nosodes. George Macleod. The C.W. Daniel Company, Ltd., Saffron Walden, England. 1995.

The Homoeopathic Treatment of Beef and Dairy Cattle. Christopher Day. Beaconsfield Publishers, Ltd., Beaconsfield, Bucks, England. 1995.

The Honest Herbal, A Sensible Guide to the Use of Herbs and Related Remedies, 3rd Edition. Varro E. Tyler. Pharmaceutical Products Press. 1992.

Medicinal Plants, Culture, Utilization and Phytopharmacology. Thomas S.C. Li. Technomic Publications Company, Inc., Lancaster, PA. 2000.

Complimentary Medicine: General Reference

Alternative medicine: expanding medical horizons, Washington, DC, 1992, U.S. Government Printing Office.

Fugh-Berman A: *Alternative medicine: what works*, Tucson, 1996, Odonian Press.

Lewith G, Kenyon J, Lewis P: *Complementary medicine: an integrated approach*, New York, 1996, Oxford University Press.

Micozzi M: *Fundamentals of complementary and alternative medicine*, New York, 1996, Churchill-Livingstone.

Homeopathy

Bellavite P: *Homeopathy: a frontier in medical science: experimental studies and theoretical foundations*, Berkeley, California, 1995, North Atlantic Books.

Herbal Medicine

Bissett N: *Herbal drugs and phytopharmaceuticals: a handbook for practice on a scientific basis*, Boca Raton, Florida, 1994, CRC Press.

Tyler V: *Herbs of choice: the therapeutic use of phytomedicinals*, New York, 1994, Haworth Press.

Weiss R: *Herbal medicine*, Beaconsfield, England, 1994, Beaconsfield Publishers.

Werbach M, Murray M: *Botanical influences on illness: a sourcebook on clinical research*, Tarzana, California, 1994, Third Line Press.

Appendix III
Periodicals

Herbs for Health
Herbal Companion Press Inc.
PO Box 7708
Red Oak, IA 51591-0708

Journal of the American Holistic Veterinary Medical Association
2214 Old Emmorton Road
Bel Air, MD 21015
410-569-0795
Fax: 410-569-2346

Journal of Alternative and Complementary Medicine
Mary Ann Liebert, Inc., Publishers
1651 Third Avenue
New York, NY 10128
914-834-3100
Fax: 914-834-3688

The American Journal of Natural Medicine
Impakt Communications, Inc.
PO Box 12496
Green Bay, WI 54307-2496
414-499-2995
Fax: 414-499-3441

International Journal of Alternative and Complementary Medicine
Green Library
Homewood House
Guildford Road, Chertsey
Surrey KT 16 0QA
England

Herbalgram
American Botanical Council
PO Box 201660
Austin, TX 78720
512-331-8868

Newsletter for the International Association for Veterinary Homeopathy
Dr. Andreas Schmidt
Sonnhaldenstr. 18
CH-8370 Sirnach
Switzerland
41 (73) 26 14 24
Fax: 41 (73) 26 58 14

New England Journal of Homeopathy
356 Middle Street
Amherst, MA 01002

Holistic Medicine: Magazine of the American Holistic Medical Association
4101 Lake Boone Trail, Suite 201
Raliegh, NC 27607
919-787-5146

Appendix IV
Veterinary Complementary and Alternative Medicine (CAM) Organizations

American Holistic Veterinary Medical Association
2214 Old Emmorton Road
Bel Air, MD 21014
410-569-0795
Fax: 7410-569-2346
email: 74253.2560@compuserve.com

Veterinary Institute for Therapeutic Alternatives (V.I.T.A.)
15 Sunset Terrace
Sherman, CT 06784

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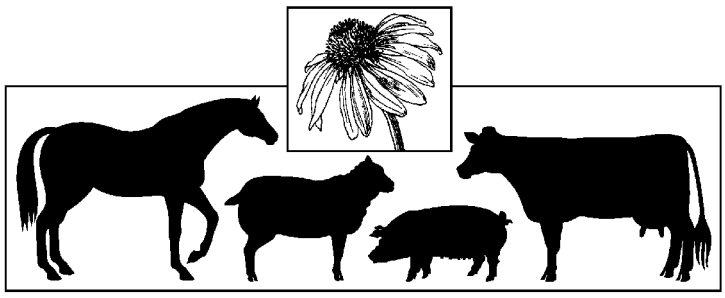

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A Scientific Review of Current Knowledge

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A Scientific Review of Current Knowledge

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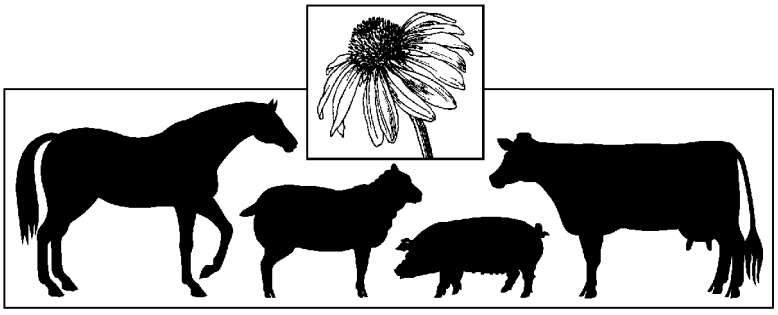
Alternative and Herbal Livestock Health Conference: A Scientific Review of Current Knowledge

October 20-21, 2000

University of Connecticut
College of Agriculture and Natural Resources

Proceedings



PROCEEDINGS

Alternative and Herbal Livestock Health Conference:
A Scientific Review of Current Knowledge

University of Connecticut
Bishop Center
Storrs, CT

October 20-21, 2000

Sponsored by:
Northeast Region Sustainable Agriculture Research and Education program, Burlington, VT
and
the College of Agriculture and Natural Resources, University of Connecticut

Edited by Thomas F. Morris

Conference coordinator: Michael T. Keilty

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Make check payable to the University of Connecticut

Table of Contents

Biochemistry of the Amazonian Medicinal Plant Cat's claw: A Natural Source of Antioxidants and Antiinflammatory Compounds

[1]Manuel Sandoval, [1]Nataly N. Okuhama, [2]Juan Lao, [2]Jennifer Santa Cruz, [3]Rabi Musah, [1]Xiao-Jing Zhang, and [1]Mark J. S. Miller.

[1]Albany Medical College, Center for Cardiovascular Sciences, Albany, New York; [2]Universidad Nacional Agraria de la Selva, Medicinal Plants & Functional Foods Research Program, Tingo Maria, Peru; [3]State University of New York at Albany, Department of Chemistry, Albany, New York.

Uncaria tomentosa is a vine commonly known as cat's claw or "uña de gato" (UdG) and is used in traditional Peruvian medicine for the treatment of a wide range of health problems, particularly gastrointestinal complaints and arthritis. The aim of this study was to determine the proposed anti-inflammatory properties of UdG. Specifically 1) does the bark extract of UdG protect against oxidant-induced stress in vitro 2) to determine if UdG modifies transcriptionally-regulated events, 3) to determine if UdG protects against oxidative injury beyond the concept of down regulating NF-?B activation, and 4) to determine the free radical scavenging activity of UdG in in vitro systems.

In the first set of experiments we addressed the first two specific aims. To achieve this purpose we used macrophages (RAW 264.7) and epithelial cells (HT29) and rats. Cell death was determined in two cell lines, RAW 264.7 and HT29 in response to peroxynitrite (PN, 300 FM). Gene expression of inducible nitric oxide synthase (iNOS) in HT29 cells, direct effects on nitric oxide and peroxynitrite levels, and activation of NF-*k*B in RAW 264.7 cells as influenced by UdG were assessed. Chronic intestinal inflammation was induced in rats with indomethacin (INDO, 7.5 mg/kg), with UdG administered orally in the drinking water (5 mg/ml). Administration of UdG (100 Fg/ml) attenuated ($P < 0.05$) peroxynitrite-induced apoptosis in HT29 (epithelial) and RAW 264.7 cells (macrophage). Cat's claw inhibited lipopolysaccharide-induced iNOS gene expression, nitrite formation, cell death and inhibited the activation of NF-*k*B. Cat's claw markedly attenuated INDO-enteritis as evident by reduced myeloperoxidase activity, morphometric damage and liver metallothionein expression.

In the second set of experiments we addressed aims 3 and 4, respectively. For this purpose we introduced a modification in the cat's claw processing to reflect the action of the commercial forms currently available in the market. Cat's claw was prepared as a decoction (water extraction) of micropulverized bark with and without concentration by freeze-drying. RAW 264.7 cells were used in cytotoxicity assays (trypan blue) in response to the free radical 1,1-diphenyl-2-picrilhydrazyl (DPPH, 0.3 FM) and ultraviolet light (UV). TNFα production was induced by lipopolysaccharide (LPS 0.5 Fg/ml). For the in vivo experiment, intestinal inflammation was induced in chickens with coccidia oocytes ($10x10^4$/ml), with UdG micropulverized given orally in the drinking water (10 mg/ml). Cat's claw was an effective scavenger of DPPH; the IC_{50} value for freeze-dried concentrates was significantly less than micropulverized (18 vs. 150 Fg/ml, $P < 0.01$). Cat's claw (10 Fg/ml freeze-dried) was fully protective against DPPH and UV irradiation induced cytotoxicity. LPS increased TNFα media levels from 3 to 97 ng/ml. Cat's claw suppressed ($P < 0.01$) TNFα production by approximately 65-85% but at concentrations considerably lower than its antioxidant activity: freeze-

dried IC_{50} = 1.2 ng/ml, micropulverized IC_{50} = 28 ng/ml. Cat's claw attenuated the coccidia-mucosal inflammation as evident by reduced morphometric damage of the intestinal mucosal. On the contrary, histological sections of the ileum of chickens infected with coccidiosis showed a pronounced disruption of the mucosal architecture, with loss of villi and a pronounced inflammatory cell infiltrate.

Our data collectively demonstrates that cat's claw protects cells against oxidative stress and negated the activation of NF-*k*B. These studies provide mechanistic evidence for the widely belief that cat's claw is an effective anti-inflammatory agent. Cat's claw is an effective antioxidant, but perhaps more importantly a remarkably potent inhibitor of TNFα production. The primary mechanism for cat's claw anti-inflammatory actions appears to be immunomodulation via suppression of TNFα synthesis. These findings demonstrate the feasibility to incorporate the use of herbal medicines, such as cat's claw, to promote the health of livestock animals considering the similarities with the stress factors observed in animal production. For developing countries, where the cost of conventional medications is expensive herbal medicines such as cat's claw deserve serious consideration.

Key Words: Cat's claw, *Uncaria tomentosa*, inflammation, TNFα, oxidants, free radicals, NF-*k*B, cytoprotection.

Reference:

Sandoval-Chacón, M.; Thompson, J. H.; Zhang, X-J.; Liu, X.; Mannick, E.E.; Sadowska-Krowicka, H.; Charbonnet, R.M.; Clark, D.A.; Miller, M.J.S. Antiinflammatory actions of cat's claw: the role of NF-kB. Aliment Pharmacol Ther **12:** 1279-1289; 1998.

Sandoval, M.; Charbonnet, R.M.; Okuhama, N.N.; Roberts, J.; Krenova, Z.; Trentacosti, A.M.; Miller, M.J.S. Cat's claw inhibits TNF" production and scavenges free radicals: Role in cytoprotection. Free Rad Biol Med 29: 71-78, 2000.

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Current Research on Medicinal Plants to Control Endo- and Ecto-parasite Infections in Livestock

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Disclaimer: Given that only preliminary results are presented in this paper, the authors do not endorse the use of any of the endo- or ecto-parasite treatments discussed.

Abstract.
There is considerable data on plants used in traditional veterinary and human medicine for endo- and ecto-parasite infections. In addition, zoopharmacognosy observations are providing information on potential endo- and ecto-parasite treatments. However, little efficacy and safety data are available for these treatments. The current status of and strategies for medicinal plant research for endo- and ecto-parasite infections are presented. Some of the plants currently under investigation include: *Cissus verticillata*, *Conocarpus erectus*, *Crescentia cujete*, *Jatropha gossypifolia*, *Laguncularia racemosa*, *Melinis minutiflora*, *Passiflora quadranqularis*, and *Senna alata* for endo-parasites and *Nerium oleander*, *Bixa orellana*, *Clusia rosea*, and *Petiveria alliacea* for ecto-parasites. These plants show activity in *in vitro* tests. *In vivo* and toxicity tests are planned for the future.

Introduction

The control of endo- and ecto-parasite infections is necessary for the maintenance of healthy, productive livestock. Endo-parasites (e.g., nematodes, cestodes) damage the gastro-intestinal (GI) tract, decrease feed intake, decrease nutrient absorption, alter feed utilization, and, in some cases, can lead to livestock death. Ecto-parasites (e.g., mites, lice, flies, and ticks) can distract livestock from grazing, damage hides, cause infections, and transmit diseases (Bowman, 1999; Parkins and Holmes, 1989).

Current endo- and ecto-parasite control methods rely on a combination of management methods and chemotherapeutics (anthelmintics, insecticides, and repellents). Alternatives to the commonly used chemotherapeutics are needed for several reasons. First, many of the available treatments for endo-parasites are becoming less effective. Endo-parasites are becoming resistant to almost every chemical class of available anthelmintics (Prichard, 1994). Second, there are environmental pollution and human health concerns with both types of treatments. For example, ivermectin, which is one of the most commonly used anthelmintics, can potentially kill beneficial soil microorganisms (Pfeiffer et al., 1998). Many of the ecto-parasite treatments are organophosphates, which are cholinesterase inhibitors. Third, there is a growing desire among the general population for more "natural" and environmentally friendly treatments (e.g., the increase

in the organic food market). Fourth, in many parts of world, synthetic endo- and ecto-parasite treatments are either unavailable or are not cost-effective (Hammond et al., 1997).

Plants with bioactive compounds are a potential alternative to the chemotherapeutics currently used to control endo- and ecto-parasite infections. Plant treatments for endo-parasites can be given as single oral doses, daily doses mixed with feeds, and planted in pastures. Ecto-parasite treatments can be sprayed on animals and mixed in bedding. Given the wide variety of applications and the need for new treatments, investigation on the use of medicinal plants in veterinary medicine is becoming a fast growing field of research.

There is extensive information available on the use of plants in traditional veterinary medicine (often referred to as ethnoveterinary medicine), and researchers such as Hammond, et al. (1997) have presented excellent reviews on the potential of using plant anthelmintics. Many recent conferences, publications, web sites, and list serves are increasing the dissemination of medicinal plant information.

There is much evidence that plant treatments can be effective. For example, from the 1920s to the 1940s, one of the most commonly used anthelmintics in humans, oil of chenopodium, was derived from the plant, *Chenopodium ambrosioides* (Ketzis, 1999). Also, many of the currently popular ecto-parasite treatments for small animals are synthetic pyrethroids, which are based on the pyrethrins found in *Chrysanthemum cinerariaefolium*. Another common ecto-parasite treatment is rotenone, derived from derris roots (*Derris elliptica*), which is used to treat mite infections in dogs.

While there is much information available on the historical and current use of plants in endo- and ecto-parasite treatments, there is little data on efficacy, appropriate doses, safety, and food residues. There is a need for systematic efficacy and toxicity testing (Mathias et al., 1996).

Research Methods in Plant Treatments

Our laboratory's approach to investigating medicinal plant treatments is based on six steps: 1) identification of potential plant treatments; 2) compound identification; 3) *in vitro* laboratory screening; 4) *in vitro* efficacy tests; 5) preliminary *in vivo* trials; and 6) *in vivo* toxicity and food residue trials. Most of our work focuses on tropical plant species and herbs. In the following sections, research methods used in our laboratory are discussed.

Identification of plants

Two main sources of information on potential plant treatments have been used to date in our research: interviews with people knowledgeable about and who currently use ethnomedicine and ethnoveterinary medicine treatments in the Dominican Republic and Honduras and observations of wild animals. Interviews are used to collect information on plant treatments for all types of livestock and human ailments (e.g., parasites, stomach pain, diarrhea, skin infections, mastitis, etc.), preparation methods, and doses. Animals are observed to determine if they are eating and/or rubbing themselves with plants known to contain bioactive compounds or if they are eating and/or rubbing themselves with plants not normally a part of the diet when the animal is known to have

an endo- or ecto-parasite infection. In addition, animals and birds are observed to determine if they are using unusual plants as bedding or nesting materials. This study of self-treatment, referred to as zoopharmacognosy, has focused on gorillas and chimpanzees in Africa and birds in the Dominican Republic (Rodriguez and Wrangham, 1993). However, observations of other animals are underway.

Voucher specimens of plants used by animals or informed about through interviews are collected and sent to the Jardin Botanico Nacional, Santo Domingo, Dominican Republic or the Bailey Horatorium, Cornell University for identification. Bulk collections of the plants are dried and the compounds are extracted with 95% ethanol, a 50:50 mixture of methanol and chloroform, or hot water.

Compound identification

Compound identification is an on-going process. If little information on the plant is available in the literature, then Thin Layer Chromatography techniques are used to obtain a general idea of the types of compounds in the plants. However, since most of the preliminary tests are done with crude plant extracts, full elucidation of the active compounds is not completed until after it is known that the extract is bioactive. Data in the literature on the types of compounds in the plant, plant family, or plant genus often are used to decide the most appropriate method for identifying the active compound in the plant. Some methods used for compound identification include: GCMS, H-NMR, and HPLC.

***In vitro* and *In vivo* tests**

Initial *in vitro* tests use crude plant extracts or purchased plant oils. Initial tests include mortality and repellency tests with the Lesser Mealworm (*Alphitobus diaperinus*; a common insect in chicken houses), larvae motility tests and egg-hatch tests with *Haemonchus contortus* (a significant parasite of goats and sheep), and nematode mortality tests with free-living stages of nematodes. In addition, all extracts are screened to determine antibacterial and antifungal properties. Bacteria and fungi used in these tests include: *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus cereus*, and *Candida albicans*. All tests follow general published guidelines (Coles et al., 1992; Hamburger and Hostettmann, 1991; Janssen et al., 1987; Laudani and Swank, 1954; Lorimer et al., 1996).

In the initial tests, relatively high concentrations of the crude extracts are used. Extracts that show some activity are retested at different concentration levels, until the lowest effective concentration level is found. Plants that had activity in the initial tests might also be tested again using more sophisticated repellency tests and larvae development and motility tests.

Plants that show high efficacy in the *in vitro* tests will be tested *in vivo* with mice or small ruminants. Currently, only one endo-parasite treatment (*Chenopodium abrosioides*) has reached this stage of testing in our laboratory. Protocols for the *in vivo* tests were based on those recommended by the World Association for the Advancement of Veterinary Parasitology (Wood et al., 1995), and included a preliminary efficacy trial, a milk and tissue residue trial, and an efficacy dose-titration trial. Fresh plant material and chenopodium oil were given to kids with *H.*

contortus infections, and the number of parasite eggs in the feces and adult parasites in the abomasum were counted and compared to those of untreated kids. No ecto-parasite *in vivo* studies have been conducted in our laboratory. Planned efficacy trials will be based on protocols outlined by Uribe et al. (1989).

Status of Research

Plants identified to date

A review of the literature indicates that plants from almost every family are currently used or have been used in endo- and ecto-parasite treatments in livestock or humans. In our laboratory, information on over 40 plants has been collected via interviews in the Dominican Republic and Honduras. These plants are listed in Table I along with plants cited in the literature as used in ethnoveterinary treatments. Some plants identified in zoopharmacognosy applications include: the fruit of *Aframamum* spp., *Panicum maximum*, *Aspilia mossambicensis*, and *Veronia amygdalina* (Rodriguez and Wrangham, 1993; Robles et al., 1995)

Compounds

All compound identification in our laboratory is in the preliminary stages and, with only a few exceptions, only the general class of compounds has been identified. Many of the plants collected contain flavonoids, monoterpenes, phenols, and tannins. Some secondary plant compounds of especial interest and that are known or believed to decrease parasite infections are: ascaridole, eugenol, genistein, methylchavicol, satonin, superoxides, terpineol, and thymol.

***In vitro* and *In vivo* tests**

Results from preliminary *in vitro* tests are presented in Table III. In the *in vivo* tests, *C. ambrosioides* was found not to be a viable anthelmintic treatment. It did not significantly decrease endo-parasite infection levels. In addition, two of the four kids given the higher doses (0.4 ml oil/kg body weight) died. Kid goats given the lower doses were depressed and rumen activity was decreased for several hours after treatment. In addition, when the oil was given to lactating does, the active compound (ascaridole) and some of its metabolites could be found in the milk 3-6 hours post-treatment.

Discussion

Using zoopharmacognosy and interviews with people currently using ethnoveterinary and ethnomedicine based treatments has been an effective means of identifying plants for laboratory treatments. All of the plants tested have had activity against either endo- or ecto-parasites *in vitro*. However, as shown with *C. ambrosioides*, *in vitro* efficacy does not guarantee *in vivo* efficacy. In addition, the tests with *C. ambrosioides* showed that natural treatments can be harmful and leave residues in foods (milk, meat). The results of the *C. ambrosioides* tests clearly demonstrate the need for systematic efficacy and safety testing of plant treatments.

C. ambrosioides is not the only plant treatment that has been ineffective and raised safety concerns with "natural" treatments. The traditionally used powdered fruit of *Mallotus*

philippinensis and *Artemisia cina* were ineffective in *in vivo* tests (Cabaret, 1996; Jost et al., 1996). Stem bark of *Zanthoxylum liebmannianum* was effective *in vivo*, but the active compound (alpha-sanshool) caused seizures in mice (Navarrete and Hong, 1996).

Other *in vivo* tests with plants have shown more promise. Leaves of *Eucalyptus grandis* fed to goats for 7 days, significantly lowered *H. contortus* infection levels compared to non-treated goats and did not cause adverse reactions (Bennet-Jenkins and Bryant 1996). Tests with papaya latex, have shown that doses of 4 and 8 g/kg body weight decrease *Ascaris suum* infections in pigs. However, the higher dose did cause transient diarrhea (Satrija et al., 1994). Of the plant-based ecto-parasite treatments, one that shows good potential is *Gliricidia sepium*. When applied to cattle, it repelled ticks (*Boophilus microplus*) and warble flies (*Dermatobia hominis*) (Miranda et al., 1999).

Conclusions and Recommendations

Livestock owners who use plant treatments to control endo- and ecto-parasite infections need to be aware of the risks related to these treatments. Uncontrolled parasite infections (due to inefficacious treatments) can lead to decreased livestock productivity and sometimes death. Also, plant treatments can cause some of the same problems as currently used treatments toxic reactions and food residues. Given the growing interest in these alternative treatments, research into efficacy and safety is essential. Negative and positive results of livestock owner experimentation and laboratory *in vivo* studies need to be made readily accessible to the general public and forums for sharing information need to be developed.

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Table I. Plants Used to Treat Endo- and Ecto-parasite Infections in Livestock Plants Used in the Dominican Republic for Endo-parasites (most are being tested)[a]

Apocynaceae
Nerium oleander
Arecaceae
Mikania spp.
Ateraceae
Ambrosia artemisaefolia
Bignoniaceae
Catalpa longissima
Crescentia cujete Cactaceae
Opuntia ficus indica
Caesalpiniaceae
Cassia grandis
Chenopodiaceae
Chenopodium ambrosioides
Combretaceae
Laguncularia racemosa
Conocarpus erectus
Cucurbitaceae
Momordica charantia
Euphorbiaceae
Jatropha gossypifolia
Fabaceae
Cajanus cajan
Centrosema spp.
Lamiaceae
Plectranthus ambionicus
Malvaceae
Gossypium barbadensis
Mimosaceae
Prosopis juliflora
Moraceae
Cecropia schreberiana
Passifloraceae
Passiflora quadranqularis
Phytolaccaceae
Petiveria alliacea
Poaceae
Melinis minutiflora
Portulacaceae
Rubiaceae
Coffee arabica
Spermacoce assurgen
Rutaceae
Citrus aurantifolia
Citrus aurantium
Citrus limeta
Scrophulariaceae
Capraria biflora
Smilacaceae
Smilax aff. rotundifolia
Sterculiaceae

Senna alata
Senna alexandria
Caricaceae
Carica papaya
Malphighiaceae
Bunchosia glandulosa
Portulaca oleraceae
Rhamnaceae
Gouania spp.
Guazuma tomentosa
Vitaceae
Cissus verticillata

Plants Used Elsewhere for Endo-parasites (not being tested at Cornell University)

Arecaceae
Areca catechu
Asteraceae
Senecio lyratipartitus
Burseraceae
Boswellia dalzelii
Euphorbiaceae
Croton macrostachys
Erythrina senegalensis
Leguminoseae
Leucaena glauca
Menispermaceae
Cissampelos mucromata
Palmaceae
Cocos nucifera

Plants Used in the Dominican Republic for Ecto-parasites (most are being tested) [a]

Apocynaceae
Nerium oleander
Bixaceae
Bixa orellana
Fabaceae
Gliricidia sepium
Malvaceae
Pavonia fruticosa
Melastomataceae
Miconia laevigata
Meliaceae
Azadirachata indica
Papaveraceae
Argemone mexicana
Phytolaccaceae
Petiveria alliacea
Piperaceae
Piper aduncum
Rubinaceae
Morinda royoc

Plants Used Elsewhere (not being tested at Cornell University)

Annonaceae
Annona squamosa
Araceae
Acorus calamus
Ascelpiadaceae
Sarcostemma viminale
Bombacaceae
Adansonia digitata
Caesalpiniaceae
Cassia alata
Caprifoliaceae
Sambucus canadensis
Euphorbiaceae
Euphorbia bicolor
Euphorbia marginata
Ricinus communis
Leguminosae
Amorpha fruticosa
Baptisia tinctoria
Liliaceae
Aloe ferox
Veratrum album
Meliaceae
Azadirachta indica
Piperaceae
Piper auritum
Polygonaceae
Polygonum hydropiper
Solanaceae
Nicotiana tabacum
Verbenaceae
Tectona grandis

Sources for plants not used in the Dominican Republic: Hammond et al., 1997, Mateo, 1992, Matzigkeit, 1990, Palacpac-Alo, 1990.

[a] Some of the plants listed are used in human medicine and not for animals. Also, some of the endo-parasite plants are used to treat stomach pain and are only used in parasite treatment mixtures.

Table II. *In vitro* Bioactivity of Plants Used in Endo- and Ecto-parasite Treatments

Plant	Ovicidal	Larvicidal	Repellent	Antibacterial
Bixa orellana (seeds)[a]	X	--	X	--
Catalpa longissima[a]	X	X	--	X
Chenopodium ambrosioides[b]	X	X	NT	NT
Cissus verticillata (vinestock)[d]	X	NT	--[c]	--
Clusia rosea (seeds)[a]	NT	NT	X	X
Conocarpus erectus[a]	--	X	NT	X
Crescentia cujete[a]	NT	NT	X	X
Jatropha gossypifolia[a]	X (leaves) -- (roots)	X (leaves) -- (roots)	X (root)[c]	--
Laguncularia racemosa[a]	--	X	NT	--
Melinis minutiflora (roots)[a]	NT	NT	X	--
Nerium oleander[c]	NT	NT	X	--
Passiflora quadranqularis[a]	X	NT	X	--
Petiveria alliacea (roots)[c]	NT	NT	X	--
Senna alata[a]	X	NT	--[c]	--
Senna alexandria[a,d]	X	--	NT	NT

X = exhibited activity -- = did not exhibit activity NT = not tested

Notes: Leaves were used for all extracts, unless otherwise indicated.
Ovicidal and larvicidal tests used *H. contortus*.
Repellency tests used *Alphitobus diaperinus*.
Antibacterial tests were conducted with *B. cereus* and *P. aeruginosa*.

a Ethanol extract
b Plant oil
c Methanol/chloroform extract
d Water extract

Herbs and Alternatives in Equine Practice

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Abstract

Complementary and alternative veterinary medicine (CAVM) in equine practice is a broad subject. Understanding the concept of health and disease is central to deciding whether to treat an individual animal. Many common, low-grade signs of ill health are considered normal by most veterinarians. The normal balance of beneficial bacteria in the intestinal tract is critical to the health of the whole animal since the bacteria do most of the work making minerals available to the horse's body, as well as manufacturing vitamins. Horses have the natural ability to select the minerals they need if they are offered the minerals in a palatable form without sweeteners to disguise the taste. Plant and soil health, as well as soil mineral content and availability is achieved through a healthy soil bacterial population which converts minerals into a form the plants can use. Feed processing can be a detriment to the nutritional status of feed and consequently the animal. Homeopathy and herbal medicine are generally used to treat specific diseases, while nutrition is often used to support the healing process. A short introduction to methods of treatment used in equine practice concludes this paper.

Key words: equine, soil, minerals, intestinal flora, alternative medicine

Introduction

Complementary and alternative veterinary medicine (CAVM) in equine practice is a broad subject encompassing acupuncture, chiropractic, homeopathy, herbal medicine and nutrition. This paper will discuss alternative medicine in equine practice and its relationship to soil health. Intestinal health is directly related to soil health in that both function optimally when the beneficial bacteria are in balance. As feed becomes more processed, less nutrition is available for the horse. A brief introduction to the treatment of disease in equine practice covers homeopathy, herbs and nutrition related to the intestinal tract.

What is health?

When looking at medicine holistically, the first question to ask is what is health? Health is defined as freedom from disease. In conventional medicine "normal", chronic conditions are accepted as healthy, as long as the animal is considered free from devastating illness. In other words, many signs of chronic disease, when not life threatening, are accepted as normal health. According to this definition many domesticated horses are not truly healthy. Many horses have low-grade problems that few people regard as signs of ill-health; the practitioner simply treats each symptom as it appears.

True health in holistic terms is freedom from any signs of disease. It includes the ability to acquire common, self-limiting diseases, such as the flu, and have adequate immunity such that the

illness is short-lived and requires little medication to recover. A healthy individual should mount a strong reaction to an infectious disease, often running a high fever (up to 105EF or more) for a short period of time, followed by a quick recovery.

A horse, by nature, is a prey animal. It lives in areas with scrub-type vegetation, and moves twenty hours a day eating, with about four hours spent resting and sleeping. Humans expect horses to adapt to our ways of living, eating and exercise, and, for the most part, horses do this very well. However the levels of stress brought on by the unnatural living conditions create chronic disease and weakened immune systems.

Signs of chronic disease

Signs of disease manifest as mental or physical symptoms that range from mild to severe. Any deviation from health can be considered a sign of disease, but may only indicate an imbalance in feed. It is important for humans as guardians of animals to become more observant of the following signs of disease.

Mental signs that chronic disease may be present include excessive fears, nervousness and inability to adapt to change. Horses with repetitive behaviors such as weaving, stall-walking, self-mutilation or cribbing appear addicted to these behaviors and are probably not dealing with the stresses of confinement very well. If a horse is having a hard time adapting to the stress of confinement, the immune system is probably being compromised and the horse's health may deteriorate.

Typically horses that are either consistently underweight or overweight have a problem with chronic disease. Underweight horses may have trouble digesting or utilizing food, or they may have low-grade liver disease or cancer. Horses chronically overweight, especially those with fat deposits and "cresty" necks, may have metabolic problems but may simply be overfed and underexercised .

The respiratory system is commonly affected in the chronically ill horse. Allergies usually manifest as heaves and allergic coughs (although allergies with itchy skin are commonly seen in the warm climates). Allergies are a sign of immune system imbalance and overreactivitly. Many high-speed horses (racing, eventing, steeplechasing) bleed from the lungs, showing signs of weakness in the respiratory tract. Foals with upper respiratory "snots" of several months duration may be considered normal by conventionally trained individuals. However, from a holistic perspective, protracted infections are an indicator of disease.

Skin is the largest organ in the body, and internal health and nutritional state are reflected in the skin and hooves. The dry, dull, bleached coats on which people spend fortunes, can be best treated from the inside using a complete holistic approach. One of the primary signs of a healthy horse is a deep rich color to the hair. Truly healthy horses have a glow to their coat and they do not bleach out in the sun.

Allergies, especially itching eruptions, are signs of chronic immune system problems (Dodds, 1993), and though skin allergies are difficult to cure with any form of medicine, the holistic approach is often successful. Often, seemingly simple conditions like dermatophilis ("rain rot", etc.) are signs of subtle disease. All horses on a given property may be exposed to a causative agent, yet only a subset of the horses succumb to the infection. As horses are cured from chronic disease, skin conditions including warts, sarcoids, oily or sticky sweat, discharges from the sheath, poor wound healing and excessive scar tissue production tend to resolve.

Feet are an adaptation of the skin structures, and the old adage, "no foot, no horse", is as true today as when it originated. Poor nutrition, chronic disease and weather conditions play

important roles in the health of the foot, as does the quality of the farrier work. Cracked, brittle or dry feet as well as soft or crumbly feet can be signs of chronic disease. Thrush, white line disease, abscesses and seedy toe need to addressed from a holistic standpoint and be considered as subtle signs of disease.

Gastro-intestinal disorders are an important disease entity, as colic is the number one killer of horses. However, most facilities where colic is common have identifiable management problems, especially when taking into account horses' natural grazing and exercising habits. Lack of correct roughage is one of the primary causes of colic, since the equine gut is designed for long stem roughage and not concentrates. The stress of confinement contributes to colic, as does the overuse of antibiotics and dewormers. Horses with chronic digestive tract problems including dry feces, soft feces, ulcers, sensitivity to change in diet or weather, odiferous stools, failure to digest completely, cravings for dirt, salt or wood, fussy eaters and various mouth problems probably suffer from chronic disease.

The reproductive system is affected by nutrition, management, heredity and chronic disease. Horses are selected for desirable performance and are not selected for reproductive health as they are in the wild. Mares have many problems, both physical and behavioral, associated with their heat cycles. Infertility of the male and female, including lack of libido, sterility, ovulation problems and chronic uterine infections of all types, can often be corrected holistically.

Equine musculoskeletal problems, which usually manifest as lameness, are a common reason for horse owners to seek veterinary services. Lameness is yet another sigh that can be an indication of disease in the horse. Muscle stiffness and tying up, as well as weak tendons and ligaments, may have a nutritional or chronic disease origin. Arthritic changes in the joints, including navicular syndrome, can result from an ill-fitting saddle, shoeing, nutrition or chronic disease. From a Chinese perspective, constant swelling or stocking up of the legs indicates poor digestion (Xie, 1994).

The signs discussed above are merely an introduction to the signs of chronic disease and are presented to stimulate thought about the current state of health in our horses. Typically disease symptoms are resolved best by treating the chronic disease with the appropriate therapy (homeopathy, acupuncture, chiropractic, herbal medicine and others), nutrition and management changes.

Intestinal health as the foundation of all healing

Horses are designed by nature as foraging animals; they were made to graze on whatever scrub, grass and weeds were available for the greater part of each day. During this time they move continually, except for relatively short periods spent sleeping. If they become ill, a wide selection of herbs (weeds) are available, in many pastures, to help remedy their health problems. Today, commercialization of nutrition into bags of feed and supplements along with rich cultivated pastures have changed equine nutrition habits from rough forage to processed feeds and rich grass. The lack of biodiversity in the pastures plus the modern feeding practices contribute to poor intestinal health.

Physiology of equine digestion

The equine digestive tract is a unique system that allows the animal to obtain nutrients and energy form a variety of feedstuffs. Horses use acid digestion in the stomach and fermentation in the cecum in the digestive process. The stomach absorbs water and begins protein digestion

primarily through the action of pepsin. The stomach's acidic environment allows for ionization and subsequent absorption of some minerals such as calcium, magnesium, manganese and iron (Kimbrough, 1995). The small intestine then hydrolyses the protein, fat and carbohydrates into the final form for absorption. The fermentation vat, the cecum, is perhaps the most important part of the equine digestive tract since it is here that the fiber portion of the diet is digested. The cecum is designed to break down and ferment long stem fiber and through bacterial metabolism produce vitamins and fatty acids. Horses evolved to graze continually in the wild to keep the digestive tract full and moving. The common practice of feeding twice a day does not keep the food moving through continually and can lead to poor digestion or colic (Clarke, 1990, White, 1993).

The intestinal environment is a miniature eco-system where each player has a place and a job, just as a symphony, and if any piece is out of place, the whole is affected. The intestinal tract contains bacteria and protozoa designed to digest food, manufacture vitamins and fatty acids and make minerals available. Bacteria inhabiting the intestinal tract are pH specific in their requirements for growth, so they are found where the correct pH is for each bacterial species. The bacteria use dietary fiber in the digestive tract as an energy source. They live on the fiber not in the intestinal wall. Consequently when fiber is deficient, the bacterial population is not healthy (Folino, 1995). When the horse is fed mostly concentrates in the form of grain and very little long stem fiber such as hay, the incidence of colic is higher.

Bacterial and the pH of the digestive tract are intimately related. The normal pH of the intestinal tract changes from acidic in the stomach and upper small intestine, moves towards neutral in the lower small intestine and becomes close to neutral in the large intestine (Swenson, 1977). With incomplete digestion and poor quality feeds, the pH and motility can become altered, allowing pathogenic bacteria move up from the alkaline large intestine, into the acidic small intestine potentially causing diarrhea to occur. Alternatively, if the pH of the large intestine becomes more acidic, and the acidophilic bacteria move down, the large intestine can become irritated.

Natural, raw food has all the bacteria and enzymes needed to aid digestion, however, processing often destroys them. The healthy digestive tract, can still digest good quality cooked or processed food since the healthy bacteria and the enzymes already present in the digestive tract will continue to function even though new bacteria are not introduced in processed food. The unhealthy digestive tract has difficulty functioning with poorer quality feed. Live foods also appear to have a "life force" that cannot be put into a package or processed into a ration.

Anything that occurs in the animal's life to upset the natural balance of the intestinal tract flora will affect digestion and direct utilization of the food. A course of oral antibiotics upsets the digestive flora balance and should only be used in specific appropriate situations (Schmidt, 1993). Overuse of antibiotics and non-steroidal anti-inflammatory drugs have been shown to increase intestinal permeability, allowing improperly digested or foreign material to enter the bloodstream. One of the side effects of antibiotics is suppression of the immune system.

Other factors that appear to disturb the normal digestive flora are frequent use of dewormers, illness, confinement, the stress of being worked while in pain (a common happening in today's horse world), and changes of diet. The latter are very common since most feed manufacturers use least-cost programs to formulate feed. The more horses are confined, stressed and managed by humans, the more nutritional deficiencies and imbalances the veterinarian will find.

Minerals

Mineral availability and balance is probably the most important aspect of nutrition and healing in equine practice. Most modern farms consist of chemically fertilized soils planted repeatedly with the same crops. This leads to depletion of trace soil minerals and subsequent mineral depletion of harvested grains used as feed. There is a complex interaction between many minerals; even a slight excess of one mineral in a diet can mean another mineral may not be properly processed. In nature each "weed" has a trace mineral associated with it, so if a particular mineral is needed the horse will eat the weed. Also, if the soil needs a particular mineral a certain weed will grow there to provide that mineral (McCaman, 1994).

A new branch of science called zoopharmocognosy involves the study of animals and their natural ability to select plants and herbs according to their needs and particular illnesses (Lipske, 1993, DeMaar, 1993). Horses will naturally select from free-choice minerals as long as they are not too sick to sense their needs through instinct and odor recognition. Conventional nutrition research reports that no species can accurately select free-choice minerals. However, upon observation it becomes apparent that the seasonal variations in mineral and vitamin consumption are significant.

Free-choice minerals need to be fed with salt provided separately. If both are fed together with salt in a mineralized salt block, the salt will limit the mineral intake due to the high salt content (about 95%). When horses are given plain free-choice minerals the quantity they eat is often astounding. Most horses will eat two to three times the normal intake for a few months or until they have balanced out their minerals, then will taper off to a maintenance level. Artificial flavorings, salt and molasses should not be used in combination with free-choice minerals as they may affect the natural selection of the nutrient.

In the author's opinion, the best way to approach mineral nutrition is through a free-choice system, with the salt and mineral separated. Very few companies provide a plain mineral supplement; usually salt will be in the top half of the ingredient list. Avoid unbalanced single minerals or combinations of just a few minerals unless they are given free-choice (and are palatable for that purpose). Many products are formulated based on human requirements, which may not be appropriate for the nutritional needs of the horse. Racehorses are constantly given iron tonics to "build their blood", but most horses this author has tested have had normal levels of iron.

Soil and plant health

Horses are often not considered as having a role in sustainable agriculture. However, the ownership of horses is vitally important to maintaining open land in rapidly developing areas. In fact, horses are a primary source of agribusiness in many states.

Since feedstuffs are grown in soil it is important to understand soil health as much as it is to understand animal nutrition. Knowledge of soil health is almost nonexistent in the equine world, as horse owners and veterinarians do not consider themselves farmers or caretakers of the land. Very little organic grain is used in the equine world, even by people who are heavily into natural healing. This is due in part due to the lack of availability.

Achieving soil health parallels achieving intestinal health in many ways. Soil minerals become available to the plants through bacterial action. Organic matter provides the substrate for healthy bacterial growth just as soluble fiber does in the intestinal tract (Ridzon 1994). A lack of a healthy bacterial balance in the soil leads to poor mineral absorption, soil compaction and poor plant health (Walters, 1996). Poor plant mineral content leads to poor animal nutrition, even

though the grain or hay produced may look big, green and healthy after adding nitrogen.

The soil in which most of our grains are grown is heavily fertilized with conventional fertilizers, replacing only three of the nutrients needed to make the plants look healthy. Many horse owners religiously fertilize their soils leading to grass that is too rich for the digestive system of the horse. Some use herbicides to improve the aesthetic appearance of the pasture, which they equate with their lawn. Many do not realize that the weeds (herbs) have a place in the eco-system of the pasture, nor do they understand the toxic load placed on their horses liver and kidneys.

Most herbicides contain estrogenic compounds. The estrogenic nature of these chemicals is altering the balance of hormones in the body (Krimsky 2000). In the world, mares are supposed to go into a winter anestrus (no heat cycles), however in recent years most of the mares in this author's practice cycle through the winter routinely. This indicates an imbalance in the hormonal system.

Genetically modified grains are used in increasing amounts. Most bags containing corn have at least some genetically modified grain present. The implications of genetic alterations of food are unknown at this time, however research from other countries does not support this practice in humans.

Once the feed is harvested, it is heavily processed in most cases. Horse feed is more frequently being ground up, cooked at high temperatures and extruded or pelleted in a process similar to dog food manufacturing. It is impossible to determine the exact quality of ingredients going into the processed feed. Preservatives are being used increasingly, adding to the liver's toxic load. The ideal way to provide better nutrition is to select pre-cleaned (dust free) plain whole grains as a base, then add specific ingredients for the individual horses or herds as needed.

Treatment of disease

Once the basic nutrition has been corrected, the alternative practitioner can then use herbs and homeopathy to treat specific diseases, as well as targeted nutrition to correct or support the tissue involved. Herbal medicine refers to the use of raw or processed herbs in their whole form. Homeopathy refers to the science of using very dilute substances to treat diseases that are similar to those that can be created in a healthy individual if that individual takes the substance in a concentrated form.

A detailed history and thorough physical exam are the most important parts of the diagnostic decision-making in a holistic practice. All of the traditional veterinary diagnostics, such as blood tests and radiographs, are utilized but are often given a lower priority. Alternative medicine requires more detailed information than conventional medicine in order to tailor the treatment to the individual rather than the disease.

Homeopathy

Homeopathy is one of the most versatile modalities used in natural healing. The remedies are made according to international standards and their manufacture is regulated by the FDA. Education of the practitioner is vitally important to the success of the prescription.

The remedies can be used to treat many different conditions. Infections are readily treated with skillful use of the remedies. These can range from a simple cut or cold to a sinus infection or osteomyelitis (bone infection), depending on the experience of the practitioner. Many eye problems such as corneal ulcers and "moon blindness" and internal imbalances such as liver, kidney and reproductive diseases respond well to homeopathic remedies. Colic and stomach

ulcers can also be treated, though it must be remembered that a complete diagnosis is required to be sure there are no life threatening problems being overlooked. Respiratory disease including allergic conditions can be treated. Musculoskeletal conditions such as laminitis, tendonitis, navicular and bone spavin are frequently alleviated homeopathically.

Basic first-aid homeopathy is fairly straight forward. Required information includes appearance, amount of pain, colors of discharges, odors, and modalities (what conditions influence animal or affected body part for better or worse - cold, hot, pressure, touch, motion, weather)(Day, 1984). A quick response to treatment can be expected. Common traumatic injuries such as open wounds and bruises respond very well.

Treating chronic disease with homeopathy, often called constitutional treatment, requires a complete history. With a complex case this may take up to an hour, though often a limited history is all that is available. All body systems must be covered completely. The condition present needs to be described in as much detail as possible, especially how the condition responds to hot, cold, touch, motion and weather. The response to the remedy will be much slower than when treating an acute condition. Results may not be seen for up to two weeks, so the horse owner must be patient.

Herbal medicine

Herbs have been used by all cultures for centuries; each area of the world uses herbs local to that area. Western herbs tend to work slowly to restore health and balance to the body, while Chinese herbology contains some fast acting herbs (antibacterials and antivirals). Chinese formulas can be much deeper acting and can cure problems faster, however, in general the practitioner needs a knowledge of Chinese medicine in order to prescribe accurately. Chinese herbology has been used with animals for centuries. There are many animal studies published on Chinese herbs, however, the translations are not complete at this time. Clinical experience with Chinese herbal formulas used in the United States is growing.

Herbs are generally used together in a formula, so the quality of a formula depends on the skill of the person putting it together. The efficacy and potency of a formula is affected by the quality of the raw ingredients. The best manufacturers test each batch for purity and strength but many companies cut corners by using inferior quality raw materials.

Herbal medicine can be used to treat arthritic conditions, immune system problems, diarrhea, colic and other digestive upsets. Internal medical problems including liver, heart, stomach, lung and kidney imbalances can be helped with many herbal formulas. Behavior can be altered with herbs by relaxing the muscles or toning down the nerves. Premade formulas for animals (Western and Chinese) are becoming more commonly available and are an excellent way to use herbs in practice.

Nutrition for the intestine

Since the intestinal tract is so frequently bombarded with antibiotics and non-steroidal anti-inflammatories, many horses will need therapy directed at repairing the intestine. High quality probiotics should be used to help replace the intestinal flora. Lactobacillus sporogenes is one probiotic (healthy bacteria) that does not need refrigeration so is well adapted to use in the barn. Fermented probiotics with enzymes can help the repair the gut wall, while the amino acid l-glutamine provides energy for the cells lining the intestinal tract. Certain herbs such as Slippery Elm can sooth the digestive tract and promote healing. The acidity of the stomach needs to be maintained for protein and mineral digestion so the use of alkalinizing agents such as bicarbonates and antacid drugs should be discouraged. Homeopathic remedies can also be used to help heal the intestine provides they are carefully selected to fit the profile of the patient.

Conclusion

The role of the horse in agriculture is important. Equine health from a holistic perspective relates closely to soil and plant health. When treating horses using alternative medicine it in important to consider all aspects of health form identifying subtle signs of ill health to treating the soil where the food is grown.

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Toxic Plants and Livestock Health

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"In order for a plant to be functionally poisonous, it must not only contain a toxic secondary compound, but also possess effective means of presenting that compound to an animal in sufficient concentration, and the compound must be capable of overcoming whatever physiological or biochemical defense the animal may possess against it. Thus the presence of a known poisonous principle, even in toxicologically significant amounts, in a plant does not automatically mean that either man or a given species of animal will ever be effectively poisoned by the plant." (Kingsbury JM. 1979)

With the increase in the use of herbal remedies for treating both human and animal diseases, it is important to recognize that many plants contain toxic components that may have therapeutic as well as poisonous outcomes depending upon the dose of the toxin consumed. A classical example of this is the glycoside digitalis from foxglove that has proven therapeutic benefits, but if overdosed can induce fatal cardiac conduction disturbances. The quantity of toxin present in a plant can be quite variable depending upon the stage of growth, soil composition, moisture content, and whether or not it is growing in shade or full sun. Animal species response differences to toxins vary widely. Ruminants for example are far more likely to develop nitrate and cyanide poisoning from plant sources than are horses. Sheep can eat larkspur (*Delphinium* spp.) without problem, while cattle are very susceptible to fatal poisoning from these plants.

Cattle and sheep can adapt to eating some toxic plants if they are allowed to gradually increase the amounts of the plant eaten over 1-2 weeks. This allows time for the rumen microflora to adapt to a new substrate that they can metabolize into a nontoxic substance. An example of such adaptation is the ability of sheep to consume large quantities of Halogeton (*Halogeton glomeratus*) that contains high levels (30% dry matter) of soluble oxalates if they are gradually introduced to the plants over 1-2 weeks. Animals on a balanced and adequate plain of nutrition are also better able to tolerate greater levels of toxin as can be seen in cattle that can tolerate higher nitrate consumption if they are fed a ration containing grain as opposed to a low energy roughage diet.

In addition to the plant toxins themselves, livestock health is often compromised by the presence of fungal toxins that may contaminate livestock food sources. Some fungi can infect plants as they are growing, while others grow in plants after they have been harvested and stored inappropriately. Fescue poisoning resulting from the presence of an endophytic fungus (*Neotyphodium coenophialum*) growing in tall fescue grass (*Festuca arundinaceae)* is a well recognized problem in cattle and horses especially in the south eastern States. A similar mycotoxin-induced disease is paspalum (Dallas) grass staggers resulting from the ergot-producing fungus *Claviceps paspali.*

Red and white clovers are subject to infection with a fungus (*Rhizoctonia leguminicola),* which produces the mycotoxin slaframine. When consumed by horses and cattle it induces excessive salivation or slobbering. Aflatoxins produced primarily by *Aspergillus* flavus are a common

source of poisoning in all animals that consume grains that are moldy. There are also many other mycotoxins such as tricothecenes, ochratoxins and fumonisins that are a significant problem to livestock health. A severe neurological disease of horses, leucoencephalomalacia, results from horses eating moldy grain containing fumonisins produced by the fungus *Fusarium moniliforme.*

When investigating plant poisoning it is important to take into consideration the intrinsic toxins present in plants, the potential for contaminating mycotoxins, species susceptibility and the cumulative effects and potential interactions of chemicals in plants or plant products fed to animals. For example, a horse treated with Russian comfrey containing pyrrolizidine alkaloids, that is also exposed to moldy feeds with aflatoxins, and/or is fed hay with hounds tongue (*Cynoglossum officinal*) in it, would have an increased potential for developing severe live disease as a result of the cumulative effects of these liver toxins. In many instances little is known about the effects of the interaction of plant toxins with other drugs administered concurrently to an animal!

Major Categories of Poisonous Plants

Plants Associated with Sudden Death in Animals
Cyanogenic glycosides

Acacia spp.	Cat claw, acacia
Amelanchier alnifolia	Service, Saskatoon berry
Bahia oppositifolia	Bahia
Mannihot esculentum	Cassava, manihot, tapioca
Cercocarpus montanum	Mountain mahogony
Chaenomales spp.	Flowering quince
Cynodon spp.	Star grass
Eucalyptus spp.	Eucalyptus, gum tree
Glyceria spp.	Tall manna grass
Hydrangea spp.	Hydrangea
Linum spp.	Flax
Lotus spp.	Birds foot trefoil
Malus spp.	Crab apple
Nandina domestica	Heavenly or sacred bamboo
Phaseolus lunatus	Lima bean
Photinia spp.	Christmas berry
Prunus spp.	Chokecherry, pin cherry
Pteridium aquilinum	Bracken fern
Sambuccus spp.	Elderberry
Sorghum spp.	Johnson, Sudan grass
Sorghastrum spp.	Indian grass
Stillingia texana	Texas queen□s delight
Suckleya suckleyana	Poison suckleya
Trifolium repens	White clover `
Triglochin maritima	Arrow grass
Vicia sativa	Common vetch
Zea mays	Corn, maize

Plants use
Prunus sp
Apricot

Nitrate Accumulating Plants

Ambrosia spp.	Ragweeds
Amaranthus spp.	Pigweed
Avena fatua	Wild oat grass
Chenopodium spp.	Lamb's quarter
Cirsium arvense	Canada thistle
Convolvulus arvense	Field bindweed
Datura stramonium	Jimsonweed
Echinochloa spp.	Barnyard grass
Helianthus annuus	Sunflower
Kochia scoparia	Kochia weed
Malva spp.	Cheese weed
Melilotus spp.	Sweet clover
Polygonum spp.	Smart weed
Rumex spp.	Curly leafed dock
Salsola kali	Russian thistle
Solanum spp.	Nightshades
Solidago spp.	Goldenrods
Sorghum halapense	Johnson grass

Crop Plants Ni
Avena sativa
Beta vulgaris
Brassica napus
Glycine max
Linum spp
Medicago sativa
Pennisetum glauc
Secale cereale
Sorghum vulgare
Triticum aestivum
Zea mays

Alkaloids

Delphinium species	Larkspur
Aconitum spp.	Monkshood
Conium maculatum	Spotted hemlock

Plants use
Aconitum

Unsaturated alcohols

Cicuta species	Water hemlock

Plants Causing Heart Disease

Cardiac Glycosides

Digitalis purpurea	Foxglove
Nerium oleander	Oleander
Convallaria majalis	Lily of the valley
Apocynum spp.	Dogbane

Plants u
Foxglov
Dogbane
Lily of t

Cardio-toxic alkaloids

Astragalus and Oxytropis Spp.	Locoweeds
Cardio-toxic diterpenoids	
Rhododendron spp.	Rhododendrons & azaleas
Kalmia spp.	Laurel
Pieris japonicus	Japanese pieris

Plants Associated with Photosensitization

Primary Photosensitizing Plants

Ammi majus	Bishop's weed, greater ammi
Cooperia pedunculata	Rain lily
Cymopterus watsonii	Spring parsley
Fagopyrum esculentum	Buckwheat
Hypericum perforatum	St. John's wort,
Thamnosma texana	Dutchman's britches

Secondary or Hepatogenous Photosensitization

Agave lecheguilla	Agave
Bassia hysopifolia	Basssia
Cenchrus spp.	Sandbur
Cynodon dactylon	Bermuda grass
Descurainia pinnata	Tansy mustard
Kalstroemia	Caltrops
Kochia scoparia	Kochia, Mexican fire weed
Lantana camara	Lantana
Lolium perenne	Perennial rye grass
Medicago sativa	Alfalfa
Microcystis spp.	Blue-green algae, water bloom
Nolina texana	Sacahuiste
Panicum coloratum	Klein grass
Panicum spp.	Panic grasses
Polygonum spp	Knottweed
Tetradymia spp.	Horsebrush
Thamnosma texana	Dutchman's breeches
Tribulus terrestris	Puncture vine, caltrop
Trifolium spp.	Clovers
Vicia spp.	Hairy vetch

Plants Affecting the Liver

Senecio spp.	Groundsels
Cynoglossum officinale	Hounds tongue
Crotolaria spp.	Rattlebox
Amsinckia intermedia	Fiddleneck
Echium spp.	Blueweed
Symphyticum officinale	Comfrey
Xanthium spp.	Cocklebur

Plants Affecting the Nervous System

Aesculus spp.	Horse chestnut
Artemisia spp.	Sages
Astragalus spp.	Locoweed
Centaurea solstitialis	Yellow star thistle
Acroptilon repens	Russian knapweed
Corydalis spp.	Fitweed
Equisetum arvense	Horsetail
Eupatorium rugosum	Snakeroot

Haplopappus heterophyllus	Rayless goldenrod
Karwinskia humboldtiana	Coyotillo
Kochia scoparia	Kochia weed
Oxytropis spp.	Locoweed
Pteridium aquilinum	Bracken fern
Sophora secundiflora	Mescal bean

Plant Teratogens and Abortifacients

Plants Associated with Livestock Abortion

Agave lechequilla	Lechuguilla
Astragalus spp	Milk vetch
Brassica spp	Rape
Conium spp	Poison/spotted hemlock
Cupressus spp	Cyprus
Festuca spp	Fescue
Gutierrezia sarothrae	Broomweed, snakeweed
Halogeton spp	Halogeton
Indigofera spp	Creeping indigo
Juniperus spp	Juniper
Medicago sativa	Alfalfa
Phytolacca americana	Poke weed
Pinus ponderosa	Ponderosa pine
Solidago spp	Goldenrods
Tanacetum spp	Tansy
Trifolium spp	Clovers
Veratrum spp	False hellebore

Teratogenic Plants

Astragalus spp	Milk vetch, locoweed
Conium maculatum	European or spotted hemlock
Lupinus spp	Lupine
Nicotiana glauca	Wild tree tobacco
Nicotiana tabacum	Tobacco
Veratrum spp.	False hellebore
Blighia sapida	Akee
Colchicum autumnale	Autumn Crocus
Cycadaceae spp	Cyads
Datura stramonium	Jimson weed

Teratogenic Plants (continued)

Indigofera spicata	Creeping indigo
Lathyrus spp	Wild pea
Leucaena leucocephala	Mimosa
Oxytropis spp	Locoweed
Papaveraceae	Poppies
Senecio spp	Groundsel
Vinca rosea	Periwinkle

Plant Affecting the Mammary Gland

Snakeweed	*Eupatorium rugosum*	Acetylbenzofurans (tremetol)
Rayless golden rod	*Haplopappus heterophylus*	
Groundsels, senecio	*Senecio* spp.	Pyrrolizidine alkaloids
Rattle pod	*Crotolaria* spp.	"
Hound's tongue	*Cynoglossum* spp.	"
Fiddle neck	*Amsinckia intermedia*	"
Comfrey	*Symphytum* spp.	
Heliotrope	*Heliotropium* spp.	"
Viper's bugloss	*Echium* spp.	"
Mustards, Crucifers	*Brassica* spp.	Glucosinolates ***
Poison hemlock	*Conium maculatum*	Piperidine alkaloids (coniine)
Tobacco	*Nicotiana* spp.	"
Locoweeds (swainsonine)	*Astragalus, Oxytropis* spp.	Indolizidine alkaloids
Lupine (anagyrine)	*Lupinus* spp.	Quinolizidine alkaloids
Bitterweeds	*Helenium, Hymenoxys* spp.	Sesquiterpene lactones ***
Bracken fern	*Pteridium aquilinum*	Ptaquiloside
Buttercups	*Ranunculus* spp.	Protoanemonins ***
Onions, garlic	*Allium* spp.	N-propyl disulphide ***
Autumn crocus	*Colchicum* spp.	alkaloids (colchicine)
Avocado	*Persea* americana	Unknown toxin
Sage	*Artemesia* spp.	Monoterpenes, diterpenes ***

*** Plants that impart and abnormal flavor to milk.

Plants used for Homeopathic Purposes in Cattle and Horses

Aconitum	Monkshood
Apocynum	Dogbane
Phoradendron leucarpum	Mistletoe
Phytolacca	Pokeweed
Atropa belladonna	Belladonna
Bryonia	Wild hops
Buxus sempervirens	Box
Convallaria majalis	Lily of the valley
Cytisus scoparia	Scotch broom
Digitalis spp.	Foxglove
Melia azedarach	Chinaberry
Gelsemium sempervirens	Carolina jessamine
Symphyticum officinale	Comfrey
Hypericum perforatum	St Johns wort
Pulsatilla	Windflower, pasque flower
Rhus toxicodendron	Poison ivy
Thuja spp.	White cedar

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Web Resources

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2. http://cal.vet.upenn.edu/poison/ppstslmonks.htm
3. http://www.wam.umd.edu/~mct/Plants/poisonous.html (Medicinal and Poisonous Plant Databases)
4. http://www.library.uiuc.edu/vex/vetdocs/toxic.htm
5. http://res.agr.ca/brd/poisonpl/ (Canadian Poisonous Plants)
6. http://vm.cfsan.fda.gov/~djw/readme.html (Poisonous Plant Database USDA)
7. http://vet.purdue.edu/depts/addl/toxic/cover1.htm Indiana Toxic Plants
8. http://toxnet.nlm.nih.gov/ (Toxicology database)
9. http://www.ces.ncsu.edu/depts/hort/consumer/poison/poison.htm (Poisonous Plants of North Carolina).
10. http://www.extension.umn.edu/distribution/livestocksystems/DI5655.html (Minnesota Poisonous plants).
11. http://www.Botanical.com/botanical/mgmh/h/helbla14.html (Modern Herbal Index).
12. http://www.agric.gov.ab.ca/agdex/100/3066601.html (Poisonous Plants on Range and Pasture).
13. http://www.fau.edu/divdept/science/envsci/poison-pl.html (Poisonous Plants of Southern Florida).
14. http://www.caf.wvu.edu/~forage/library/poisonous/page19.htm (Poisonous Plants of the Southern States).
15. http://www.inform.umd.edu/EdRes/Topic/AgrEnv/ndd/goat/POISONOUS_PLANTS.html.

Animal Poison Control Center

http://www.napcc.aspca.org/

Homeopathy - Health from the Ground Up

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The workable and successful concepts of organic agricultural practices, grass based nutritional systems and holistic livestock healthcare have enabled farm families to survive and thrive into the 21st Century.

At the core of any sustainable holistic healthcare system is Homeopathy. It is very important for those entering organic agriculture to ponder the future and plan for any contingencies . Most of today's farmers are not old enough to remember farming without antibiotics. Because we have been accustomed to using conventional drugs, we can now substitute natural homeopathic medicines where drugs had formerly been employed.

Farmers who seek homeopathic consultation probably fall into three categories:

1. Those who are committed to holistic agriculture and will not turn back to harsh drugs
2. Those who have tried other forms of therapy and found them wanting
3. Those who are desperate as a result of sudden flare-ups of mastitis, high somatic cell counts, infertiliy or other diseases.

Homeopathy has many advantages when used in a knowledgeable manner. Farmers prefer it over harsh approaches because of its safety for the animals, farm family, and the environment, ease of oral dosing, and economic advantage. At times it may be cost effective and preferable to view a herd of any species (especially a dairy herd) as one patient. In those cases the simillimum can be determined and the entire herd receive the homeopathic medicine.

After graduation from University of Pennsylvania School of Veterinary Medicine in 1970, I practiced conventional medicine in southeastern Pennsylvania for five years. A restlessness developed as I did not see the successes and cures from the antibiotics, steroids, and conventional drugs that I was using. My search continued until 1981, when I was directed to Millersville University for the National Center for Homeopathy Summer School. There I heard such wonderful teachers as Henry Williams, M.D., Julian Winston, George MacLeod, MRCVS and David Wember, M.D. That was the springboard that started me, and the use of homeopathic and holistic therapies increased from that date.

By 1990 Bonnie and I were able to break from the conventional practice. In March 1990, the Clark Veterinary Clinic birthing process was completed with the support of both large and small animal clients. Initially a group of Lancaster county farmers asked if we would make farm visits and teach homeopathic medicines while performing herd health exams. That was like a second springboard that began our association with organic farmers.

John Muir said,"Everything is connected to everything else". Arthur Young, DVM repeated that thought when he said, " A small pebble makes a large ripple in a pond". As a

homeopathic veterinarian, you have a tremendous potential to have a ripple effect on the lives of both your patients and clients and on the agricultural community around you.

Some very wise homeopaths in the past saw this ripple concept and spoke about it at other American Institute of Homeopathy meetings. Dr. Marion Bell Rood, a practitioner in MI saw the deterioration of soil fertility and the wide spread use of antibiotics eventually causing a deterioration of human health as early as the 1940s. In 1948 Dr. H.W. Eilkenberry, Pres. AIH echoed the theme. "It is evident that a high percentage of our topsoil has been lost -yes, wasted- because of careless and negligent methods of farming and lumbering. Inasmuch as the topsoil is the rich and fertile part of the ground from which wholesome nourishing foods are produced, the loss of that rich and fertile topsoil has deprived us of much of the nourishment to which we are justly entitled," warned Dr. Eilkenberry.

The present situation in conventional and commercial agriculture emphasizes the application of N-P-K (Nitrogen, Phosphorus and Potassium) fertilizer rather than the increasing the organic matter of the soil. "That is all the plant needs", they say. However, the truth is that the more N-P-K fertilizer is applied to the plant and the soil the more the plant and soil becomes deficient. It is estimated that one pound of chemical Nitrogen destroys 100 pounds of soil Carbon. Levels of trace minerals such a Copper, Boron., Selenium, Zinc, Cobalt and Manganese continue to decline under these chemical applications. As deficiencies worsen, the rate of fertilizer application often increases until the only nutrients supporting the plant comes from fertilizer. Since the American people have been consuming these deficient foods from conventional farms (such as vegetables, meat, milk, eggs, yogurt, butter, cheese and soybeans), those deficiencies have been transferred to the public. And at the dawn of the 21st century 25% of American couples are infertile. And severe, chronic diseases are affecting the young at a much higher rate.

With organic agricultural practices, the emphasis is upon increasing the organic matter in the soil to a optimum level of 4% to 7%. With the application of manures and compost derived from organic farms the soil increases in vitality and fertility. When there is optimum organic matter, the soil acts like a sponge soaking up the rain and preventing erosion. The much desired minerals are retained in high Carbon soil, combined in organic compounds.

With organic, grass based agriculture the nutrients remain in the soil ready for plant use and in turn ready for consumption by the animals that are grazing on the nutrient rich plant. Growth (and production) of quality vegetables and fruits is dependent on the organic matter derived from the manure and compost from organic livestock. Numerous vegetable/fruit producers testify to the need for such organic material. The decomposition of fruit and vegetables waste does not replace the nutrients that are used as those foods are grown. Animals are essential for sustainable agriculture.

Two organic farms in Pennsylvania have unique and different histories. Farmer A bought his farm in 1992 while a member of the state government. At that time he and his family made a commitment not to use any chemical fertilizers with the thought that when his time is government service ended the farm could be developed into an organic dairy. In 1995, Farmer A began his grass-based dairy operation. An emergency situation of bloat occurred. A third of the herd had symptoms of bloat. The local veterinarian though apologetic offered no non-conventional

solutions. The farmer quickly sought homeopathic consultation. With frequent dosing of Carbo veg all the cows responded and not one was lost. That tense time was the springboard that confirmed his need for homeopathic medicine for his 34-cow herd.

Farmer S began conventional farming in 1986 but after three years his hard work matched his frustration. Initially very skeptical, Farmer S would sit back in the corner during my homeopathic lectures and asked questions that put me on the spot. He just wasn't convinced of the ability of homeopathic medicine to address the many health problems in his livestock, but he was an honest seeker after truth. Then a family pet goat became paralyzed. With no conventional drug options and pressure from his children, he relented and called for homeopathic consultation. Cicuta virosa was the remedy chosen with positive results. As the goat improved the medicine disappeared only to be found in the hands of their two-year old, the bottle empty. With assurances from their homeopathic medical physician than no harm had occurred, they pondered the fact that, "What other medicine could bring a paralyzed goat to its feet but not harm a two-year old child? Only a homeopathic medicine". That incident was the springboard that began their homeopathic adventure for their 100+ dairy herd, and other species of livestock on the farm.

Farmer A's farm although mildly neglected had not been abused by chemicals before he purchased it. It is often easier to take a neglected farm and return it to top condition than to take a chemically abused farm and try the same thing. Because an organic farm needs a 25 feet buffer zone surrounding it, a wise and courageous farmer will seek the support of his surrounding neighbors. This he did. All 12 neighbors agreed not to apply any forbidden fertilizers or chemicals on their 25 feet of property that joins Farmer A's land. That in itself was quite an achievement. It then was relatively easy to have every square inch of his land certified followed by the dairy cattle. Farmer A's farm would be best be described as a semi-seasonal, grass-based organic dairy. The missing link to his operation was of course Homeopathy.

Farmer S is surrounded by five other farmers, all skeptics. Even though they thought and communicated to him that he was "cracked", he continued to change methods toward sustainability. The 25-foot buffer zone is maintained by Farmer S on his land. At present, he and his wife and nine children operate a 280-acre grass-based semi-seasonal organic dairy.

Many of the universities find it difficult to accept the fact that an organic dairy operation can be profitable without having the farm family rely on "off the farm income". All the income of Farmer S is derived from the land, the crops, and the livestock.

A grass-based dairy operation means:
1. All of the farm produces grass or legumes for the purpose of grazing or hay making.
2. Only small amounts of grain are fed to the animals, or none at all.
3. The farm has only a few acres of non-grazing cropland compared to the large percentage of the land that can be grazed. "If you can't graze it you don't raise it."

A semi-seasonal dairy operation means:
1. The MAJORITY but not ALL of the livestock have their calves the same time each year and therefore are dry or non-lactating at the same time as well.
2. In Pennsylvania, births occur in March and April and the cattle are dry or non-lactating in

December, January and February.

A seasonal dairy operation means:
1. ALL the cows would be giving birth within a 4-6 week window of time and be dry or non-lactating nine months later hen they and hopefully the farmer and his family go on vacation (or attend a homeopathic meeting).

A conventional year- around dairy would have constant calving at all times of the year leaving little room for time off for the farmer and his family.

God did not intend cows to eat grain. Cows do not need to eat soybeans. The cow was not created to eat the things man eats. He created ruminants to convert forage into milk, and meat and hide and things for us to use. A conventional farm is feeding grain to these cows by the shovelfuls and then they have to give drugs in large quantities to combat the acidosis produced by the high levels of grain and the stress of confinement and crowding.

Chemical fertilizers began to be promoted after World War I. for economic reasons, Germany did not want to close the munitions plants that produced the explosives. Instead they took the same raw materials and began to manufacture fertilizer. What happen in Oklahoma City? What blew up that federal building? A truckload of fertilizer.

By 1950, many of the world's farmers had become convinced that all you need to grow bigger crops was to put a little ammunition - N-P-K fertilizer on the plants. The Nitrogen, Phosphorus, and Potash compounds on the plants would produce higher yields. Now the farmers of the year 2000 are paying for the sins of the farmers of the 1940's and 1950's. Fortunately Farmer A and Farmer S are not going that route. As Farmer S would say," I'm religiously opposed to chemical fertilizers".

In 1990, our practice serviced one organic dairy in Vermont. Opportunities developed to allow my wife and I to lecture and instruct farmers and veterinarians in the principles of homeopathy for the health needs of their organic farms.. At present there is an dramatic increase in the number of organic dairies. In the first 9 months of 2000, about 1300 dairy farms were certified in the US. It is growing at about the same rate as homeopathy - 25% to 35 % growth per year. Now the consumer need not be limited to a quality organic restaurant like NORA in Washington, DC but can travel to an organic farm and purchase their organic vegetables, chicken, turkey, yogurt, cheese, milk, eggs and meats directly from the farmer.

What homeopathic medicines did Farmer A use his first year? For the bloating symptoms, Carbo veg was dosed frequently. Later when a new pasture was opened, the drinking water was medicated with Carbo veg and cows were encouraged to eat a little dry hay and take a drink before grazing. A few stubborn cases of bloat were dosed with Nux vomica in alteration with Carbo veg.

The first year of farming Sepia was prescribed for each missed estrus. A dairyman knows that the cow was hiding her estrus(receptivity) yesterday when he observes blood tinged mucous on her tail today. It is too late to breed her today since ovulation is passed. After Sepia, she will

again be receptive in 19 or 20 days. Cows in proestrus were given Ovarian before each breeding. This homeopathic nosode prepared from the fluid of a healthy ovary helps to regulate ovulation.

Today, Farmer A employs Arnica in cases of trauma, Phytolacca in painful mastitis, and Aconite for acute fevers. The next most frequently used medication is Lycopodium which is effective in the prevention and treatment for the metabolic condition known as ketosis.

Farmer S in his first homeopathic year found that Calcarea Carb and Calcarea Phos were strongly therapeutic in maintaining milk production and fertility in the herd. Calcium was likely deficient over the entire farm in those early years. Conventional farming practices and N-P-K fertilizer often produce deficiencies of Calcium, Carbon, and trace minerals. Applying manure and compost year after year will replenish these soil nutrients.

In addition to Sepia in postestrus, dosing with Pulsatilla in proestrus and Ovarian in estrus was helpful for the herd during the 1991 breeding season. Regular herd health exams continued for two years with no major episodes. In 1993, Farmer S experienced a rash of illness in livestock. The cause was found to be mold in the corn silage. Afterward, the family began diligently seeking a feeding program that did not rely on corn silage.

Both family farms have enjoyed some measure of economic freedom since converting to grass-based organic dairying. Farmer S in 1998 recorded an income of $764.00 per cow per year. His cull rate was 18%. The national conventional average is 40% to 50%, and the organic cull rate average is 30% to 33%.

These two farm families are examples of success in organic dairying. Using homeopathic medicines (and principles) lead to both success and sustainability. If questioned, I am sure that each family member would be enthused about the progress of the past and plans for more sustainability in the future.

International Trade, Beef Production, and Food Safety: Lessons from the 20th Century

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Beef production, distribution and consumption at the beginning of the 21st century raises many ecological, human health and international trade concerns. Beef is among the most highly consumed foods in the US, both by adults and children. Children face special risks from residues and contaminants in foods. Rapid rates of growth and development of children's organ systems and functions may make children more susceptible to adverse health outcomes from exposure to biological and chemical hazards. Potential chemical hazards include veterinary drug residues especially hormones and antibiotics, and pesticides. Risks associated with these residues are vigorously contested among food safety experts, and reflect differences among national regulatory systems, risk assessment methods, and approaches to risk management.

Considerable uncertainty surrounds understanding the distribution of these residues in the US food supply, resulting from sampling and analytical detection methods. Some residue data are classified as confidential business information by federal agencies, inhibiting the public's ability to review and participate in government risk assessment and management efforts. The US legal system evolved during the 20th century permitting government to regulate chemicals individually rather than as mixtures. US law also has allowed USDA and EPA to balance health risks against economic benefits when setting allowable pesticide residue limits in foods. This decision standard was altered by the 1996 Food Quality Protection Act, that now demands residue limits be set to ensure 'a reasonable certainty of no harm' . Transforming the US pesticide regulatory system from one governed by a risk-benefit balancing standard to one that ensures a 'reasonable certainty of no harm' has proven to be an extraordinary challenge.

The European Union has adopted the 'precautionary principle' when establishing acceptable levels of risk for some products. In practice this may result in the choice of additional safety factors lowering or prohibiting certain pesticide and drug residue levels and these may result in trade barriers against imports that do not comply with the more cautious standards. The European Union ban on US beef treated with bovine growth hormone provides an example. Distinguishing between trade protectionism and legitimate national concerns over environmental health risks is becoming increasingly difficult, and often demands interpretation of complex and uncertain scientific information on risk. A contrasting approach is demonstrated by the Cartagena Protocol on Biosafety concluded in January 2000. This international agreement requires "informed consent' of a nation prior to the release of a genetically modified organism into its environment.

The paper concludes with a recommendation that knowledge of environmental health threats including chemical residue and toxicity data be freely accessible to the world community as international common property. Further, deliberations to set acceptable levels of risk from products traded internationally 'by WTO, CODEX, and others' should be conducted in a transparent manner.

The Antisecretory, Analgesic and Gastrointestinal Healing Properties of Sangre De Grado Reflect a Common Mechanism Vanilloid Receptor Antagonism

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Introduction

Sangre de grado is a medicinal treasure from Amazonia, but its effectiveness for a diversity of conditions has not been well appreciated in the developed world nor utilized for health maintenance. The reasons for this lie in a lack of knowledge as to how it works, as well as a general poor understanding of Amazonian medicinal plants per se. These problems can be resolved by research and information dissemination of. The value of Amazonia's medicinal plants are often maligned by reiteration of substandard and preliminary research, inappropriate and unsubstantiated claims and influence of commercial entities. We need objective evaluations and responsible reporting of applications, actions and therapeutic possibilities.

Sangre de grado: Ethnomedical Background

Derived from several Croton species (*Croton dracanoides, Croton palanostigma, Croton lechleri*), Sangre de grado is readily available in the Amazon, with the highest quality originating in the Upper Jungle of Peru and Ecuador. The tree is fast growing, reaching heights of 40 feet in three years. Current experimental farming techniques are focusing on growing and felling the trees in a 2-3 year cycle. At this time a tree will have grown to a height of 20-30 feet and produce approximately 1.5 liters of sap; a large quantity considering that Sangre de grado is applied drop by drop. Sangre de grado is best cultivated with other plants; as a stand alone crop it is ravaged by pests, retarding the growth and health of the Croton tree.

Sangre de grado is utilized for a diverse array of conditions (1-4), but we believe there are common mechanistic threads that weave these applications together. Sangre de grado is applied topically to wounds or insect bites and stings to promote healing and as a fast acting analgesic agent. The sap binds to wounds and forms a long lasting seal not that dissimilar to a natural scab. Its inherent antimicrobial activity limits infection. It's other anti-inflammatory actions allows for healing that is devoid of irritating symptoms. Whether these anti-inflammatory actions accelerates healing is not clear, but is a tenable hypothesis. Sangre de grado is also consumed orally, highly diluted, for the treatment of severe gastrointestinal distress (1-4). This includes healing gastrointestinal ulcers, diarrhea and generalized cramping and discomfort. The validity of these gastrointestinal applications have been confirmed by us and Shaman Botanicals (5-7). Sangre de grado has also been used for antiviral activity, as well as for cancer applications. The cancer applications, while evident throughout Amazonia, has been one of the least studied applications by Western scientists, and is the basis of our current investigations. Interestingly, it may have a chemical commonality with its analgesic properties.

Sangre de grado: Proposed Active Chemicals

Over 90% of the chemicals in Sangre de Grado are proanthocyandins, which are largely responsible for the color of the sap. Proanthocyandins are antioxidants, which polymerize into short oligomers (8,9). A variety of proanthocyandins oligomers derived from Sangre de grado, have been patented by Shaman Pharmaceuticals, now doing business as Shaman Botanicals. This company also confirmed that Sangre de grado is an effective treatment for diarrhea. They propose inhibition of cAMP mediated epithelial secretion as the mechanism (6). In contrast, our studies indicate Sangre de grado inhibits epithelial secretion primarily via antagonism of sensory afferent nerves in the gut (7), and that the antisecretory actions of proanthocyandins are too weak to account for this activity.

While proanthocyandins are the major chemical class present in Sangre de grado, there are a number of other chemicals that have been isolated and may be involved in the diverse effects exhibited by Sangre de grado. Phillipson (8,9), noted the presence of crolechinol, crolechinic acid, korberin A and B, 3'4□-O-dimethylcedrusin and taspine have received the most attention, albeit there are only a few studies evaluating this herbal medicine. 3'4'-O-dimethylcedrusin and the polyphenolic fraction have been suggested to be the chemicals responsible for wound healing via an action on fibroblasts (10,11). This cicatrizant effect is perhaps better explained by the array of chemicals acting in concert rather than a single chemical. For example, beyond the antiviral actions of proanthocyanidins, antimicrobial actions may be critical, an effect thought to be due to 1,3,5 trimethoxybenzene and 2,4,6 trimethoxyphenol that are present in trace amounts, but are 30 times more potent than penicillin (8,9). Taspine is present in Peruvian sap, but not from Ecuadorian sap, and has been implicated in its use in inflammation and cancer as it readily kills tumor cells (12,13). In cell culture studies Sangre de grado inhibits cell proliferation, yet protects against cell death initiated by media starvation (10-13). This suggests a critical action at the level of cell cycle regulation and apoptosis, which we have explored. Taspine has been touted as a principle component of the wound healing actions of Sangre de grado based on its early stimulation of wound repair (14). However, others consider that other chemicals are important, including the polyphenols (10,15).

Sensory Afferent Nerve Mechanisms

Sensory afferent nerves, sometimes called c fibers or primary afferents, serve protective roles, alerting the central nervous system of adverse events in the periphery. They primarily exist in barriers □ skin, gut and lungs, where the body□s defenses may be breached. The sensitivity of primary afferents can be enhanced by eicosanoids (particularly PGE_2) and nerve activity can be induced by various inflammatory mediators (adenosine, bradykinin, serotonin), glutamate and its own neurotransmitters (CGRP, Substance P) as well as tissue acidification. More recently, we have also demonstrated that protease activated □2 receptors (PAR-$_2$AP) directly activate primary afferent nerve fibers and lead to hyperalgesia (16). PAR-$_2$AP may be activated in vivo by mast cell tryptase (76), which highlights the multi-level interactions between sensory afferent nerves and mast cells (18). Primary afferents innervate mast cells and their neurotransmitters activate mast cells and induce degranulation, as do vanilloids directly (17,18). Tryptase released from mast cell granules then in turn can activate primary afferents, leading to both pain, as well as the sustenance of neurogenic inflammation. Sensory afferent activation can sustain a number of chronic states of inflammation (19-22). To date this neurogenic component of inflammation has been poorly managed

pharmacologically. The major approach has utilized capsaicin, the pungent spice from chili peppers. With repeated exposures to capsaicin the nerve becomes desensitized and lacking in neurotransmitter content (22), but before that can occur the precise mechanisms that are to be attenuated must be activated. Clearly, this is an inadequate approach.

Vanilloids and Sensory afferent Nerves

The term vanilloids chemical structure that interacts with sensory afferent nerves at what is known as the vanilloid receptor. Another common term for this receptor is the capsaicin receptor, as capsaicin the pungent spice of chilli peppers is the prototypical agonist for vanilloid receptors. Vanilloids vary in potency, but the most potent is resiniferatoxin, derived from an African Cactus of the Euphorbaciae family. However, therapeutically, what is needed I not vanilloid receptor agonists but rather receptor antagonists, agents that will reduce pain signaling and neurogenic inflammation. What is needed is the anti-chilli pepper. Sangre de rgado represents just that - the perfect anti-chilli pepper agent, and therefore a new ttherapeutic tool.

It may be only of anecdotal interest, but Sangre de grado and resiniferatoxin are both red saps derived from the genus Euphorbaciae, the genus gave its name to phorbol esters. Sangre de grado is not resiniferatoxin however, as it has no pungency and the origins are old world vs. new world (Africa vs. South America), and structurally one is cactus-like (resiniferatoxin), and the other a fast growing tree. However, tantalizing phylogenic links may exist.

The vanilloid receptor 1 (VR1) has been placed in central importance in regulating the activity of sensory afferent nerves following the development of the VR1 gene deleted mouse model. VR1 KO mice are analgesic to a wide range of painful inflammatory states. However, VR1 KO mice are not immune to all painful stimuli. They display normal responses to noxious heat, thermal pain following nerve injury and to some degree painful heat (23,24). This suggests that VR1 receptor antagonists will provide a broad treatment of inflammatory pain. Most likely sangre de grado will be effective in those pain states associated with tissue injury, and chemical exposure (protons). This limitation is not regarded as a threat to its marketing potential, rather it is important to know that important defense mechanisms still exist, and the potential market share for a VR1 antagonist is still in the multibillion dollar range. Currently, hyperalgesia is managed by NSAIDs (cyclo-oxygenase inhibitors) and opioids that possess pre-synaptic as well as post-synaptic actions (25,26). While effective for many conditions, both of these therapeutic classes possess significant limitations. Opioids are addictive and suffer from tolerance, whereas NSAIDs possess significant side-effects on the gastrointestinal and renal systems.

Novel vanilloids

The search for new structures that interact with the vanilloid receptor has revealed that the classic vanilloid structure present in known vanilloids - capsaicin, resiniferatoxin, capsazepine and zingerone, is not critical for activity. Rather, new structures lacking the recognizable vanillyl motif have been demonstrated to possess significant and encouraging activity (27). Included in these novel structures are polygodial a full vanilloid agonist derived from marsh pepper, warburganal - isolated from the bark of warburgia trees which grow in Africa and the Caribbean, isovelleral - another agonist whose terpenoid structure was isolated from fungi, scalaradial - is another unsaturated

dialdehyde isolated from sponges, and scutigeral - isolated from edible mushrooms. It is scutigeral that has generated significant interest lately because it lacks pungency (agonistic activity) but its potency is questionable. Thus, there is a growing appreciation that a variety of novel structures can interact with the vanilloid receptor, although few have pure antagonistic activity. These structures have been derived from a variety of natural sources, but we are not aware of any Amazonian botanicals being tested.

Sangre de Grado Actions and Gastric Ulcer Healing

Oral consumption of highly diluted Sangre de grado (1:1000 or 1:10,000) results in an acceleration of gastric ulcer healing in rats (7). The rate of healing is equivalent to the combination of penicillin and streptomycin (28) or novel therapeutic agents like epidermal growth factor (29). Sangre de grado administration was associated with a reduction in the expression of various inflammatory genes in the ulcer bed, including the cytokines IL-1, IL-6, TNFa, and the enzymes COX_2 and iNOS. The gastric ulcer bed becomes rapidly colonized with bacteria, and these bacteria retard healing, as one would expect for any wound. Sangre de grado treatment substantially reduces the bacterial load in the ulcer. While Sangre de grado is inherently antimicrobial the concentrations required for this action far exceed that administered, hence we consider that this reduction in bacterial load was due to an inherent change in the local environment, rendering it unsuitable for bacterial colonization.

Sangre de Grado and Diarrhea

Sangre de grado is an effective agent in managing diarrhea. It is not a paralytic like loperamide. Rather it works through the same mechanism for its analgesic properties. Sensory afferent nerves drive secretory responses in the gut. Sangre de grado was shown to block epithelial secretion in response to capsaicin, the VR1 agonist, but not to Substance P (neurotransmitter) or cholinergic stimuli (7). In addition, acute fluid shifts in response to gut injury induced by acid and undigested protein (a model of bacterially driven intestinal necrosis) was blocked by Sangre de grado at dilutions of 1:1000 (200mg/ml). Interestingly, in addition to preventing the secretory response, Sangre de grado blocked the damage to the intestinal mucosa normally associated with this model. Thus, Sangre de grado is an effective anti-diarrheal that also offers substantial mucosal protective and anti-inflammatory properties.

Sangre de Grado and Analgesia

Hyperalgesia is the heightened sensitivity to painful stimuli. Stimuli that are below threshold for a pain response may become painful when hyperalgesia is induced (PGE_2 is an example of a mediator that acts in this manner). The converse, is analgesia, which is the failure to register pain in response to an agent that would normally induce a pain response. Because of its VR1 antagonistic properties Sangre de grado is an excellent analgesic agent. It is broad acting as the VR1 receptor plays a central processing role pain perception. In other words, inhibition of VR1 blocks pain perception to a wide range of stimuli. Indeed that is the case with Sangre de grado. It also explains its ethnomedical uses where it is applied topically for broad conditions insect bites, stings, rashes, plant reaction, cuts and wounds.

Sangre de Grado and Itching

As discussed above Sangre de grado is an effective inhibitor of sensory afferent nerves. These nerves innervate blood vessels, epithelia and mast cells. Activation of mast cells is a critical component of neurogenic inflammation, and for the skin this includes itching. For some skin conditions itching is the most serious symptom. Vanilloid receptors exist on mast cells and drive activation and mast cell derived mediators and enzymes activate sensory afferent nerves. Sangre de grado is a therapeutic agent that interrupts this positive cycle. Clinical tests indicate that Sangre de grado can stop itching responses on average, in less than 2 minutes. Even for difficult conditions like Fire ant bites and poison ivy.

Sangre de grado and Cancer

A small number of studies indicates that cancer cells express a vanilloid receptor and that it is linked to cell death. Of interest is that the degree of cell death evoked by VR1 antagonists far exceeds that of VR1 agonists (30,31). This suggests that the vanilloid receptor responsible is not VR1; vanilloid receptor heterogeneity is well appreciated but full characterization is not available at this time. In vitro, Sangre de grado, results in cancer cell death, at concentrations that are comparable to those required to block VR1 and heal gastric ulcers and acute intestinal injury. While results are preliminary, it is intriguing to consider that vanilloid antagonists may become effective anticancer therapies. In this case it would coincide with a mucosal protective function and analgesia concomitant with cancer regression, through related mechanisms.

Conclusion

Sangre de grado is an excellent example of a medicinal plant that has a profound history of effective use in an indigenous culture, which offers therapeutic opportunities that Western medicine cannot match. Originating from fast growing trees it is efficient to harvest and cultivate and can be applied for a wide range of condition. Sangre de grado also offers an experimental tool to evaluate the role of sensory afferent nerves and vanilloids in health and disease. Sangre de grado and derived formulations will eventually become a critical component of health care delivery for veterinary and clinical conditions including analgesia, topical applications for wounds, skin irritation and inflammation, management of diarrhea and gastrointestinal distress and possibly cancer.

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Traditional Oriental Medicine in Livestock Health

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Abstract

Traditional oriental medicine (TOM) including acupuncture, acupressure, herbology, moxabustion, and Qi Gong is based upon Yin and Yang theory and five-element theory. Eastern medicine, unlike Western medicine has the unification of the subjective and physical world. The fundamental concept of TOM is balancing the body with nature. Therefore, oriental medicine is holistic in its approach to diagnosis and treatment of illnesses.

Herbology (bonchology in Korean or bancaology in Chinese) in TOM has been considered as a principle therapeutic or prophylactic way for humans as well as animals in China, Korea, Japan, India, Tibet along with other Asian countries for thousands of years. Oriental herbs can be divided into two categories, food and medical. Traditional Oriental Veterinary Medicine (TOVM) originated from the Yellow Emperor's Classic of Internal Medicine (475-221BC) in China. Nearly 3,000 herbs are listed in *the Supplement to the Compendium of Meteria Medica* and characterized by the properties, taste and meridian tropism based on TOM. However, there is a limited amount of oriental herbs available for veterinary use.

In general, oriental herb formulas should contain a mixture of several different kinds of herbs in order to increase therapeutic effects, minimize toxicity or side effect, accommodate complex clinical situation, and alter the action of the substances. Oriental herbal treatments based on TOM theory in western countries are still in the experimental stage. Modern researches in pharmacology have been looking for the active ingredients in the individual herb and synthesizing it for pharmaceutical purposes. In western society, the single active ingredient is often extracted for the therapeutic purpose that can induce critical side effects or no effect.

In high intense animal agriculture production systems, antibiotics are commonly used as feed additives to prevent or treat diseases and to improve animal productivity. However, the use of antibiotics in animal agriculture has been documented relating to the emergence of antibiotic resistant bacteria. The prohibition of antibiotic use is now widely accepted by legislatures, consumers, and even food animal industry. In spite of all these facts, food animal producers and pharmaceutical manufacturers still believe that antibiotics are vital to the profitability of animal agriculture. Furthermore, increasing the growth performance is another consideration for the animal producers. To solve our confronted task, we need to identify the specific oriental herbs for antibiotic substitute and for growth performance.

Several researches have studied the antimicrobiol effect of oriental herbs including *Allium sativum, Angelica dahurica, Anguisorba officinalls, Artemisia argyi, Coptis chinensis, Dictamnus dasycarpus, Fraxinus rhynchophylla, Geranium thunbergii, Hydrastis canadensis, Phellodenron amurense, Polygonum cuspidatum, Scutellria baicalensis* and *Sophora flavesens*.

These herbs may be used as a natural antibiotic substitute along with other supportive herbs. The antibacterial effect of Huang qi (Scutellariae Radix) and Lonicera Flos to gram negative bacteria including *Salmonella spp* or *E. coli* and gram positive bacteria *Staphylococcus spp*. and *Streptococcus spp.* are also evaluated. The major flavonoid components, baicalin and baicalein of Huang qi demonstrated the antibacterial effect. Dochaetang extract, herb formula containing Radix paeonia lactiflorae, Radix angelica gigantis, Radix Scutelariae and Rhizoma coptidus has shown the antimicrobial effect against intestinal bacteria. Studies have proved that the root powder from Bupleurum falcatum used as a feed additive enhanced growth performance in poultry.

Oriental herbs for antibiotic or probiotic substitutes should be prescribed and formulated based on the TOM theory. It has been known that herbs having antimicrobiol activity have bitter taste and/or cold in nature. Therefore, prescription with a single herb is not recommended, because long-term use of a herb having bitter taste and/or cold in nature can render some unwanted effect to the body such as weakening the spleen function due to these properties. Furthermore, we recommend not using a single major ingredient solely for these purposes due to the potential possibilities creating critical side effects or no effects. This is why our research team is working to generate several formulas substituting antibiotics and probiotics. The selection, combination and processing procedure of the formulas have been done based on TOM theory. We are trying to provide the evidence based scientific data for our formulas and pre-existed formulas. We believe that this work will contribute to both public health and animal warfare by reducing emerging antibiotic resistant bacteria, diminishing the risk of antibiotic residues in the food and concomitantly, increasing the growth performance.

Alternative Medicine for Animals: FDA Regulations of Dietary Supplements for Animals

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Good morning. My name is Claudia A. Lewis-Eng and I am an associate with the firm Emord & Associates located in Washington, D.C. We represent over three hundred clients who specialize in alternative medicine and dietary supplements, including food and supplements for animals. We represent those clients before the Food and Drug Administration, the Federal Trade Commission and the federal courts.

Today I will provide an overview of FDA regulations for animal food products, including the growing use of dietary supplements with animals.

Nonbiological animal drugs as well as animal foods are regulated by FDA under the Federal Food, Drug and Cosmetic Act. There are two major categories of animal foods and drugs: Those used in nonfood-producing animals (pets) and drugs for therapeutic purposes and those used in food-producing animals

The FDA has the authority to adopt standards of identity, quality and container fill for animal food. FDA can also regulate animal food labeling and animal food adulteration as it does food for humans. However, FDA has not expended its limited resources to develop comprehensive labeling regulations because most states have drafted such regulations.

Instead, FDA has drafted limited labeling regulations requiring that livestock feed and pet food include the name of the food, its ingredients, the name and address of the packer or distributor and the net weight of the product. Indeed, in the area of regulating animals foods and drugs, FDA has formed a unique relationship with the states. Specifically, pet foods, nonmedicated livestock feed and medicated feeds that fall below drug levels that require FDA licensing are regulated by the states through model acts and state regulations. Of course, medicated feeds that require FDA licensure require plant registration, mandatory FDA inspection, and approved FDA medicated feed applications. Most state model acts outline state registration and labeling requirements for the manufacture, distribution and sale of animal foods and drugs.

In regulating animal feed and drugs, most states have adopted the Model Bill drafted by the Association of American Feed Control Officials ("AAFCO"). AFFCO is made up of state regulators and Canadian representatives. AFFCO publishes an annual publication that contains feed and pet food regulations and also individual state feed law requirements. FDA works jointly with AFFCO in regulating animal products.

As many of you are aware, AFFCO has developed separate model regulations for livestock feed and pet food products. Under AFFCO regulations, pet foods must state the nutritional use of the food. For example, the label must state whether the food is for adult animals or for all stages of life. AFFCO requires that manufacturers and/or distributors conduct trials on pet foods using AFFCO specified protocols to assure that the food is for "adult animals," for "all stages of life,"

or is "complete and balanced" as claimed on the label.

AAFCO has also developed labeling rules and defined the ingredients that can be used in animal feed, i.e., whether the ingredient is generally recognized as safe for use in animal feed. In fact, FDA recognizes as official the AFFCO developed feed ingredient names for labeling purposes.

For the most part the AAFCO method of determining and defining ingredients that can be used in animal food has taken the place of FDA's GRAS determination. Under AFFCO's GRAS process an ingredient name and definition is submitted to AFFCO. AFFCO then solicits comments from the industry and state and federal regulators. AFFCO's recommendation about the ingredient is then submitted to and approved by the AFFCO Board of Directors and annual convention of delegates.

Please note however, that a FDA official does participate in AFFCO's GRAS determination and FDA does from time to time identify ingredients that must undergo food additive licensing, which is a rigorous process.

AFFCO has also defined terms such as "lite" or "low calorie" that appear on animal foods. While FDA has defined those terms for human foods, it had not promulgated similar definitions for animal feed and pet foods. To use the terms under AFFCO regulations, the products must meet a standard amount, regardless the manufacturer.

As far as livestock feed is concerned most states require that producers of animal feed register with the state annually. Under federal regulations livestock feed is subject to annual mill inspections to ensure that the animal food is not adulterated or misbranded in violation of the FDCA. If a state is a member of AFFCO, AFFCO members may conduct the inspections in place of an FDA inspection.

While FDA to a large, has extent relied on state regulations for pet foods and animal feed, it has not taken a back seat when it comes to the use of dietary supplementation for animals. Since the passage of the Nutrition Labeling and Education Act of 1990 ("NLEA"), which permitted the use of FDA approved health claims on the labels of human foods, the Center for Veterinary Medicine ("CVM") has attempted to incorporate some the policy of the NLEA to permit meaningful health related information to appear on pet food labels. However, it is important to note that the NLEA did not specifically include pet foods or animal feeds in the law. Accordingly, the NLEA regulations do not apply to animal feeds or pet foods.

In the area of dietary supplements for animals FDA has taken the position that while animals that are on balanced rations do not require extra nutritional supplementation, it does not object to the marketing of dietary supplements for animals provided the following criteria are met:

1. There is a known need for each nutrient ingredient represented to be in the product for each animal in which the product is intended.

2. The label represents the product for use only in supplementation and not as a substitute for daily rations

3. The labeling bears no disease prevention or therapeutic claims including growth promotion
4. The labeling is not false or misleading in any particular
5. The product is neither over-potent nor under-potent nor otherwise formulated so as to pose a hazard to the health of the target animal.

Certified Organic Livestock Production in Connecticut

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The Northeast Organic Farming Association of Connecticut (CT-NOFA) is an independent, non-profit organization dedicated to strengthening the practice of ecologically sound farming, gardening and yard care. It also helps consumers gain increased access to safe, health food. CT-NOFA is one of seven state NOFA chapters in the Northeast. Since 1971, NOFA has been working in support of local organic food production in garden and farms.

One of the main purposes of CT-NOFA is to provide certification of organic farms. The Certification Committee of CT-NOFA exists to provide a credible independent third-party verification of organic food production of Connecticut's farmers and consumers. The basis for organic certification is the method of production and the understanding and commitment of the producer regarding these methods. The method of production will be those practices and substances that are biologically enhancing to the soil, to plant and animal life, to consumers and to the grower.

While CT-NOFA has been in existence since 1982, livestock certification has only been offered since 1995. Since that time there has been a slow but steady increase of certified organic livestock in Connecticut. Certification is offered for organically produced meat and poultry, eggs and dairy. This summer, nine farms received certification for livestock production. Four produce meat for on farm sales, five produce eggs and three produce milk. CT-NOFA also offers a food processing certification for production of cheese for example. Currently one producer is certified to manufacture ricotta cheese.

By the end of this year the federal rule should be published by the USDA will create a national certified organic standard that all certifying agencies will have to follow. The purpose of this rule is to gain uniformity throughout the nation so all organic food sales here and abroad will mean the same thing. After final approval of the rule all certifying agents will apply for accreditation with the USDA to be a certifier under the new standards. There are only minor differences between the CT-NOFA standards and the national standards. It is the hope CT-NOFA that the transition from our standard rule to the USDA rule will be a smooth one.

If you have any questions about the program or are interested in becoming certified contact me at the University of Connecticut Cooperative Extension Systems Organic Farming and Gardening Program.

Botanicals for Pigs

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Abstract

The historic use of herbal remedies to treat and prevent infectious disease has been supplanted with the emergence of specific man-made chemotherapeutic and antimicrobial agents. With increasing interest in decreasing the emphasis on these products, studies were undertaken to evaluate the use of four botanicals for swine production. Graded levels of Echinacea, garlic, goldenseal and peppermint were fed to weanling pigs and compared to a standard nursery diet containing 45 ppm Mecadox (carbadox). In general the use of these products did not enhance performance and, in the case of high levels, garlic reduced feed intake and flavored the meat. One reason for the lack of response may have been the high health status of the herd at the Iowa State University Swine Nutrition and Management Farm. Alternatively, the addition of Mecadox was not always beneficial when compared to higher levels of Echinacea.

Keywords: swine, botanical, Echinacea, garlic, goldenseal, peppermint

Introduction

The historic use of herbal remedies to treat and prevent infectious disease has been supplanted with the emergence of specific man-made chemotherapeutic and antimicrobial agents. However, selected herbs are known to possess natural antimicrobial activity and other characteristics that could be useful in value-added (natural) animal protein production. This area of investigation has not received substantive examination because of the relatively low costs, proven effectiveness and availability of synthetic antimicrobial products. The possibility of significant antibiotic resistant bacterial development through the use of human drugs in animals and subsequent transfer of resistance to human pathogens has caused concerns within the medical community. Inclusion of herbs in animal feeds as alternative growth promotion and efficiency stimulating strategies can address some of these concerns while producing a more holistically grown pork product.

The following botanical products have been selected for inclusion in swine feeds based on their pharmacological and agronomic characteristics, which make them applicable to Iowa. Limited information about the use of botanicals in livestock production makes this evaluation timely.

Echinacea (purple coneflower)

Echinacea species are perennial herbs capable of growth throughout the Midwestern USA. There are nine species, but *E. augustifolia, E. purpurea* and *E. pallida* are most commonly considered for medicinal purposes (Taylor, 1968). The whole plant, including aerial portions and taproots, has been utilized. Additionally,

pressed juice from the aerial portion of *E. purpurea* and aqueous and alcohol extracts of the roots have viral inhibition characteristics in cell culture (Wacker and Hilbig, 1978). The German government has approved oral use of Echinacea for respiratory and urinary tract infections and topically for improving wound healing. Liquid preparations have been shown to have immune-stimulating activity and enhance several white blood cell types as well as phagocytes (cells that can destroy bacteria and protozoa (Burton Goldberg, 1999)).

Garlic (Allium sativum)

Garlic, a member of the lily family, is a perennial plant cultivated worldwide. Garlic bulbs, either fresh or dehydrated, are used for medicinal purposes. The bulbs contain volatile oils composed of allicin, diallyl disulfide, and diallyl trisulfide, which are considered the reservoirs for most pharmacological properties attributable to garlic. Garlic demonstrates a broad-spectrum antimicrobial activity against many bacteria, viruses, parasites and fungi (Hughes and Lawson, 1991). Garlic has also shown an ability to aid certain immune functions, particularly increasing natural killer cells activity (Foster, 1991)

Goldenseal (*Hydrastis canadensis*)

Goldenseal, native to eastern North America, is a perennial herb. The most pharmacologically active isoquinolone alkaloid, berberine, is concentrated in the rhizome and roots. Berberine has been demonstrated to possess antimicrobial, immuno-stimulatory, anticonvulsant, sedative, hypotensive, choleretic and carminative activity. This antimicrobial activity has been demonstrated against a wide range of bacteria, protozoa and fungi (Duke, 1985). Berberine and berberine-containing plants are generally considered non-toxic. The LD50 for berberine in rats was reported as greater than 1000 milligrams per kilogram body weight (Hladon, 1975).

Peppermint (*Mentha piperita*)

Peppermint grows under a wide range of conditions. The most popular varieties are black peppermint (*Mentha piperita* var*. vulgaris*) and white peppermint (*Mentha piperita* var. *officinalics*). The major medicinal components of peppermint are the volatile oils found predominantly in the aerial portions of the plant. The principal components of these oils are terpenoids, menthol, methone and menthyl acetate. Other components that may have pharmaceutical properties include polyplenols, flavonoids and betaine.

Menthol possesses carminative, antispasmodic and cholerectic properties. Peppermint and other members of the mint family have demonstrated significant antiviral capability including treatment of the common cold (Kerman and Kucera, 1967). Peppermint also inhibits antimicrobial activity against *Streptococcus pyogenes, Staphylococcus aureus, Pseudomonas aeruginosa,* and *Candida albicans* (Sanyal and Vamra, 1969). The LD50 of menthol in rats is 3,280 mg/kg and a fatal dose for humans

was reported as 1 g/kg. Hypersensitivity reactions (skin rashes) have also been reported (Briggs, 1993).

Experimental Design

These experiments were conducted at the Iowa State University Swine Nutrition and Management Center in temperature-regulated nursery rooms. Pigs were weaned at an average of 18 days (14 to 21) and 6.25 kg. They were allotted at random to pens by litter and initial weight immediately following weaning. There were 20 or 24 pens of five pigs each, providing four to six replications of the dietary treatments. Each pen received 16 kg of the prestarter treatment per pig and then was switched to the starter treatment diet for the remainder of the five-week study (Table 1). The positive control diet contained 45 ppm of Mecadox (carbadox). Botanical treatments consisted of the same diet without Mecadox and increasing levels of botanicals replaced corn, with the 0% level considered the negative control. Pigs were grown in 1.2 x 1.2 meter raised-deck pens and the average room temperature was 24 " 2EC. Heat mats supplied supplemental heat. Pigs were weighed and feed disappearance measured weekly for five weeks. In the first year (1997) of studies the project was completed at the end of the nursery phase. In 1999-2000, when the Echinacea, garlic, and peppermint studies were repeated, upon completion of the nursery phase pigs were fed the standard farm grower (Tylan, 36 ppm) and finisher (BMD, 27 ppm) diets. Medications were included because of an ileitis infection. Post-nursery weights were recorded every four weeks to evaluate long term effects of the nursery treatments. Average daily gain (ADG), average daily feed (ADF), and feed efficiency (F/G) were analyzed using the GLM procedure of SAS with the pen as the experimental unit. Least square means are presented in the tables.

Where appropriate, one pig at the end of the nursery phase from each botanical treatment was taken to the ISU Meat Laboratory, slaughtered, and various muscles evaluated for sensory and quality characteristics. Pigs fed Mecadox were not slaughtered because of a 42 day withdrawal requirement.

Between the first set of trials (1997-1998) and the second set (1999-2000) the farm was depopulated and repopulated. The herd currently is at a high health status, being Porcine Respiratory and Reproductive Syndrome (PRRS) free. This high status may have reduced the need for medications in the nursery.

Table 1. Example diets

Ingredient	Prestarter	Starter
Corn, yellow	36.43	51.57
Whey, dried	25.00	10.00
Appetein	5.00	0.00
Soybean meal, dehulled	29.20	33.50
Dicalcium phosphate	1.65	2.19
Limestone	0.90	0.78
Salt	0.00	0.25

Lysine, synthetic	0.20	0.20
Methionine, DL	0.10	0.10
Vitamins, Trace minerals	0.52	0.41
Animal fat, stabilized	1.00	1.00
Mecadox 2.5/Botanical	--	--
Total	100.00	100.00

Calculated analysis of example diets (%):

Nutrient	Prestarter	Starter
Lysine	1.46	1.28
Methionine + cystine	0.88	0.66
Calcium	0.79	0.79
Phosphorus, total	0.72	0.70
Phosphorus, available	0.48	0.41

Summary and Implications

Echinacea I

At the tested inclusion levels (0, 0.1, 0.5 and 2.0%) no statistical advantage existed when compared with the diet containing 45 ppm Mecadox or with a 'negative' control containing no antimicrobial or botanical inclusions. Echinacea-treated pigs exhibited a slight, but not objectionable, off-flavor when compared to pigs fed non-inclusion levels. The study noted that in weeks 0-3 and 0-4 the higher levels of Echinacea (0.5 and 2.0%) were significantly more efficient ($P<0.05$) but daily gain and feed intake were not statistically different. Total performance for the entire experiment, Weeks 0-5, was not statistically different. These data suggest higher levels of Echinacea enhanced feed efficiency compared to the 0% Echinacea during the first two weeks and were greater than the Mecadox diet during the Weeks 0-3 and 0-4. Overall, performance was similar, suggesting minimal subclinical stress during this experiment. Higher levels of Echinacea may be required to enhance growth rate and feed efficiency.

Echinacea II

This trial evaluated lower levels than in Echinacea I to reduce feed costs and potentially maintain some of the feed efficiencies observed. Mecadox or Echinacea (0, 0.10, 0.25 and 0.50%) replaced corn. One pig was removed during the nursery phase and one during the finishing phase. In Week 1 there were no statistical differences, indicating similar performance between the treatments. Subsequent performance indicated no advantage for feeding Echinacea with the exception of Weeks 0-2 and 0-3 when a significant quadratic observation was observed for the Echinacea levels for feed/gain. The Mecadox diet had significantly better performance than the treatment levels of Echinacea in Weeks 0-2, 0-3, 0-4 and 0-5. Growth rate during the post-nursery phase was not affected by nursery treatments. These lower levels of Echinacea failed to enhance performance.

Echinacea III

This trial was initiated to explore higher additions of Echinacea. Mecadox (45 ppm) or

Echinacea (0, 1.50, and 3.00%) replaced corn. No pigs were removed during the nursery phase. During the grow-finish phase one poor-doer was removed from the Mecadox treatment and a ruptured pig was removed from the 3% Echinacea treatment. There were few treatment differences. Mecadox generally increased daily gain in Weeks 0-3 and 0-5 (P<.01). Echinacea additions depressed feed/gain in Weeks 0-2 and 0-3. However, 3% Echinacea enhanced overall gain in the Week 0-5 nursery period when compared to 0 and 1.5% levels and supported gains equal to the Mecadox diet. No significant gain responses were observed post-nursery although the highest level of Echinacea fed during the nursery supported gains equal to the Mecadox pigs. Neither Mecadox nor Echinacea were fed after the nursery period.

Garlic I

At the tested garlic inclusions (0, 0.5, 2.5 and 5%), increasing levels of garlic generally depressed feed intake and average daily gain in nursery pigs and depressed performance compared to the Mecadox diet. Muscle samples from all slaughtered pigs had "very objectionable" or "extremely objectionable" off-flavors. This suggests that the garlic odor was sufficiently strong in the room that it also flavored muscle samples of pigs not fed garlic. A visitor's first observation was that the room and adjacent hallway had a very strong, objectionable odor of garlic combined with hog manure throughout the nursery phase.

The overall summary, Week 0-5, indicated the Mecadox diet significantly improved daily gain compared to the garlic treatments (P<.01 to P<.05); generally the higher the level of garlic, the poorer the daily gain. Mecadox ADF was significantly greater than the 5% level of garlic (P<.05). Overall feed efficiency favored the 0% garlic diet, but was statistically different only from the 2.5% garlic treatment.

The 5.0% level of garlic significantly reduced feed intake in Weeks 0-2, 0-3 and 0-5 when compared to Mecadox (P<.01 and P<.05). Additionally, in Weeks 0-3 as the level of garlic increased, feed intake decreased.

Garlic II

The second garlic trial fed inclusion levels of 0.00, 0.10, 0.25 and 0.50% garlic, levels that hopefully would be low enough not to depress performance or alter meat flavors. Pigs fed diets without Mecadox demonstrated significantly poorer performance. Based upon this and the 1997 study, pigs fed diets with Mecadox performed better. The addition of garlic did not enhance pig performance. Because of the garlic flavoring of the pork in the first garlic study (Table 6) muscle samples were tested at the end of the nursery period and again two weeks later. At the end of the nursery phase, a slight garlic flavor was detected in muscle but after two weeks on a garlic-free diet no garlic flavor was detected.

Goldenseal I

This study evaluated four levels of goldenseal (0.0 to 1.0%) to a diet containing Mecadox. Although not performing to the level of the Mecadox-fed pigs, those fed 0.25% and 1.00% goldenseal diets performed numerically better than the 0.00% and 0.05% goldenseal diets.

Mecadox-fed pigs generally performed statistically better than the other treatments. Increasing levels of goldenseal did not influence the muscle characteristics evaluated.

Some F/Gs appear unreasonable because of an occasional pen with very poor gains with normal or high feed intakes. In Week 1, the Mecadox diet produced daily gains ($P<.05$) greater than the 0.00% goldenseal diet and feed intake greater than the 0.05% goldenseal. This suggests additions of goldenseal produced performance comparable to the Mecadox pigs during the first week. During weeks 0-2 the Mecadox diet ADG was significantly greater than the 0.00% diet ($P<.05$) and tended to be greater than the three higher levels of goldenseal. Mecadox F/G was improved over the 0.00% and 0.05% goldenseal but not statistically different from the higher levels.

Weeks 0-3 had significantly greater ADG and ADF for the Mecadox pigs over the other treatments. The ADF of the two highest levels of goldenseal tended to be greater than the 0.00% negative control. Mecadox-fed pigs F/G was not statistically different from the two highest levels of goldenseal and significantly greater than the 0.00 and 0.05% diets, with the two highest levels also having improved efficiency compared to the 0.05% diet. During Weeks 0-4 the Mecadox diet ADG was significantly higher than the 0.00% and 0.05% goldenseal diets ($P<.05$). Overall feed efficiency was lowest for the Mecadox diet when compared to the 0.00% and 0.05% treatments but not statistically different from the two highest level. The two highest levels tended to be more efficient than the 0.00% and 0.05% goldenseal diets.

Peppermint I

Nursery pigs fed inclusion levels of peppermint (0, 0.5, 2.5 and 5.0%) failed to respond to added levels. Pigs on all treatments (including the Mecadox and 0% peppermint) performed similarly over the entire experimental period. The 5% pigs in Week 1 required significantly more feed per pound of gain than the Mecadox pigs ($P<.05$), probably because of the bulkiness of that diet. During Weeks 0-2 the 0% pigs required significantly more feed than both Mecadox and 2.5% peppermint pigs ($P<.05$). Generally the Mecadox pigs and the added peppermint pigs performed similarly during this period. No statistical differences were observed after the first two weeks ($P>.05$).

Peppermint II

This experiment evaluated Mecadox and 0, 0.5 and 1.0% peppermint levels under a similar feeding regimen plus a 12-week post-nursery evaluation to observe any carry-over effects. Peppermint failed to elicit a positive nursery response and those pigs performed more poorly statistically when compared to the Mecadox-fed pigs. Pigs fed Mecadox maintained their advantage when cumulative performance was evaluated for the additional 12 weeks, but performance within each weighing period was not statistically different after the nursery phase. Under the conditions of this experiment peppermint, as in Peppermint I, was not an efficacious addition to swine nursery diets.

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Mastitis Control: Lessons from the Vermont Nosode Study

Evaluation of Homeopathic Nosodes for Mastitis and Calf Scours, and Documentation of Homeopathic Practices in Dairy Production.

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Introduction

Mastitis continues to be considered the most costly disease of dairy cows (Fetrow et al. 2000). Mastitis also has numerous detrimental effects on milk quality and composition. Unfortunately, the use of antibiotics has not proven totally effective in curing all types of existing udder infections during lactation, and the use of antibiotics increases the risk of residues in milk and dairy products (Hady et al. 1993). Alternative treatments and preventative measures should be evaluated as methods to reduce the incidence of new mastitis cases and to eliminate existing cases.

Neonatal diarrhea is a major cause of dairy calf morbidity and mortality, and can result in significant financial loss on dairy farms. Eliminating neonatal diarrhea can be labor intensive and frustrating. Neonatal diarrhea caused by *Escherichia coli* is of particular concern on many dairy farms.

Homeopathic nosodes have been recommended as an alternative to conventional therapies for the prevention and treatment of bovine mastitis and *E. coli* calf scours. It has been suggested that homeopathic nosodes function in a manner similar to conventional vaccines, in that they may act to increase the natural resistance mechanisms of the cow, and thus prevent establishment of new infections and enhance the cure rate of existing infections (Day, 1986; Day, 1995; Macleod, 1991; Stopes and Woodward, 1990).

Methods

A research project evaluating the effectiveness of nosodes for mastitis and calf scours was initiated in September 1997 with the enrollment of 11 dairy farms, including over 1000 lactating cows and 300 calves. Table 1 contains descriptive information on the original 11 farms participating in this study. The research was conducted by the Northeast Organic Farming Association of Vermont with the collaboration of the University of Vermont Quality Milk Research Laboratory, and was funded under a grant awarded through the USDA Northeast Sustainable Agriculture Research and Education initiative (SARE). The first three months of the project were spent meeting with participating farmers to educate them about the research process. Time was devoted to training of farmers on proper milk sampling and nosode treatment procedures. This was critical to assure compliance by the participating farmers. Ten of the original 11 farms completed the 18 month study period, with farm 3 removed from the study due to evidence of improper treatment administration and poor milk sampling practices.
Nosode preparation and administration: The E. coli nosode used was a commercially available

product from Washington Homeopathics. Farmers that chose to participate in the E. coli study gave newborn calves one of two treatments, the nosode or placebo control which were randomly labeled on each farm as treatment "A" or "B" so that both farmers and researchers were blinded to the treatments given. Treatments were given to all new-borne calves once daily for the first 3 days of life. The calves were assigned alternately to group A or B to assure equal numbers in the treatment and control groups, and in an attempt to randomize treatments. Producers recorded all health problems of the treated calves during the first 3 weeks of the calves' life.

A mastitis nosode was prepared commercially from common mastitis pathogens isolated from cows within the cooperator herds. Lactating cows in participating herds were stratified by lactation number, days in milk, and composite milk somatic cell count (SCC), prior to being randomly assigned to two treatment groups. Heifers entering the study prior to expected calving date were alternately assigned to a treatment group. Each treatment group was given either the mastitis nosode or the placebo as an aerosol applied to the vaginal mucosa at recommended time intervals throughout the trial. As a double blind experimental design, only the consulting veterinarian who coordinated nosode preparation knew which treatment group received the placebo or the nosode for each farm, and the key to the treatments was maintained in a sealed envelop until the completion of the trial.

The mastitis nosode was prepared from quarter milk samples obtained from cows with clinical mastitis from the participating farms. The milk samples from these individual cases were cultured to identify the pathogen causing mastitis. Thus clinical milk samples were obtained from cows where a single mastitis pathogen was identified to be causing mastitis. The nosode was prepared at a 30C potency from clinically abnormal milk samples where the following mastitis pathogens had been isolated: *Staphylococcus aureus, Staphylococcus chromongenes*, *Streptococcus uberis*, *Streptococcus dysgalactiae*, *Escherichia coli*, and *Klebsiella spp*. Milk samples, obtained from two farms per pathogen, were randomly selected to be used for the final mastitis nosode. The following farms contributed clinically abnormal milk samples for the mastitis nosode (samples taken November 1997): *Staphylococcus aureus*, farm 2 and 6; *Staphylococcus chromogenes*, farm 4 and 9; *Streptococcus uberis*, farm 2 and 9; *Streptococcus dysgalactiae*, farm 1 and 4; *Escherichia coli*, farm 3 and 8; *Klebsiella spp*., farm 1 and 8 (Table 1).

Treatment procedures: In all cooperator herds, the mastitis nosode and placebo were diluted in a solution of 50% alcohol and administered as an aersol spray applied to the vaginal mucosa of dry cows, lactating cows, and bred heifers. Treatments were administered initially for 5 consecutive days, and then once every two months for the remainder of the study on all animals, plus at calving and at dry off for all lactating animals.

Farmers were instructed to manage all animals that developed clinical disease (including mastitis or calf scours) according to established practices for each farm. Farmers were asked to record all disease events, treatments and the outcomes, although no formal criteria and protocols for recording clinical disease events were established in this study.

Measures of efficacy: Effect of treatment on mastitis rates was evaluated by

bacteriological culture of milk samples from all cows collected at calving, 30 days post-partum, dry off, the onset of clinical mastitis prior to any treatment, and 30 days following the onset of clinical mastitis. Duplicate individual quarter milk samples were collected aseptically by cooperating farmers. Samples were either refrigerated and delivered to the laboratory within 24 hours, or were stored frozen and delivered to the laboratory with 2 to 3 weeks after collection. Milk samples (0.01 ml) were streak-plated on quadrants of tryptose-blood agar containing 5% washed bovine red cells and 0.1% esculin. Plates were incubated at 37EC for 48 hours and presumptive diagnosis of isolates made. Species identification was by methods recommended by the National Mastitis Council. A quarter was diagnosed as infected by one of the following criteria: 1) both milk samples contained 500 cfu/ml, or more, of the same bacterial isolate; or 2) a clinical sample contained at least 100 cfu/ml of an isolate. Somatic cell counts of all individuals quarter milk samples were determined using a Fossomatic 90. In addition, all herds enrolled in the study were either on monthly DHIA testing for individual cow milk production and composite SCC, or obtained monthly milk production and SCC data by an alternative means.

Differences between treatment groups in prevalence of all IMI, prevalence of new IMI, rates of clinical mastitis, and spontaneous cure rates of IMI were examined. Spontaneous cure was defined as negative for the same species (or a closely related species, in the case of coagulase negative staphylococci) on two subsequent samples. Also, differences in SCC of infected quarters were compared between treatment groups. A modified Student t test was used to compare differences in proportions for prevalence of IMI and spontaneous cure between treatment groups. Control and treatment groups were compared for differences in distribution of cows by lactation number and DIM throughout the study, and for SCC prior to initiation of the treatments. Treatment effects were tested within parities (lactation number) one and two or greater. Differences in SCC of infected quarters between treatment group were examined by analysis of variance. Differences between treatment groups in average monthly milk production and composite SCC of individual cows was examined by analysis of variance. Season and month of study were considered as dependent variables affecting milk production and SCC.

Clinical mastitis cases were identified by each farmer. Clinical mastitis was defined as the presence of abnormal milk secretions, abnormal swelling of the gland, or both. Clinical mastitis may or may not be accompanied by systemic signs of illness such as loss of appetite or fever. Farmers collected milk samples from all quarters of cows with clinical mastitis, prior to initiation of any mastitis treatments. Farmers or veterinarians treated clinical cases as per commonly practiced on each farm, and all treatments were recorded. The overall and the pathogen specific incidence rates of clinical mastitis were compared between treatment groups on individual farms and on all farms. The incidence rate of clinical mastitis was expressed as number of quarter cases per 1000 cow-days at risk. Only lactating cow days were considered in the calculation of total number of cow-days at risk for treated and control cows on each farm. The number of lactating days at risk for each cow was determined using individual cow DHIA records. Differences in rates of clinical mastitis were tested by Fisher s exact probability test.

Bulk tank milk samples were collected weekly and frozen for subsequent analysis. Bulk tank milk samples were analyzed by bacteriological culture and somatic cell count. Changes in bulk tank somatic cell count and bacteriology will be examined for the 6 months prior to, for the

18 months during, and for the 6 months following the study.

Results

An abundance of anecdotal information and case histories strongly suggest that homeopathic remedies effectively prevent mastitis. To the best of our knowledge, this project involved the largest placebo controlled, double blind clinical field trial of nosode efficacy for the prevention of mastitis among dairy cattle. This study was conducted on 10 different farms that use conventional and organic production practices and ranged in size from 20 to 250 lactating cows. Collaborating farms used a range of management practices, including: intensive seasonal rotational grazing systems feeding strictly grass forages and a small amount of grain for 6 months of the year, and year round confinement systems feeding a total mixed ration to maximize year-round milk production.

One important outcome of this project was the documentation of the use of homeopathic remedies on farms and the development of a resource for more information on how different remedies may be used successfully.

***E. coli* nosode efficacy:**

A total of 287 calves were enrolled in this portion of the project. Rate of scours in the nosode treated group did not differ from the control group for either calves with scours at all ages, or calves with scours between days 0 and 7 postpartum.

Mastitis nosode efficacy:

Rates of new intramammary infections (IMI) among primiparous and multiparous cows treated with the homeopathic nosode did not differ from that of cows in the control group. These results are consistent with what might be expected if mastitis nosodes function in a manner analogous to that of an autogenous vaccine. Rates of new infections would most likely be effected by changes in management practices that effect either the prevalence of pathogens in the environment or the susceptibility of cows in the herd. A vaccine administered to a host is likely to have limited effect on environmental prevalence of many mastitis pathogens. These results are consistent with those observed for the one proven efficacious mastitis vaccine presently used by the dairy industry. The *E. coli* J-5 vaccine has been shown in field trials to have no effect on the rate of new IMI, but to effectively decrease the severity and duration of *E.coli* mastitis (Hogan et al., 1992). If mastitis nosodes function in a manner analogous to a vaccine, then differences in spontaneous cure rates and rates of clinical mastitis might be expected. Data analysis continues to identify potential differences in mastitis cure rates and rates of clinical mastitis, as well as potential differences in somatic cell counts between nosode treated cows and cows receiving the placebo.

Discussion

We present here some preliminary results of placebo controlled double blind studies conducted in Vermont to assess the efficacy of mastitis and E. coli nosodes used in dairy cattle.

These studies should be considered a starting point for the critical evaluation of alternative therapies used in food animal medicine.

In order to further stimulate discussion we present some comments on the challenges with the study design, and some issues that have been brought to our attention concerning the study of homeopathy. We conclude with a review of the considerations for the design of field trials to study homeopathy.

Challenges with the design of the study

In general, the herds involved in this study were run by good managers. The high quality of these herds may have influenced the results of the study, because they entered the study with relatively low somatic cell counts, and low rates of clinical mastitis. Thus the opportunity to observe dramatic differences in cure rates may have been limited. However, this must be weighed against the possibility of poor compliance of managers who demonstrate a lower standard of milk quality and udder health. Barkema et al. (1999) studied management style and the association with bulk tank milk somatic cell count, and found that there was a strong relationship between a quick and dirty management style and a high bulk milk SCC, and that the farmers with a high bulk tank SCC implemented mastitis prevention measures less often and for shorter periods.

Just by being in a study, the participants may become more aware of their mastitis prevention practices, and improvements in overall udder health and milk quality might be expected.

Cooperator herds were not always good at taking milk samples on time. Sometimes a few days post fresh instead of on the day she freshened (for example). This should not be a significant problem, as for majority of samples were taken within an acceptable range of days.

Some farmers were more observant and treated cows for situations that may have gone overlooked on other farms. For example, a number of organic herds recorded clinical mastitis cases in the early dry period, which raises the question of whether this was a measure of better observation of dry cows or a result of lack of dry cow therapy use on organic farms? Regardless, the number of clinical cases reported for a herd depended on farmer observation.

Other Issues:

1) Nosode Administration

A lot of preliminary discussion on nosode administration took place with the help of two experienced large animal homeopathic vets, Dr. Steve Woodard and Dr. Edgar Sheaffer. It is important for the nosode to come in contact with the mucous membranes and our choices were the mouth, nose, eye or vulva. We decided that the best way to treat the animals, with the smallest risk of the animals treating each other, was by administration in the vulva of individual cattle. The farms involved had various management styles, including: 100% confinement in freestalls, tie barn housing with access to pasture, and freestall housing with access to pasture. We knew that we could not ask the farmers to divide their herds into two groups for administration in separate

water sources. We wanted to find a way to conduct an experiment where the cooperating herds could continue managing their animals the way they normally do. Further, by not housing treatment groups separately, an additional source of "pen" or "group" bias was avoided.

One of the participating farmers pointed out, since we really know so little about how homeopathy does work, is it possible that the cows that are getting the placebo are actually getting "treated" by the other cows just by rubbing noses, sharing the same space, grazing the same ground? There is so little that we know about how homeopathy works. Is it possible to study its effects in a conventional, reductionistic design when it may work in a more holistic, energetic way? How do you measure such effects?

2) Why booster the animals every two months, at calving and at dry off?

Steve Woodard found that when using a mastitis nosode on other farms, it is necessary for the nosode to be given to all the animals a minimum of every 5 months. We decided that, for safety, we would booster them every 2 months to make sure the there is no reduction in the effects of the treatment. We also felt that, since the animal is being handled at calving and dry off, and since there tends to be a certain amount of stress at these times, it would be good to give the animals a booster at these times as well.

The mastitis nosode is a 30 C potency in a 50% alcohol solution. The alcohol solution gives the nosode a longer shelf life making it affective for at least 5 months provided it is stored in a cool dry place

3) Why look at bacteriologic outcomes, when homeopathy may be acting in a more holistic way?

The use of homeopathic remedies is being promoted for the treatment and prevention of mastitis. Given this objective, it seems appropriate to test a hypothesis that homeopathic nosodes are significantly better then no treatment for the prevention of mastitis. In order to test this hypothesis it seems appropriate to use a discrete outcome such as differences in prevalence and incidence of bacteriologic infections, or bacteriologic cure rates. Homeopathy is being promoted as a treatment alternative for mastitis, so discrete measures of mastitis risk and occurrence are indicated – if homeopathy were being promoted only as a method to enhance the vitality of the whole farm system, then outcome measures of a more holistic nature would be more appropriate.

Response to the nosode

The response to the nosode is supposed to be very fast. A first response can be discharge; a lot of junk (aggravation) is part of a homeopathic treatment. This is just the animals response of cleaning itself out.

Discussion of design and critical features of field trials

Practitioners and producers require information about the effectiveness and safety of treatments and preventatives such as pharmaceuticals, vaccines, and alternative therapies.

Information may come from numerous sources including anecdotal clinical experience (personal and collective), laboratory studies, and clinical field trials. Information obtained from well-designed clinical field trials may provide some of the strongest evidence of the efficacy of specific therapeutic options. But such information is often lacking for both conventional and alternative therapies in veterinary medicine. Elbers and Schukken (1995) described the critical features of veterinary field trials in their review of veterinary field trials of drug and vaccine efficacy published in the Veterinary Record from 1988 to 1992. This review provides a list of criteria for the evaluation of field trials (table 4). In this review it was noted that a considerable number of papers lacked details of the study design and a formal analysis of the data. Of particular concern were the number of papers that: 1.) used small numbers of animals in treatment groups (46% with # 10 animals per group); 2.) did not state that treatment allocation was random (50%); 3.) did not use or state whether treatments were blinded (94%); or 4.) did not make a formal statistical analysis of results (25%). Similar reviews of study design quality have been completed for published clinical trials of homeopathic therapies used in human medicine (Kleijnen, et al., 1991, and Linde, et al. 1997). The same types of concerns were raised in these reviews, with issues of study population size, appropriate control groups, randomization, double blinding, and adequate statistical analysis being of particular concern (table 4). Kleijnen et al.(1991) found a surprisingly small number of published human clinical trials on homeopathy that are of high methodological quality. Despite these results, these authors stated they were surprised by the amount of positive evidence in favor of homeopathy, even among the trials with higher methodological quality. Based on the amount of positive results the authors stated they "would be ready to accept that homeopathy can be efficacious, if only the mechanisms of action were more plausible." Similar, positive trends were observed by Linde et al. (1997) in their meta-analysis of the human clinical trial literature. In summary, both reviews of the human literature suggest that the evidence from clinical trials of homeopathy "is positive, but not sufficient to draw definitive conclusions because most trials are of low methodological quality" (Kleijnen et al. 1991). In addition to the issue of methodological quality of clinical trials, two other issues are raised by these reports with regard to the study of homeopathy. First, is the possible effect of publication bias on a review of the literature, and second is the question of conducting research on a treatment modality where the mechanism of action is not completely understood.

With regard to publication bias, the extent to which this bias effected the conclusions of homeopathy efficacy in the reports by Linde et al. and Kleijnen et al. is unknown. The journal of publication and the bias of scientific reviewers for a particular journal may affect the publication of a clinical trial on alternative therapies. This was recently illustrated in a publication by Resch et al. (2000). These authors submitted two versions of an invented report describing a randomized, placebo controlled, trial of appetite suppressants to reviewers of scientific medical journals. Resch et al. compared the review of conventional "questionable" appetite suppressant (hydroxycitrate) with an unorthodox controversial drug (homeopathic sulphur), where the only difference in the two manuscripts was the name of the therapeutic. They identified a significant bias among reviewers in favor of the conventional version of the manuscript for the invented "research trial." They concluded that: "studies incongruent with *a priori* beliefs tend to be rated by outside reviewers as incompetently conducted." But the authors noted that while the bias observed "may put authors of unconventional papers at a disadvantage," they suggested the disadvantage was not large enough to preclude publication in peer-reviewed conventional journals." They concluded that reviewer bias " does not explain the scarcity of methodologically

sound papers on unconventional treatments in peer reviewed journals."

It has been suggested that it may be inappropriate to conduct research on treatment modalities were the mechanism of action is unknown or does not conform to current theories. Yet defenders or enthusiasts of alternative treatments typically suggest that there are many conventional therapies in common clinical use where the mechanism of action is incompletely understood. This may be true, and examples of efficacious conventional therapies where the mechanism of action are poorly defined may be presented, however, the understanding of these therapies is typically supported by accepted pharmacological mechanisms. Perhaps, a more relevant question may be that proposed by Kleijnen et al. (1991), "Are results of randomized double blind trials less convincing because there is no plausible mechanism of action?" The answer to this question may be no, as Wynn (1998) seemed to suggest, since the theories on the homeopathy's mechanism of action are speculative. And while the reports of electromagnetic differences or unique energetic frequencies of homeopathic preparations might provide some vague clues to possible mechanisms of action, these reports do little to suggest a physiological cause and effect relationship between the treatment and the outcome. Therefore, it is likely appropriate that researchers concentrate on trying to detect a clinical effect of treatment, especially given the increasing interest in, and the amount of emotional debate engendered by, homeopathy.

It is clear from these reviews that improvements in trial design and data analysis are necessary in clinical field trials of both conventional and alternative treatment modalities in veterinary and human medicine. There is no reason to believe the influence of publication bias, data massage, bad methodology, etc. is less in conventional medicine then in alternative medicine research. However, the unique nature of homeopathy suggests that rigorous attention to detail in study design and data analysis may be required for the publication of clinical research trials on homeopathy. While Wynn (1998) has provided a review of studies on homeopathy in veterinary medicine, no assessment of the methodological quality of veterinary homeopathy research has been made. In the future, it appears that a critical review of clinical trials of homeopathy in food animal species is warranted.

It also seems clear from these reviews, that it is possible to perform trials on the efficacy of homeopathy in a way that is acceptable to both classical (i.e. skeptical) physicians, and enthusiastic homeopaths (Kleijnen et al. 1991). Schukken and Deluyker (1995) provided a summary of the design and analysis of field trials for the evaluation of the efficacy of products for treatment of bovine mastitis. The recommendations made in that paper may also be applied to the design and analysis of products recommended for mastitis prevention, including alternative treatments such as homeopathy nosodes. In addition, the features (or criteria) for design of field trials for the evaluation of mastitis therapies are similar to those suggested for the evaluation of human homeopathic therapeutics (table 1), so it should be possible to design clinical field trials of high methodological quality for the study of alternative therapies for mastitis prevention and treatment. Key among these design features is defining the trial objectives and the hypothesis being tested, reducing bias and confounding influences, assuring appropriate randomization and blocking, selecting appropriate experimental units, reference populations, and study populations. Defining appropriate treatment regimens (including blinding), and relevant response measures or outcomes, is also a critical component of study design. Finally, appropriate statistical analysis

and reporting of results must be planned for prior to initiation of the study. One complication to be considered in the study of homeopathy is the consistent application of an individual treatment regimen for a clinical case, and different potencies of various remedies may need to be compared, as "virtually no evidence exists about the correct choice of remedy or potency" (Kleijnen, 1991). A related difficulty is the apparent disagreement among homeopathic practitioners concerning the efficacy of the various types of homeopathic preparations and practices, including disagreements on the efficacy of prophylactic use of nosodes, or on the use of combination preparations to treat an animal with a clinical disease such as mastitis based only on the presenting sign of mastitis, and not a larger spectrum of signs and symptoms.

Using the criteria in table 1 it should be possible to complete a review of literature on the use of homeopathy to prevent and treat mastitis in dairy cattle. Such a study is currently being conducted, and approximately 50 publications on the use of homeopathy for treatment of mastitis have been identified. Similar to the findings reported in the human literature, few of these publications appear to be of high methodological quality. Therefore the criteria described by Schukken and Deluyker for the design of mastitis therapy trials must also be applied to future studies. If skeptical practitioners are asked to accept the results of clinical field trials of homeopathy in food animal medicine, then additional evidence must consist of well performed controlled trials with large numbers of participants under rigorous double blind conditions.

Table 1: Criteria and features for assessing the quality of clinical field trials

Feature	Reference[1]			
	Schukken & Deluyker (1995)	Elbers & Schukken (1995)	Kleijnen, et al. (1991)	Linde, et al. (1997)
Characterize the patient population or case adequately (describe symptoms, duration, severity)	Yes	No	Yes	Yes
Number of treatment groups and the inclusion of a control group	Yes	Yes	Yes	Yes
Numbers of animals in each treatment group relative to the number in the control group	Yes	Yes	Yes	Yes
Random allocation of animals to the treatment and control groups (confounders eliminated)	Yes	Yes	Yes	Yes
Intervention (treatment) well described (repeatability of trial)	Yes	No	Yes	Yes
Single or double blinding	Yes	Yes	Yes	Yes
Outcome well defined (measurable)	Yes	No	Yes	Yes
Descriptions of statistical analysis applied	Yes	Yes	Yes	Yes
Calculation of the type II error and statistical power	Yes	Yes	Yes	No
Potential problems associated with clustering of patients due to housing or grouping for management	Yes	Yes	No/NA	No/NA

1. Yes, if authors included the feature or criteria in their review; No, if the feature or criteria was not mentioned in the reference. NA= may not be directly applicable in human trials, however clustering within treatment groups may be possible

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Alternative Methods of Disease Prevention in Herd Situations

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When one speaks of disease prevention, one of the first ideas that comes to mind is vaccinations. While this is an important method, I'd like to come back to this later, as there are more fundamental and important methods to first be considered.

Animals should live in a dean environment. They shouldn't have to lie in their own feces or urine, breathe stale air, or drink dirty water. Infection is often a question of numbers; while the body's own immune system can usually handle a few invading bacteria or viruses, a massive overload will often overwhelm even a healthy individual.

Good nutrition allows all organ systems, including the immune system to function properly. The diet should consist of a wide variety of food stuffs appropriate to each individual species. For most live stock, this consists of a variety of plants and herbs, preferably in a fresh or naturally preserved state, such as in hay or silage. Heating destroys or changes many nutrients and can lead to deficiencies. The best way to ensure that an animal is getting a wide variety of nutrients is to allow it to gaze in a native pasture where, in addition to grass and legumes, it can also consume various herbs. We need to trust an animal's instincts to seek out those herbs and nutrients it needs to heal itself, for what is instinct but the cravings and aversions the body has for certain materials. If the body needs a certain nutrient, the animal will have a craving for that nutrient, and will consume it in g-eater than normal amounts until that need is satisfied. Similarly, an aversion is the body's way of saying that there is something here which is not good, that may be harmful, and so to avoid it. Few animals will eat something poisonous if there is other feed available. Native fields, rather than monocultures, are more likely to have a greater variety of healing herbs.

Low herd densities in a field allow for more choice in the balance of plants consumed. It's easy to determine the carrying capacity of a field and then to stock it under that carrying capacity. This allows both for better nutrition and for better hygiene, as the animals are more able to avoid each others' waste. Pasture rotation furthers this. Following one species on a pasture with another avoids contamination while at the same time allows for better utilization of fields. Goats, for example, browsers, could follow cattle or sheep, grazers, followed by pigs, rooters. Companion animals can help reduce disease too. Guinea fowl, and to a lesser extent chickens, will eat ticks, thus lowering the incidence of Lyme disease.

Most herd animals will go off from the herd when giving birth, thereby avoiding disease and contamination to the newborn. An important start for any newborn mammal is its mothers colostrum, which gives it an early passive immunity to diseases.

Proper hygiene is important to avoid disease. Animals should not be forced to live in their own excrement. By nature, most herd animals are migratory, seeking fresh pastures, and leaving their feces behind. Contact with stool leads to increased worm burdens, as well as disease from Salmonella, E. coli, and other gastrointestinal diseases, and can lead to mammary infections. Contact with urine can spread leptospirosis. Overcrowded barns increase ammonia and water vapor in the air, leading to respiratory infections and immune weakening.

Barns need proper sanitation, where the feces and urine are removed, fresh air is circulated and clean water is provided. Lower population densities mean a lowered likelihood of spreading disease. If the animals can't move away from their wastes, the wastes must be removed from the animals.

Lets look at some specific steps that can be taken to enhance immunity. The first and most important is to ensure that all newborn mammals receive colostrum from their dams. This provides them with antibodies against the disease to which their dams had been exposed. It would be wise to always have some frozen colostrum on hand for those newborn who for some reason didn't get it from their dam. Colostrum can also be used in older animals to treat diarrhea and gastrointestinal dysfunction, as well as providing specific antibodies and general immune stimulation.

There are numerous plants that have the ability to stimulate an animal's immune system. Some, such as Echinacea and golden seal, are well known for vial and bacterial infections. Another common immune stimulant, garlic, also helps to dispel intestinal parasites. Other, less well known plants that will help prevent, and also treat, viral infections are cats claw, astragalus, pao d'arco, thuja, St. John's wort, and various mushroom types such as reishi, shitake, and maitake. Lemon balm is useful for treating as well as preventing herpes infections. This list is certainly not complete, as this is a new and evolving field. Oscillococcinum, from duck liver, is used to stimulate the immune system after exposure to the flu. Most materials that can prevent infectious diseases can also treat them, though the reverse is not always true.

The most common method of specific disease prevention is by vaccination. For many diseases, this is quite effective, but not for all. In other words, the efficacy of the vaccines vary significantly. For example, the rabies vaccine and canine and feline distemper vaccines are very effective, while the feline leukemia vaccine, FIP vaccine, and Lyme disease vaccine are almost worthless. Parvo vaccine is moderately effective, as is the kennel cough vaccine. The other problem with vaccines are the side effects, the most serious of which are long term. Vaccines are designed specifically to stimulate the immune system, leading at times to auto-immune problems. The canine distemper vaccine may lead to hypothyroidism and the feline distemper vaccine to hyperthyroidism. Lyme disease vaccinations have at times induced symptoms of Lyme disease, and Feline Leukemia vaccinations have led to clinical FIP. Rabies vaccinations in older cats and dogs can lead to renal failure.

Homeopaths have found that certain remedies could be given in the face of epidemics which would prevent those epidemic diseases from infecting those patients. Teste relates how Hahnemann first found this in a Scarlet Fever epidemic, where a patient he had previously given Belladonna did not develop Scarlet Fever while all the rest of her family became ill. He later used camphor to protect against cholera. Others have found other remedies protective; lathyrus for polio, mercurius cyanatus for diptheria, and baptisia for typhoid, amongst others.

Other homeopaths found that giving a potentized remedy made from the disease organism or typical infectious agent could protect against that disease. Such a remedy is called a nososde. Hering,1879, protected several dogs from rabies by using a remedy made from the saliva of a rabid dog. Homeopaths have used morbillinum to protect against measles, diphthermnum for diptheria, pertussinum for whooping cough, variolinum for small pox, and tuberculinum for tuberculosis, amongst others, according to Shepherd, 1983.

Clinical trials in recent years by homeopathic veterinarians have yielded interesting results. Day, 1986, in England, used a mastitis nosode to lower the rate of mastitis in a herd of dairy cows,

as well as lower the cell count in the milk. Another clinical trial of Day, 1987, reduced the incidence of kennel cough in a boarding kennel by giving kennel cough nosode, from over 90% to under 5%. Saxton, 1991, also in England, dropped the incidence of distemper in a dog pound from over 11% to under 5%. In a number of catteries, I have reduced the incidence and severity of feline upper respiratory tract infections by giving a nosode made from the discharge of affected cats. I have been using a Lyme disease nosode to protect dogs and horses from Lyme disease, and have seen no more than 10 cases in the 10 years I have been doing this. My own experience with kennel cough nosode is that it will prevent the spread of kennel cough and can also be used to treat kennel cough.

From time to time, new diseases appear, like parvovirus disease in dogs, or appear perhaps in a new locale, such as HIV. Many of these are viral diseases. Developing a new vaccine takes many years, if possible at all. If the infectious agent is known, be it saliva, mucous, blood, feces, or something else, a homeopathic nosode can be made that would very likely b protective against that disease.

Here is how to prepare such a nosode. Let's assume that a major symptom is a nasal discharge, and there is coughing, so it is likely the disease is spread by coughing, spreading aerosols. Get a small 1-oz bottle of vodka, pour off half of it (save this). With a 0-tip, wipe up some of the mucousy discharge from a sick animal. Cut the tip off of the 0-tip so that it falls into the half-filled small vodka bottle. With a fresh 0-tip, wipe mucous from another sick animal. Cut head of Q-tip, wipe mucous from another sick animal. Cut head of a 0-tip off so it falls into the vodka bottle. Repeat with each sick animal. Put the cap back onto the bottle, shake well, and leave for a few days to macerate. Take a small vial, about 10 ml (I use a 10 dose rabies vaccine vial), wash it well, sterilize it, dry it, then add water until it is about half full, counting the number of drops added, until it is an even multiple of 100; that is, 200, 300, 400, etc. Put a piece of clean tape around the vial and with an indelible marker, mark the height of the water level. With a dropper, add 1 drop of the vodka mix for each 100 drops of water in the vial. For example, if you have 300 drops of water in the vial, add 3 drops of vodka mix; to 400 drops, add 4 drops vodka mix, etc. Take some fluffy towels, fold them and pile them up. Put a stopper in the vial, hold the vial in your fist, and pound your fist onto the towels 10 times. This is now your 1 C potency. Take out the stopper, pour out the contents of the vial, immediately stand the bottle upright, (a few drops cling to the wall) and add fresh water up to the mark showing the original water level. Replace the stopper, take the vial in your fist and pound your fist into the pile of towels 10 times. This is the 2C potency. Continue through the 28C potency. This time, to make the 29C potency, don't add water, but use the vodka you originally poured out of the bottle, before you added the 0-tips, to fill the vial to the original water level. Cap it, pound it (called sucussing), but pour this into a small jar and save it. Add some more vodka to your potentising vial to make the 30 C potency. This is what you will dispense. Add 1-2 d-ops to each animal's water bowl or bucket. Try to keep the water bucket out of direct sunlight.

The protocol I generally use is to give the nosode once a day for 1 week, then once a week for 1 month, then once every six months. Some people prefer to give it once a day, especially when there is a continually changing population, such as in an animal shelter. If you think you will be using a lot of the nosode, make your 28C potency also with the vodka and save. When you run out of the 30 C potency, put 100 (tops of water in a vial and add 1 (top of the 29 C potency in vodka, sucuss 10 times, and you have a 30 C potency. This is easy to make, costs no more than a 1

ounce bottle of vodka and a few Q-tips, and in spite of it's simplicity, will amaze you with how effective it is in preventing disease, and even in treating the same disease.

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AVMA Perspectives on Complementary and Alternative Veterinary Medicine

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The AVMA Executive Board convened the Task Force on Complementary and Alternative Medicine in order to review and revise the Guidelines that were created in 1996. There has been an increasing amount of interest in complementary and alternative veterinary medicine (CAVM) at many levels—private practice, some students and faculty at the accredited veterinary colleges, and among legislative bodies in various States and Provinces. In view of this, the Task Force was Charged with the following:

1) Research the literature on the development and use of alternative and complementary therapies in veterinary medicine, including: acupuncture, botanical medicine, chiropractic, holistic medicine, homeopathy, massage, nutraceuticals, and physical therapy.
2) Review the 1996 AVMA "Guidelines on Alternative and Complementary Veterinary Medicine" in the light of current literature and knowledge about the application and efficacy of the alternative and complementary therapeutic methods.
3) Recommend to the Executive Board revisions to the Guidelines that are necessary to make them consistent with the current knowledge in the subject areas to provide up-to-date guidance for AVMA members.
4) Review and report on programs designed to provide opportunities for providing education to members of the veterinary profession on the application and efficacy of alternative and complementary therapies.

Chosen to be members of the Task Force were AVMA members representing the following sectors of the profession. Each sector or species organization sent nominations to the Executive Board, which then chose one person per sector.

1) Equine practice (only traditional Western medicine)
2) Equine practice (using CAVM as well as traditional Western medicine)
3) Small animal practice (only traditional Western medicine)
4) Small animal practice (using CAVM as well as traditional Western medicine)
5) Food animal practice
6) Academic clinician
7) American Association of Veterinary State Boards (AAVSB)
8) Association of American Veterinary Medical Colleges (AAVMC)
9) AVMA Executive Board—serving as Chair of the Task Force

The names of the individuals are being kept confidential at this time (except Drs. Harman and Karreman present at this meeting) until the process is complete. In the last two weeks the Task Force reached unanimous agreement regarding the document and the Chairman has moved the process forward—submitting the document to the AVMA Executive Board for review. It is anticipated that the Executive Board will be sending the document out for comments, either to the AVMA membership in its entirety or to all known veterinary groups (both traditional Western oriented and alternative) for each group's official response.

Once unanimous agreement was reached, the Chairman generated a list of anticipated Frequently Asked Questions (FAQ's), to which the Task Force members are still adding, deleting and/or creating answers. These are (so far):

1) Why are guidelines for CAVM needed?
2) How were these guidelines developed?
3) Why are the definitions and descriptions of some specific CAVM modalities in the 1996 AVMA Guidelines for Alternative and Complementary Therapies missing from these guidelines?
4) Do these guidelines support or discourage CAVM?
5) Do these guidelines establish a different standard for CAVM than that for other medicine?
6) Do these guidelines support the practice of CAVM by non-veterinarians?
7) What training is needed to become competent in CAVM?

It is hoped that we (Drs. Harman and Karreman) will be helpful in interpreting this meeting's information in light of the work done by the AVMA Task Force on Complementary and Alternative Veterinary Medicine.

Alternative and Herbal Livestock Health Sourcebook

University of Connecticut
College of Agriculture and Natural Resources
Department of Plant Science

Chapter 19
Western Herbal Medicine: Traditional Materia Medica

James E. Duke, Judi duCellier, Stephen Beckstrom-Sternberg

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Complementary and Alternative Veterinary Medicine
Principles and Practice

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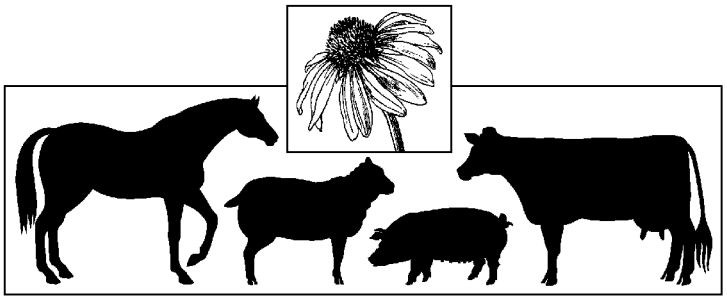

Chapter 19 pages 299-336 entitled Western Herbal Medicine: Traditional Materia Media by James A. Duke, Judi deCellier and Stephen Beckstrom-Sternberg. This chapter is in a text entitled *Complementary and Alternative Veterinary Medicine, Principles and Practices* edited by Schoen and Wynn, ISBN 0-8151-7994-4 © Mosby, Inc.

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University of Connecticut
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for Complementary and Alternative Veterinary Medicine

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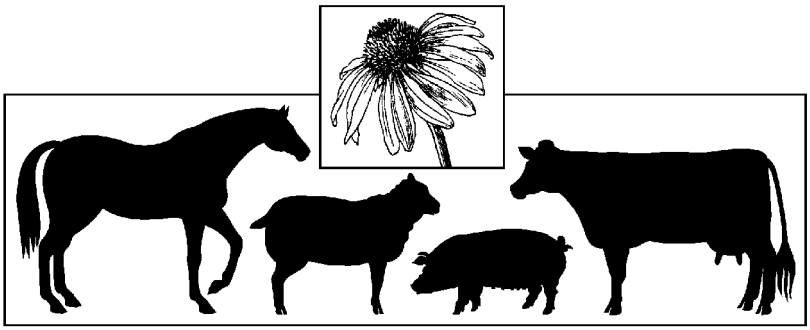

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Summary of USDA Organic Standards

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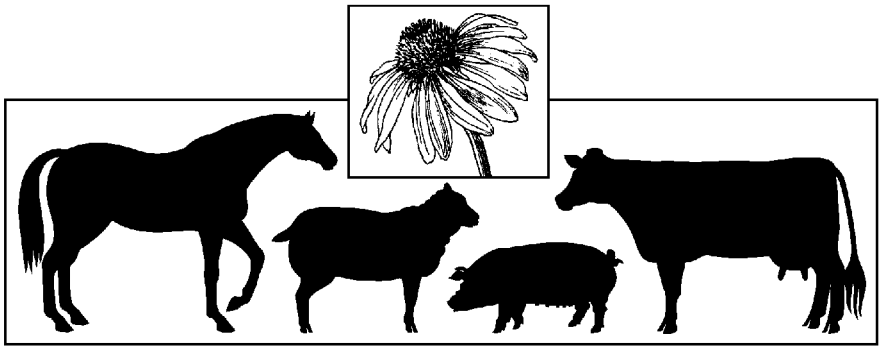

Certified Organic Livestock Production in Connecticut

Robert J. Durgy

Currently all organically produced livestock are regulated under the National Organic Program (NOP). The NOP developed standards for organic production that acts as the basis for certification. Certification is the process by which a producer verifies their production methods are in compliance with the national organic standards. This is done by submitting an application to a certifying agent accredited by the NOP. The application describes the producers organic management system. The application is reviewed and then verified by an on-site inspection.

The NOP went into effect on October 22, 2002. Prior to this date certification was done by many independent or state managed programs each independent from one another. In Connecticut the Northeast Organic Farming Association (CT-NOFA) offered certification, as was the case in most of the states in the northeast. While most developed standards based in those set forth by the International Federation of Organic Agricultural Movements (IFOAM) there was no national standard. The USDA became involved after concerns, especially from other countries, were raised as to the uniformity of certified organic products from the United States. After many years of development and many revisions after public comment the national standards now are the basis for certified organic throughout the nation. Many of the same agencies that certified prior to the NOP gained accreditation from USDA to certify under the new standard. CT-NOFA did not seek accreditation for philosophical reasons and for lack of manpower to develop the massive application.

There are now 8 certified organic livestock operations in Connecticut, one dairy and seven producing eggs and poultry; probably twice that who follow the standards but are not certified. Many producers have gone this route because of a prevision in the national standards that allow farms that gross less than $5,000 to use the term organic without being certified. As is the case with much of agriculture across the United States, most organic producers in Connecticut only farm part time.

The following is a description of the NOP livestock standards with regards to animal health:

The NOP standards are rules governing how livestock is managed to be called organic. Also, the standards include the National List. This is a list of synthetic and non-synthetic generic products that are designated as usable or not under the NOP standards. This list is referred to often throughout the standards. The standards do not refer to any brand name product. It is up the certifying agent to interpret the standards and accept or reject the use of any individual product.

The health of any animal starts with good nutrition. The feed requirements are quite basic in that the feed including pasture and forage must be organically produced. Additives may be added to feed if they are on the National List. These additives must be for proper species health and growth. Animal drugs, growth hormones or plastic pellets for roughage my not be used. The feed may not contain urea, manure or slaughter by-products.

The key to health maintenance is preventative practices. As stated above, adequate and appropriate diet is required. Varietal selection is based on site-specific conditions. The producer

must establish appropriate housing, pasture conditions, and sanitation practices to minimize the occurrence and spread of diseases and parasites. Physical alterations, such as trimming horns or bobbing tails are allowed providing that the action is for improved animal well-being. These operations should be conducted in a manner that minimizes stress and pain.

The producer must administer medicine as needed to protect the well-being of their animals. When preventive practices and veterinary biologics don't work to prevent sickness, the producer may administer medications included on the National List. No substance, synthetic or natural, that are prohibited on the National List, may be used for health care if the animal is to remain certified. The producer may not administer synthetic parasiticides to breeder stock during the last third of gestation or during lactation if the progeny is to be sold, labeled, or represented as organic. After administering synthetic parasiticides to dairy stock, the producer must observe a 90-day withdrawal period before selling the milk or milk products produced from the treated animal as organically produced. Paraciticides must not be used on any slaughter stock. Animal medication should not be used on a routine basis. The producer must not administer any animal drug, other than vaccinations, in the absence of illness. On the other hand, medical attention must not be withheld simply to maintain organic status. The well-being of the animal is of utmost importance. Prohibited materials should be used when organic methods fail, even when this means losing organic status permanently, to protect the health of the animal.

One requirement of certification is organic system plan. All producers must have a document including the basics of their farm operation. This plan also must include information that addresses potential problems. For a livestock producer this plan must include the preventative measures taken to deter illness, the allowable medication that will be used and a method of determining when a sick animal must be treated with prohibited medicines. Once again, the animals well being is the priority. A producer cannot have "an acceptable level of chronic illness". Nor can they deal with health problems by sending the sick animals to slaughter rather than deal with the issues causing the health problem. The organic system plan must show that the producer has an idea of what potential problems may occur and has a way of dealing with them. The standards describe this as a "proactive approach to health management".

The standards recognize the fact that housing is an important factor in animal health. The housing should be appropriate for maintenance of the natural behavior of the animal. "The producer must provide access to the outdoors, shade, shelter, exercise areas, fresh air, and direct sunlight suitable to the species, its stage of production, the climate and the environment." Ruminant animals must have access to pasture. The bedding must be cleaned often and remain dry to prevent disease. When using an edible bedding such as hay, it must be produced organically. The housing should provide for a natural comfort level of the animal. While this may be subjective, basically they are looking for housing that provides the proper temperature, enough space to move around and act out their natural functions, such as a chicken scratching in dirt. Although access to the outdoors is a requirement, the animal is not made to go outside on a set schedule, especially during bad weather or when the animal's health is at risk. A Massachusetts egg producer argued that access to the outdoors at any time was dangerous to the entire flock because avian influenza is endemic to the region. The NOP agreed.

§205.237
Livestock Feed

(A) The producer of an organic livestock operation must provide livestock with a total feed ration composed of agricultural products, including pasture and forage, that are organically producer and, if applicable, organically handled: Except, That, nonsynthetic substances and synthetic substances allowed under §205.603 may be used as feed additives and supplements.

(B) The producer of an organic operation must not:

(1) Use animal drugs, including hormones, to promote growth;
(2) Provide feed supplements or additives in amounts above those needed for adequate nutrition and health maintenance for the species at its specific stage of life;
(3) Feed plastic pellets for roughage;
(4) Feed formulas containing urea or manure;
(5) Feed mammalian or poultry slaughter by-products to mammals or poultry; or
(6) Use feed, feed additives, and feed supplements in violation of the Federal Food, Drug and Cosmetic Act.

§205.238
Livestock Health Care Practice Standard

(A) The producer must establish and maintain preventive livestock health care practices, including:

(1) Selection of species and types of livestock with regard to suitability for site-specific conditions and resistance to prevalent diseases and parasites:
(2) Provision of a feed ration sufficient to meet nutritional requirements, including vitamins, minerals, protein and/or amino acids, fatty acids, energy sources and fiver (ruminants);
(3) Establishment of appropriate housing, pasture conditions and sanitation practices to minimize the occurrence and spread of diseases and parasites;
(4) Provision of conditions which allow for exercise, freedom of movement and reduction of stress appropriate to the species;
(5) Performance of physical alterations as needed to promote the animal’s welfare and in a manner that minimizes pain and stress; and
(6) Administration of vaccines and other veterinary biologics.

(B) When preventive practices and veterinary biologics are inadequate to prevent sickness, a producer may administer synthetic medications: Provided, That, such

medications are allowed under §205.603. Parasiticides allowed under §205.603 may be used on:

(1) Breeder stock, when used prioer to the last third of gestation but not during lactation for progeny that are to be sold, labeled, or represented as organically produced; and

(2) Dairy stock, when used a minimum of 90 days prior to the production of milk or milk products that are to be sold, labeled or represented as organic.

(C) The producer of an organic livestock operation must not::

(1) Sell, label, or represent as organic any animal or edible product derived from any animal treated with antibiotics, any substances that contains a synthetic substance not allowed under §205.603, or any substance that contains a nonsynthetic substance prohibited in §205.604.

(2) Administer any animal drug, other than vaccinations, in the absence of illness:

(3) Administer hormones for growth promotion;

(4) Administer synthetic parasiticides on a routine basis;

(5) Administer synthetic parasiticides to slaughter stock;

(6) Administer animal drugs in violation of the Federal Food, Drug and Cosmetic Act; or

(7) Withhold medical treatment from a sick animal in an effort to preserve its organic status. All appropriate medications must be used to restore an animal to health when methods acceptable to organic production fail. Livestock treated with a prohibited substance must be clearly identified and shall not be sold, labeled or represented as organically produced.

§205.239
Livestock Living Conditions

(A) The producer of an organic livestock operation must establish and maintain livestock living conditions which accommodate the health and natural behavior of animals, including;

(1) Access to the outdoors, shade, shelter, exercise areas, fresh air and direct sunlight suitable to the species, its stage or production, the climate and the environment.

(2) Access to pasture for ruminants;

(3) Appropriate clean, dry bedding. If the bedding is typically consumed by the animal species, it must comply with the feed requirements of §205.237;

(4) Shelter designed to allow for:

(i) Natural maintenance, comfort behaviors, and opportunity to

exercise;

(ii) Temperature level, ventilation, and air circulation suitable to the species, and

(iii) Reduction of potential for livestock injury;

(A) The producer of an organic livestock operation may provide temporary confinement for an animal because of:

(1) Inclement weather;
(2) The animal's stage of production;
(3) Conditions under which the health, safety or well being of the animal could be jeopardized; or
(4) Risk to soil or water quality.

(C) The producer of an organic livestock operation must manage manure in a manner that does not contribute to contamination of crops, soil or water by plant nutrients, heavy metals or pathogenic organisms and optimizes recycling of nutrients.

Organic Production and Handling Standards

The National Organic Program (NOP) final rule contains regulations that will ensure that organically labeled products meet consistent national standards.

What agricultural operations are affected by the standards?

Any farm, wild crop harvesting, or handling operation that wants to sell an agricultural product as organically produced must adhere to the national organic standards. Handling operations include processors, manufacturers, and repackers of organic products. These requirements include operating under an organic system plan approved by an accredited certifying agent and using materials in accordance with the National List of Allowed Synthetic and Prohibited Non-Synthetic Substances. Operations that sell less than $5,000 a year in organic agricultural products are exempted from certification and preparing an organic system plan, but they must operate in compliance with these regulations and may label products as organic. Retail food establishments that sell organically produced agricultural products but do not process them are also exempt from certification.

Standards apply to production process

The national organic standards address the methods, practices, and substances used in producing and handling crops, livestock, and processed agricultural products. The requirements apply to the way the product is created, not to measurable properties of the product itself. Although specific practices and materials used by organic operations may vary, the standards require every aspect of organic production and handling to comply with the provisions of the Organic Foods Production Act (OFPA). Organically produced food cannot be produced using excluded methods, sewage sludge, or ionizing radiation.

Crop standards

The organic crop production standards say that:

Land will have no prohibited substances applied to it for at least 3 years before the harvest of an organic crop. The use of genetic engineering (included in excluded methods), ionizing radiation and sewage sludge is prohibited. Soil fertility and crop nutrients will be managed through tillage and cultivation practices, crop rotations, and cover crops, supplemented with animal and crop waste materials and allowed synthetic materials.

Preference will be given to the use of organic seeds and other planting stock, but a farmer may use non-organic seeds and planting stock under specified conditions. Crop pests, weeds, and diseases will be controlled primarily through management practices including physical, mechanical, and biological controls. When these practices are not sufficient, a biological, botanical, or synthetic substance approved for use on the National List may be used.

Livestock standards

These standards apply to animals used for meat, milk, eggs, and other animal products represented as organically produced.

The livestock standards say that:

Animals for slaughter must be raised under organic management from the last third of gestation, or no later than the second day of life for poultry. Producers are required to feed livestock agricultural feed products that are 100 percent organic, but may also provide allowed vitamin and mineral supplements. À`□À Producers may convert an entire, distinct dairy herd to organic production by providing 80 percent organically produced feed for 9 months, followed by 3 months of 100 percent organically produced feed. Organically raised animals may not be given hormones to promote growth, or antibiotics for any reason. À`□À Preventive management practices, including the use of vaccines, will be used to keep animals healthy. Producers are prohibited from withholding treatment from a sick or injured animal; however, animals treated with a prohibited medication may not be sold as organic. All organically raised animals must have access to the outdoors, including access to pasture for ruminants. They may be temporarily confined only for reasons of health, safety, the animal's stage of production, or to protect soil or water quality.

Handling standards

The handling standards say that:

All non-agricultural ingredients, whether synthetic or non-synthetic, must be included on the National List of Allowed Synthetic and Prohibited Non-Synthetic Substances. Handlers must prevent the commingling of organic with non-organic products and protect organic products from contact with prohibited substances. In a processed product labeled as "organic," all agricultural ingredients must be organically produced, unless the ingredient(s) is not commercially available in organic form.

December 2000

Alternative and Herbal Livestock Health Sourcebook

University of Connecticut
College of Agriculture and Natural Resources
Department of Plant Science

Perennial Medicinal Herb Trials 1996-1999

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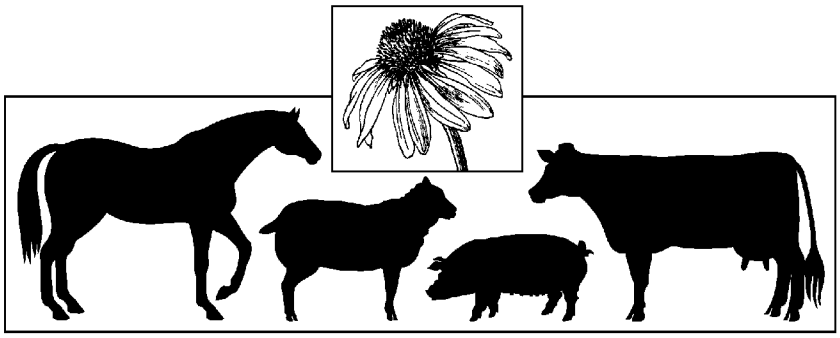

The Connecticut Agricultural Experiment Station, New Haven

Perennial Medicinal Herb Trials 1996-1999

BY MARTIN P.N. GENT

Bulletin 972

April 2001

Perennial and Medicinal Herb Trials 1996-1999

BY MARTIN P.N. GENT

Herbs are either herbaceous or woody plants that enrich the flavor and aroma of foods, or have therapeutic value in medicine. Most of these plants were known to prehistoric man; for instance, they recognized all sources of caffeine that are known today (Anderson, 1960). The medical use of herbs is documented throughout written history. The earliest account comes from the Mycenean culture in the 13th Century BC (Mabberley, 1990). Cultivated herbs spread from the Mediterranean throughout Europe during the Roman Empire (Page, 1971) and ultimately to America.

Herbs contain essential (aromatic) oils, alkaloids and other complex chemicals. Advances in analysis have identified many of these constituents (Bisset, 1994; Lawless, 1995; Duke, 1997). Several recent texts cover the pharmaceutical aspects of medicinal herbs, (Hoffmann, 1994; Duke, 1997; McGuffin et al., 1997; Tyler, 1999) and much of this information can be found on the internet (*see references*).

Consumers are interested in alternative medicine and medicinal herbs. In the United States today, herbs are found not only in health food stores, but also in the pharmacy sections of drugstores and supermarkets. Commercial production of potted and fresh-cut herbs in greenhouse and field has increased greatly in the last 20 years (Craker, 1999).

Many herbs can be grown in Connecticut. Knowledgeable gardeners have been growing them since Colonial times. However, information concerning the culture and yield of herbs is limited. In the recent Proceedings of the Second World Congress on Medical and Aromatic Plants, there was only one reference to yield of plant material from repeated harvests (Jeliazkova et al., 1999). Most reports were on the quality and quantity of the constituents of the herbs. Some recent work in the United States has examined the yield of herbs as affected by row covers and plastic mulch (Bower, 1998) or differing rates of fertilizer application (Csinzinsky, 1998).

There are many books on the culture of herbs, particularly with reference to their use as ornamentals in the garden (Mabberly, 1990). Such books include information on suitable soil types and microclimate for growing herbs. However, as the plants are grown as isolated specimens, or in irregular clusters, no information can be gleaned about likely yield from a larger and more regimented planting.

This bulletin describes the yield of 13 species of perennial medical herbs grown in the field in Connecticut. Our particular focus is the variation in yield due to the source of seeds, and changes in yield over time for several years after planting. Previous bulletins described yield of culinary herbs (Hill, 1992), and yield in the year of planting of some of these medicinal herbs (Butterfield, 1997). The information presented here will help determine the quantity of plants or the size of plot necessary to produce a desired yield of herbs for retail or wholesale trade.

METHODS AND MATERIALS

Fourteen companies supplied seeds for this study. Contact information and the abbreviation used for each company is listed in Appendix A. Appendix B lists the names of the varieties and the common name and Latin binomial of each species supplied by each seed source.

Seed Germination. The rate of germination was determined for the seeds used in plantings in 1996 and 1998. In 1996, seeds were sown in flats containing ProMix in a greenhouse maintained at 72F. Germination was counted for 36 to 72 seeds per source over a period of 3 weeks. In 1998, germination rates were determined from 100 seeds per sample. Seeds were sown in ProMix and grown in a controlled environment of 75F and a 12-hour photoperiod with light equivalent to 1/10 full sun.

In 1996, seedlings were grown for 6 weeks in the greenhouse before transfer to a cold frame to acclimate for 10 days. In 1998, seedlings were grown for 4 weeks in the controlled environment before transfer to a cold frame to acclimate for 7 days. Before they were transplanted in 1996, seedlings were fertilized with Hoagland's solution. In 1998, seedlings were fertilized before and at transplanting with a complete fertilizer containing 20-9-16 N-P-K applied at 400 ppm nitrogen.

Field Planting. Trials were conducted at Lockwood Farm in Hamden, CT. The soil was Cheshire fine sandy loam, a well-drained soil with a moderate moisture holding capacity. An area of 5,000 square feet was prepared and amended with 50 lbs. of 10-4-8 N-P-K fertilizer and 400 lbs. of limestone. Seedlings were transplanted into the field on May 24,1996. Some blocks were tilled and replanted with sage, thyme and yarrow on April 29, 1998.

The species were planted in blocks surrounded by walkways. A block contained one species, with plants of a given seed source in adjacent rows of five plants per row. The plant spacing was 2-ft x 2-ft. The walkways were 4 feet wide. In 1996, there were usually two rows per seed source and one block per species. In 1998, there were three rows per seed source planted in each of two replicate blocks of each species.

The plot received full sun. It was watered as necessary in summer to maintain growth. Weeds in walkways between species were controlled with glyphosate herbicide and hand cultivation. Black landscape cloth was used to control weeds within blocks in 1996. This was removed early in 1997, and thereafter weeds within the rows of plants were removed by hand. Many species tended to spread until there was no bare ground between adjacent plants. The area around the plants was hoed to prevent spread into walkways and to maintain a space of 6 inches between plants. In each year after planting, soil tests indicated good fertility for all elements except nitrogen in the established perennial plots. In early spring of each year, these plots were fertilized with a broadcast application of ammonium nitrate at 4 lbs. per 1000 square feet.

Harvesting and drying. The species were harvested at various times due to differing growth and development. The entire block of one species was harvested at one time, when flowers were open, but before they went to seed. This timing is recommended by herbalists to maximize phyto-chemicals in the foliage (Dobelis, 1986). In the year of planting, there was one harvest. In the following years, there were generally two harvests, in early June and mid to late August. Herbs were harvested by cutting the shoots at a height of 4 inches above ground level. The shoots were dried in an open greenhouse at maximum temperatures of 75 to 100F for 3 weeks. The entire sample was weighed. A sub-sample was dried in an oven at 140F for 3 days to determine water content and to express results on a dry weight basis. In some harvests, the yield of individual plants was recorded by position within row and row within plot. This information was used to determine the effect on yield of growing on the edge of the plot. Border plants yielded 30% to 100% more than those growing in the interior of the plots. The increased yield of border plants varied among species and with time after planting. The yields were corrected for these edge effects. In this report we give yields of the entire shoot on a dry weight basis in grams/plant, as calculated for an individual plant entirely within a large plot. To convert these values for larger areas, multiply by 24.0 to give pounds/acre, and by 21.4 to give kilograms/hectare. The roots of three species were harvested after two years of growth. A longer growth period of 3 to 5 years is recommended for roots to develop in echinacea and valerian. Flowering shoots were removed periodically from echinacea and valerian, which may have lowered root yield. Shoots of lovage were not cut before the root was harvested.

RESULTS

Seed germination. Although all seeds were germinated under controlled conditions or in a greenhouse, there was great variability in the fraction of seeds that germinated (Table 1). This variability was seen for each of the species studied. There was no consistent pattern in germination rates across species that could be attributed to the source of seeds. These results should not be used to estimate the germination of other batches of seed from these or other seed sources, as they are likely to vary as much as the range of germination percentages shown here.

The herbs differed in time to germinate. Feverfew and hyssop were among the fastest species to germinate. Cotyledons appeared within 3 days, and full germination was reached by day 12. Thyme and yarrow appeared in 5 days and reached a maximum germination after 10 days. Beebalm and horehound began to germinate after 7 days, and the maximum germination was reached by day 14. Lovage did not appear until 10 days, and only 30% of the sage had germinated by this time. Lemon balm germinated more slowly, only 50% of the seeds had germinated after 2 weeks. Catnip also germinated poorly. Seedlings began to emerge after 7 days, and maximum germination occurred at 20 days. The germination of mint seeds was not quantified, because they are extremely small. The seedlings emerged within 5 days. Early in germination, a cold treatment of 40F in the dark was applied to echinacea for 12 days and valerian for 6 days. For both species, some cotyledons were visible after 5 days, and germination was complete at 11 days.

Yield of flowering shoots. Three of the herbs planted in 1996 were harvested over four years. These species were horehound, hyssop, and lemon balm. Yield changed as the plants aged in this long-term study, and the difference in yield for spring compared to summer cuttings also varied from year to year.

Other species in this trial were only harvested for two years after planting in 1996. The growth characteristics of beebalm and mint were similar to that of lemon balm, while catnip was similar to horehound. Feverfew had poor survival over the winter and the stand was sparse in the second year. Echinacea was grown to harvest the roots, but the flowering shoots were also harvested in each year.

The species, sage, thyme and yarrow, were planted in 1998 and harvested for two years. Although sage and thyme are primarily grown as culinary herbs, they also have medicinal value. These species had production characteristics similar to balm or hyssop, with a higher yield in the second year than in the first.

Table 1. Percent of seed that germinated by species and seed source

	Seed source												
Latin binomial	CP	CF	FB	GC	HS	JS	NG	PS	PT	SG	TG	TS	WB
Achillea millefolium			9%					90%	92%			85%	86%
Echinacea purpurea	77%			63%	72%	80%	70%		88%	40%	90%		
Hyssopus officinalis	53%	62%		79%	96%	58%	50%		6%		94%		
Levisticum officinale			51%			45%		69%					37%
Marrubium vulgare	60%	37%		42%	40%	53%	90%				77%		
Melissa officinalis	16%	87%			43%	36%			46%	66%	75%		
Mentha species													
Monarda didyma				93%	54%	21%	46%				0%		
Nepeta cataria		28%		5%	4%	32%	30%		38%	38%	31%		
Salvia officinalis			50%			45%		62%					
Tanacetum parthenium		66%			98%	32%	66%			54%	67%	37%	
Thymus vulgaris						71%		52%	50%				71%
Valerania officinalis					26%	56%	18%				89%		

Achillea millefolium *L. (yarrow, milfoil)*

The flowering shoots should be harvested and dried. Yarrow is a polymorph aggregate of species with tetra-, hexa- and octa-ploidy. The ploidy affects composition. There is 0.2 to 1.0% essential oil. In the tetra-ploid, 50% of this oil is chamazulene, but in the octa-ploid it is primarily linalool (Bisset, 1994). Yarrow also contains sesqui-terpene lactones, such as achillin and its esters, and alkaloids. Yarrow is a diaphoretic and is used to relieve fevers (Hoffmann, 1994).

Yarrow flowered intermittently in the first year, resulting in a poor yield. Plants flowered more uniformly in the spring of the second year, and the majority of the 2-year yield came from this cutting (Table 2). Plants flowered intermittently in the summer, and it was not worthwhile harvesting the few shoots flowering at any one time. The plants were well established and should yield well in the third year.

The seed sources differed in flower color and variation in flower color within seed source. This may reflect differences in ploidy. All flowers from the PG seed source were dark pink. Flowers from PS seeds were also all pink but more variable in hue. The WB and TS seed sources resulted in plants with pink, white or yellow flowers. WB was more predominantly pink than TS. The yield of PS was less than half that of other seed sources, due to erratic flowering in spring. All plants spread vigorously and neither insect nor fungus pests were apparent. A higher yield per plant would be obtained at a 2.5-ft or 3-ft spacing.

Table 2. Shoot yield in grams per plant of yarrow by seed source and cutting time.

Seed Source	1st year 9/10/98	2nd year 6/25/99	2-year sum
PS	28	67	95 b+
PT	51	205	256 a
TS	19	192	211 a
WB	36	179	215 a
All	33	161	194

+ Averages followed by different letters are significantly different at the 5% probability level.

Echinacea purpurea L. Moench. (common echinacea, purple coneflower, Kansas snakeroot)

SHOOTS

Echinacea is often grown to harvest the roots. However, shoots of *E. purpurea* contain 0.1 to 1.0% essential oil, composed of humulene, caryophyllene and its epoxide, germacrene-D, and methyl-*p*-hydroxycinnamate (Bisset, 1994). The foliage is used in teas and may be saleable.

Some plants flowered in the first year, and these shoots were harvested 130 days after planting. Because development was erratic, the yield was low. A high yield was obtained the following spring when all plants flowered (Table 3). There was erratic regrowth and flowering through the summer of the second year. The 2-year yield was among the highest of the species examined, due to high yield in the spring. The GC seed source gave the highest yield, and PT gave the lowest.

Echinacea is a member of the aster family, and susceptible to the same insects. Sunflower moth larva damaged more than 80% of blooms cut in late summer. They were not a problem in spring. Aster yellows was a more serious problem. It is a phytoplasma-mediated disease that alters shoot- and flower-structure (Hwang et al., 1996). It is vectored by leafhoppers, so early-season control of the insect is critical. This disease was not evident in 1996, but one third of the plants developed signs of disease through 1997. Diseased plants were removed, and not included in harvests or calculation of yield per plant. Border plants yielded 35% more than those inside the plot. A 2.5-ft x 2.5-ft spacing may promote root and shoot growth.

Table 3. Shoot yield in grams per plant of echinacea by seed source and cutting time.

Seed Source	1st year 10/1/96	2nd year 6/25/97	2nd year 9/9/97	2nd year sum	2-year sum
CP	122	152	48	200	322 ab+
GC	94	242	64	306	400 a
HS	42	145	35	180	222 bc
JS	78	203	38	241	319 ab
NG	42	183	59	242	284 b
PT	46	159	40	199	245 bc
SG	61	154	41	195	256 b
TG	29	115	26	141	170 c
All	64	169	44	213	277

+ Averages followed by different letters are significantly different at the 5% probability level.

Echinacea purpurea L. Moench. (common echinacea, purple coneflower, Kansas snakeroot)

ROOTS

The root of *Echinacea angustifolia* is highly valued for echinacoside, a glycoside with antiviral and immuno-stimulant properties (Weiner, 1990). However, many other biologically active substances are present in *Echinacea purpurea* as well as in *E. angustifolia*, and there is evidence that these constituents work synergistically (Hoffmann, 1994). In 1996, one seed source of *E. angustifolia* was planted in this trial. Few *E. angustifolia* plants survived the winter, and none survived long enough to harvest the roots.

There was a relatively low yield of fibrous roots when *Echinacea purpurea* was harvested in early September of the second year of growth (Table 4). The roots accounted for only a small fraction of the biomass of the plant. The yield of roots did not differ by seed source.

Table 4. Root yield in grams per plant of echinacea by seed source.

Seed Source	Root Yield
CP	20
GC	20
HS	15
JS	19
NG	15
PT	17
SG	12
TG	13
Alt	16

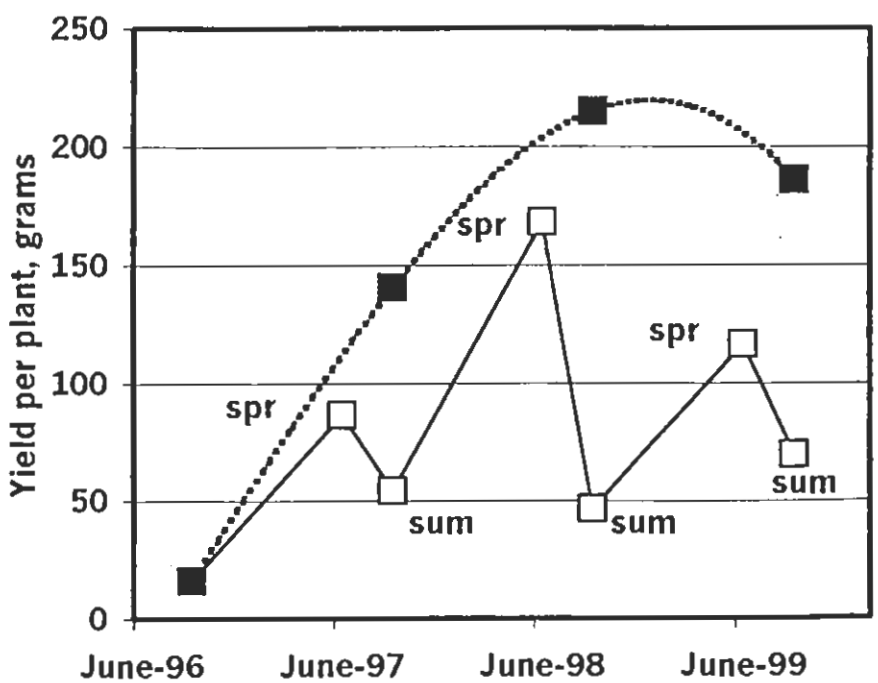

Figure 1. Shoot yield per plant for hyssop averaged over all seed sources in the trial. The line indicates yield per cutting, and solid symbols indicate yield per year over four years after planting.

Hyssopus officinalis L. (hyssop)

The woody shoots of hyssop should be harvested while in flower and dried in the sun. Hyssop contains a di-terpene, marrubiin, a glucoside, hyssopin, and tannins. The essential oil is composed mainly of camphor, pinocamphone and thujone (Hoffmann, 1994). Hyssop is used as an expectorant and to soothe sore throats (Ody, 1993).

Although hyssop grew slowly in the year of planting, it flowered only 53 days after transplant. A cutting at this time was not worthwhile as it only resulted in 16 grams/plant (Figure 1). Yields from cuttings in spring increased dramatically over the next two years. There was a particularly high yield in spring 1998, due to a delay in cutting, about 15 days after the other species. In other years, hyssop was harvested only a few days after horehound. The yield of a late-summer cutting was similar in each year after planting. Hyssop continued to produce well in the fourth year.

There were differences in yield between seed sources (Table 5). The yield of GC and HS was low because spring cuttings resulted in low yield. The CF, CP and JS seed sources had the best yields. All seed sources had similar growth habit, but some resulted in plants with either blue or pink flowers, while others were all blue.

The plants remained in flower for a long period, and bees frequented hyssop blossoms throughout. No deleterious insects or pests were noted. Over the four-year period, only three plants died in the entire plot. In the second year, border plants yielded 35% more than interior plants. In the third year, this difference in yield increased to 80%. Thus older plants were crowded by the 2-ft x 2-ft spacing.

Table 5. Shoot yield in grams per plant of hyssop by seed source and year after planting.

Seed Source	1st year	2nd year	3rd year	4th year	Sum of 1st 2 years	Average per year
CF	24	158	250	222	182	163 a+
CP	18	185	225	221	203	162 a
GC	16	89	146	125	105	94 c
HS	19	133	191	135	152	120 bc
JS	18	132	251	218	150	155 a
NG	13	136	240	182	149	143 ab
PT	10	120	195	205	130	133 ab
TG	11	171	220	183	182	146 ab
All	16	141	215	186	157	140

[a] Averages followed by different letters are significantly different at the 5% probability level.

Levesticum officinale W. Koch. (lovage)

The roots of lovage should be harvested in the second year when the plants flower. The dried roots contain 0.6 to 1.0% essential oil of which 70% are alkyl-phthalides. The herb is used as a diuretic to cure edema (Bisset, 1994). Lovage gave a high yield of roots after only 1 year of growth (Table 6). At the time of harvest, on June 8, 1999, all plants appeared to be healthy. The seed sources did not differ in yield. A part of the tuberous roots with a shoot attached was replanted to see if this would provide plants for the following year. None of the replanted roots survived the summer.

Table 6. Root yield in grams per plant of lovage by seed source.

Seed Source	Root Yield
FB	96
JS	115
PS	100
WB	84
All	99

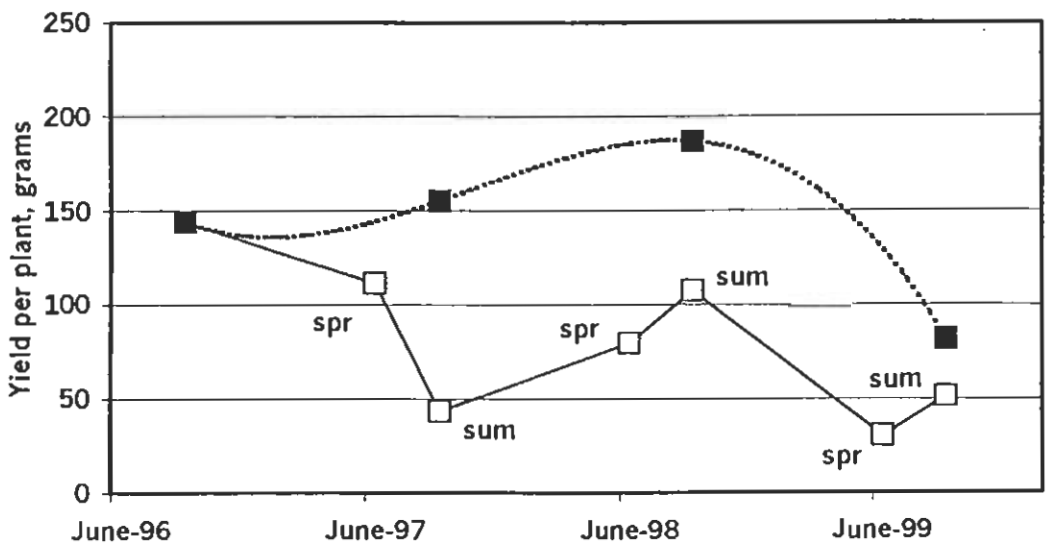

Figure 2. Shoot yield per plant for horehound averaged over all seed sources in the trial. The line indicates yield per cutting, and solid symbols indicate yield per year over four years after planting.

Marrubium vulgare L. (white horehound)

The flowering shoots of horehound should be harvested and dried in the shade at temperatures less than 95F. The main constituent of horehound is marrubiin, a di-terpene lactone. It also contains diterpene alcohols, essential oil and alkaloids (Bisset, 1994). An extract of horehound is used for cold-soothing properties in candies (Dobelis, 1986) and the dried herb is used in teas (Weiner, 1990).

Horehound began to flower 80 days after planting in 1996, and shoots were harvested 2 weeks later. This first cutting yielded more than any later cutting (Figure 2). However, the yield per year remained high for 3 years and then declined (Table 7). Horehound flowered early and was one of the earliest species to be harvested each spring. In the third and fourth year, yields were higher in late summer than in spring, because the early harvest gave plants a long period to recover in summer. The spring harvest was about 1 month later in the second year than in other years.

Yield did not differ among seed sources, except the yield from CF was significantly greater than the lowest yields (Table 7). Plants from all seed sources had a similar growth habit. There was sporadic death of plants. Only 80% of plants from CF, CP and JS seed sources survived through 4 years. All plants survived from other seed sources. Yield of horehound was restricted by the 2-ft x 2-ft spacing. Border plants yielded 80% more than did those inside the plot. A 3-ft x 3-ft spacing would be more appropriate. There were no insect problems. A sporadic yellowing and necrosis of leaves on main stems was likely due to self-shading of the plants.

Table 7. Shoot yield in grams per plant of horehound by seed source and year after planting in grams per plant.

Seed Source	1st Year	2nd Year	3rd Year	4th Year	Sum First 2 years	Average
CF	189	146	222	115	335	168 a+
CP	110	134	176	84	244	126 b
GC	139	170	150	67	309	131 b
HS	127	131	219	111	258	147 ab
JS	130	156	205	54	286	136 b
NG	165	181	139	57	346	135 b
TG	148	168	197	83	316	149 ab
All	144	155	187	82	299	142

+ Averages followed by different letters are significantly different at the 5% probability level.

Melissa officinalis L. (lemon balm, balm, or melissa)

The entire shoot of lemon balm is harvested. It contains 0.02 to 0.30% essential oil, comprised of 60% mono-terpenes and 30% sesqui-terpenes. The dominant terpenes are citronellal, 30 to 40%, and citral, 10 to 30% (Bisset, 1994). Lemon balm is used as filler in teas to hide unpleasant flavors and add fever-reducing and anti-depressant action (Ody, 1993). Externally, it is used on skin eruptions and as an insect repellent (Lawless, 1995).

Lemon balm did not flower in 1996, but a cutting late in the season gave a good yield. However, when it was cut two times in the second and third years, the yield per year was twice that in the first year (Figure 3). Yield from the June cutting declined from year to year, and yield from the late-summer cutting was always less than that in spring. Flowering of lemon balm was delayed and inconspicuous. Lemon balm was cut later than horehound, which may explain why spring harvests resulted in a higher yield of balm than of horehound. There was very little regrowth of foliage in summer 1999, and a fall harvest was not considered. The plants were still healthy, and could have been cut the following year. Overall yield from the diverse seed sources of lemon balm only differed by 20% (Table 8). Due to poor yield in the year of planting, overall yields from CF and TG seed sources were significantly less than the highest yields. This variation in yield was due to differences in growth habit. Vegetative growth of CF and TG seed sources was low and spreading, while others were more upright.

An unidentified necrosis was similar to that reported above for horehound. Self-shading was more severe in lemon balm as leaves were larger than in horehound. In the second year, plants on the edge of the plot yielded 60% more than those in the middle. This yield difference increased to 100% in the third year. Lemon balm should be planted at 3-ft x 3-ft spacing.

Table 8. Shoot yield in grams per plant of lemon balm by seed source and year after planting.

Seed Source	1st year	2nd year	3rd year	4th year	Sum of 1st 2 years	Average per year
CF	57	188	175	72	245	123 b+
CP	86	220	204	109	306	155 a
HS	85	183	212	59	268	135 ab
JS	140	186	207	64	326	149 a
PT	131	218	200	70	349	155 a
SG	159	212	185	63	371	155 a
TG	48	194	203	86	242	133 b
All	101	200	198	75	301	143

+ Averages followed by different letters are significantly different at the 5% probability level.

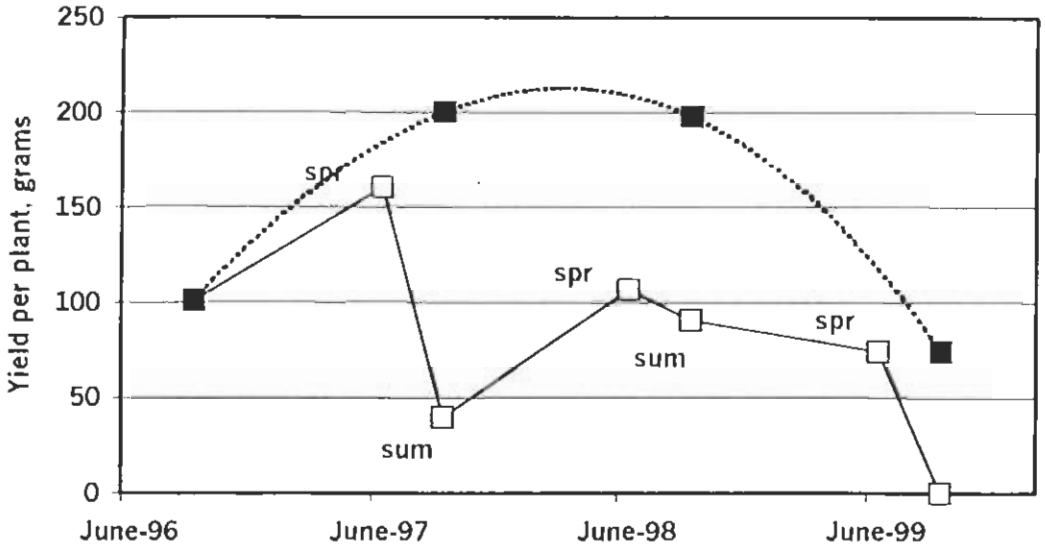

Figure 3. Shoot yield per plant for lemon balm averaged over all seed sources in the trial. The line indicates yield per cutting, and solid symbols indicate yield per year over four years after planting.

Mentha spicata L. and *Mentha x piperata* (mint, spearmint, peppermint)

These seeds were likely spearmint, as peppermint is 99% sterile and is propagated from cuttings (Tucker, 1993). The aerial shoot is used fresh or dried. Mint contains 0.8 to 2.5% essential oils. In peppermint most of this is menthol, but in spearmint about 50% is a related mono-terpene, carvone (Bisset, 1994). Mint is a flavoring agent commonly used in products for oral hygiene and cold and flu treatment. Both types of mint are used in teas to settle digestion (Weiner, 1990).

Mint flowered sporadically 96 days after planting in 1996. A cutting at this time gave a relatively low yield. The plants flowered consistently in the following spring, and this cutting gave a higher yield (Table 9). There was relatively little regrowth through the summer of the second year. The 2-year yield for mint was lower than for beebalm, because the yield from a spring cutting was only half that for beebalm. The seed sources of mint did not differ in yield or growth habit.

Mint spread more quickly than other species, and was hard to contain. The substantial root pruning necessary to maintain the distinction between individual plants may have reduced yield. Border plants yielded 80% more than those inside the plot. All plants survived and showed no sign of insect pests or disease.

Table 9. Shoot yield in grams per plant of mint by seed source and cutting time.

Seed Source	1st year 8/26/96	2nd year 7/15/97	2nd year 9/9/97	2nd year sum	2-year sum
CF	37	93	40	133	170
NG	49	83	41	124	173
PT	37	97	29	126	163
TG	36	84	24	108	144
All	40	89	34	123	163

Monarda didyma L. (beebalm, Oswego tea)

The entire flowering shoots of beebalm should be dried at 75 to 95F. Both the foliage and flowers of beebalm contain active ingredients such as thymol, a powerful antiseptic for both internal and external use (Grieve, 1992). The foliage, cut and dried, is used as a tea to aid in digestion and for respiratory ailments (Erichsen-Brown, 1979).

Beebalm did not flower in 1996, and a cutting was delayed until 130 days after planting. Even so, the first cutting had a low yield compared to that in the following spring (Table 10). After the cutting in spring, regrowth and flowering was erratic through the summer of the second year. The seed sources did not differ significantly in yield. The HS seed source had a high yield only in the second year.

No insect pests were observed on beebalm. Powdery mildew, a white mold on the leaves, was a problem in late summer but not in spring. In addition, some leaves developed black necrotic spots, followed by yellowing and abscission of the leaf. As border plants yielded 35% more than did those inside the plots, a 2.5-ft x 2.5-ft spacing may be more appropriate for beebalm.

Table 10. Shoot yield in grams per plant of beebalm by seed source and cutting time.

Seed Source	1st year 10/1/96	2nd year 7/10/97	2nd year 9/2/97	2nd year sum	2-year sum
GC	59	124	31	155	214
HS	33	217	42	259	292
JS	38	145	33	178	216
NG	31	147	31	178	209
All	40	158	35	193	233

Nepeta cataria L. (catnip, catmint)

The entire flowering shoots are collected and dried. Catnip is another member of the mint family, with an essential oil containing carvacrol, citronellal, nerol, geraniol, pulegone, and thymol. It also contains nepetalactones, compounds with antiseptic properties (Bourrel et al., 1993). Catnip is used as a sedative and to relieve stomach pains (Dobelis, 1986).

Because catnip grew vigorously after transplant, the first stems were cut shortly after planting to encourage bushy growth. All plants were in flower 91 days after planting in 1996. A cutting at this time gave a higher yield of catnip than a cutting the following spring (Table 11). There was relatively little regrowth through the summer of the second year. The 2-year yield for catnip was as high as for horehound, because all shoots elongated and flowered in the first year. The PT seed source had the highest yield overall and in the spring cutting. Due to slower growth in the first year, the CF and SG seed sources gave the lowest yields.

All seed sources resulted in a similar growth habit. There were no disease problems. Border plants yielded 50% more than interior plants. A 3-ft x 3-ft spacing would increase yield per plant.

Table 11. Shoot yield in grams per plant of catnip by seed source and cutting time.

Seed Source	1st year 8/27/96	2nd year 6/25/97	2nd year 8/20/97	2nd year sum	2-year sum
CF	130	78	19	97	227 c+
GC	171	142	45	187	358 ab
HS	204	62	33	95	299 bc
JS	171	111	56	167	338 b
NG	166	97	55	152	318 bc
PT	163	194	51	245	408 a
SG	141	88	50	138	279 c
TG	173	108	43	151	324 b
All	165	110	44	154	319

+ Averages followed by different letters are significantly different at the 5% probability level.

Salvia officinalis L. (garden sage, common sage, red sage)

Leaves of sage should be gathered at flowering and dried in the shade at temperatures less than 95F. Sage contains 1.0 to 2.5% essential oil, of which 35 to 60% is thujone, and also cineole, borneol, and camphor. It also contains, di-terpenes, flavonoids, and tannins including rosmarinic acid (Bisset, 1994). Sage is used to remedy inflammation of the mouth, throat and tonsils (Hoffmann, 1994).

Sage did not spread, but grew from a single stem. A 2-ft x 2-ft spacing was appropriate for this growth habit. There was a relatively low yield per plant. The highest yield was obtained from the late-summer cutting in the second year (Table 12). The yields reported here are for the whole shoot, but only the leaf blades are of value. About 35 to 55% of the shoot weight was in leaves. The fraction in leaves was higher in late summer than in spring. The seed sources did not differ in yield, except in the last harvest, when PS yielded more than JS. All seed sources resulted in a similar growth habit. There were no disease problems.

Table 12. Shoot yield in grams per plant of sage by seed source and cutting time.

Seed	1st year	2nd year		2nd year	2-year
Source	9/16/98	6/1/99	9/12/99	sum	sum
FB	53	58	92	150	203
JS	60	69	74	143	203
PS	51	69	110	179	230
All	55	65	92	157	212

Tanacetum parthenium L. (feverfew)

Both the flowers and foliage of feverfew contain active ingredients. The essential oil contains camphor, pinene and derivatives. Other constituents are bornylacetate, pyrethrin, and sesqui-terpene lactones known as parthenolides (Hoffmann, 1994). Parthenolides may reduce the incidence and severity of migraine headaches (Ody, 1993).

Feverfew had the lowest yield of all the herbs in this trial. Only half the plants survived over-winter, and those plants yielded less in the second than in the first year (Table 13). This species grew like a biennial. A better yield may be obtained by planting in mid-summer and harvesting the following spring.

The PT seed source resulted in the lowest yield in the year of planting, 5 g/plant, and no plants survived the winter. There was no difference in yield per plant among seed sources that did survive the winter (Table 13). The various seed sources resulted in single- and double-flowered varieties. Single-flowered varieties had the highest yield in the year of planting, but the seed sources did not differ in yield in the second year, or overall. No pest or disease problems were noted. Feverfew spread only slightly, and there was no crowding of the plants within the plot. Plant spacing could be reduced to 1.5 x 1.5 ft.

Table 13. Shoot yield in grams per plant of feverfew by seed source and cutting time.

Seed Source	1st year 8/26/96	2nd year 7/23/97	2-year sum
CP	44	24	68
GC	33	21	54
HS	71	20	91
JS	62	23	85
SG	36	30	66
TG	22	36	58
All	45	26	71

Thymus vulgaris L. (common thyme, garden thyme)

Branches are collected at flowering and dried, after which leaves are rubbed off. Thyme has 1.0 to 2.5% essential oil, with the mono-terpene isomers, thymol (30 to 70%), and carvacrol (3 to 15%). It also contains flavonoids and tannins (Bisset, 1994). The oil is antiseptic and it is used externally as a lotion for infected wounds (Hoffmann, 1994).

Thyme grew more slowly than did sage. A late summer cutting in the year of planting gave a low yield. However, growth of thyme was better than sage during the second year, and the 2-year yield was higher (Table 14). The seed sources did not differ in overall yield; those seed sources giving a high yield in spring had a low yield in late summer. All seed sources resulted in similar growth habit and flower color. There were no disease problems. A closed canopy of plants was not obtained until the end of the second year. The 2-ft x 2-ft spacing was appropriate at this stage. If the plants were to be grown for several more years, the spacing should be increased.

Table 14. Shoot yield in grams per plant of thyme by seed source and cutting time.

Seed Source	1st year 9/15/98	2nd year 6/1/99	2nd year 9/12/99	2nd year sum	2-year sum
JS	45	68	117	185	230
PS	52	74	126	200	252
PT	44	75	99	174	218
WB	53	94	102	196	249
All	49	78	110	188	237

Valeriana officinalis L. (valerian, garden heliotrope)

The dried tuberous roots or stolons of valerian contain 0.3 to 0.7% essential oil, composed of bornyl esters of isovalerianate and related compounds, such as eugenyl isovalerates, and valerianol. A number of these components hydrolyze over time to isovaleric acid, a pharmaceutically inactive compound that provides a distinctive odor. Roots also contain up to 0.1% alkaloids (Bisset, 1994). Valepotriates, another class of compounds isolated from valerian, are claimed to regulate the autonomic nervous system. One fraction is a suppressant, another is a stimulant, and the combination has an equalizing effect referred to as amphoteric (Hoffmann, 1994). Valerian is used to relieve anxiety and sleeplessness.

Although the yield of valerian roots varied greatly among seed sources (Table 15), only a few plants survived until roots were harvested, so these differences in yield were not significant. Most plants survived the winter, but many died at or after flowering in late spring of the second year. Only one-third of the plants survived until the roots were harvested. Roots of the dead plants showed evidence of damage by a boring insect. It is likely that the insect damage was followed by systemic disease. Valerian is a large plant, and yield should benefit from a wider spacing than the 2-ft spacing used in this trial.

Table 15. Root yield in grams per plant of valerian by seed source.

Seed Source	Root Yield
HS	68
JS	75
NG	29
TG	20
All	48

DISCUSSION

The fraction of perennial herb seeds that germinated was variable, even when grown under controlled conditions. This variability was seen for all species, and there was no consistent pattern among seed sources. Seed viability likely depends on climate and the time of year when seed is collected, which can vary greatly for these species which flower over a long period. In addition, most of these perennial herbs can propagate vegetatively by spreading, so there is little selection pressure for a high seed germination rate. A germination test should be done whenever a large planting of perennial herbs is contemplated, to insure a sufficient number of seedlings for transplanting.

The species of perennial herbs differed in the yield of shoots, and in the year-to-year variation in yield. Some species produced a high yield of shoots in the year of planting, while for other species, the yield increased for 3 years after planting. Those species whose yield in the first year was as great as in subsequent years could be grown as annuals. Catnip and horehound were species that fell in this category. These species grew vigorously and flowered relatively early in the year of planting.

Lemon balm, beebalm and mint grew well in the first year, but yielded more in the second year than in the year of planting. These related species have similar growth habits. They have large leaves and a dense canopy. They tended to flower erratically or not at all in the first year. These species should be grown for 2 or 3 years to maximize returns. Yield of lemon balm declined in the fourth year. This may be related to the narrow 2-ft x 2-ft spacing used in this trial. The yield of border plants as a ratio of plants inside the plot increased from the second to the third year. Planting at a wider spacing of 3 feet would increase yield per plant and likely would prolong the useful life of a planting of any of these three species of herbs.

Hyssop, sage, thyme, and yarrow had low yields in the year of planting. The yield of hyssop increased over 3 years. Sage and thyme had a growth pattern similar to hyssop over the 2 years that they were observed. These woody species should be grown for at least 3 years to maximize the return of investment costs related to planting. Although these species did not spread as rapidly as the species described above, the plants became crowded by the end of the second year. A 2.5- or 3-ft spacing may be more appropriate to optimize yield per plant in a long-term planting.

All the species of herbs mentioned above should yield well if grown as perennial plants for commercial production in Connecticut. Feverfew was the only herb in this study that did not do well when grown as a perennial. It may be better to plant this species at a closer spacing and grow it as a biennial.

Of the species grown for their roots, only lovage gave a high yield of roots when grown as a biennial. Dividing and replanting the roots did not yield viable plants, so lovage would have to be grown from seed. Echinacea and valerian are true perennials that could be grown for more than two years. However, insect and/or disease problems in this trial caused a substantial loss of plants after only two years. In addition, *Echinacea angustifolia*, the more valuable species of coneflower, did not survive the winter. These problems must be addressed in order to grow these herbs on a commercial basis in Connecticut.

ACKNOWLEDGEMENTS

Laura Butterfield designed the initial trial of herbs, and planted and harvested the herbs in 1996. Michael Short and Joan Bravo assisted in the cultivation and harvesting of herbs in 1997 through 1999 and germination and planting of the second trial of herbs in 1998.

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The Internet contains good sources of information about the use of herbs.

http://www.herbs.org Herb Research Foundation site, features scientific, political, and business news concerning herbs.

http://www.herbnet.com The Herb Growing and Marketing Network site, features *The Herbalist* magazine and links to courses, associations, software, and seed sources.

www.herbmed.org Alternative Medicine Foundation site, provides hyperlink access to the scientific data underlying the use of herbs for health.

www.medherb.com A site by the journal *Medical Herbalism*, provides links to medical information and resources relevant to medicinal herbs.

www.egregore.com Medicinal Herbs Online site, indexes herbs and diseases and links to other sources of information.

http://www.ars-grin.gov/duke/ Dr. Duke's Phytochemical and Ethnobotanical database, allows searches for a chemical within a species, and for species which contain a chosen chemical.

APPENDIX

Appendix A. Companies that supplied seed for the herb trials.

Company	Address	Phone	Symbol
Comstock, Ferre & Co.	263 Main Street;Wethersfield, CT 06109	860-571-6590	CF
Companion Plants	7247 N Coolville Ridge; Athens, OH 45701	614-592-4643	CP
The Flowery Branch	POB 1330; Flowery Branch, GA 30542	na	FB
Goodwin Creek Gardens	PO Box 83; Williams, OR 97544	800-846-7359	GC
Horizon Seeds	PO Box 69; Williams, OR 97544	503-846-6704	HS
Johnny's Select Seeds	310 Foss Hill Road; Albion, ME 04910	207-437-4301	JS
Nichol's Garden Nursery	1190 Pacific Coast Hwy; Albany, OR 97321	541-928-9280	NG
Park Seed Co.	1 Parkton Ave; Greenwood, SC 29647	800-845-3369	PS
Pinetree Garden Seeds	Box 300; New Gloucester, ME 04260	207-926-3886	PT
Shepard's Garden Seeds	30 Irene Street; Torrington, CT 06790	860-482-3638	SG
Stokes Seed Ltd	POB 548; Buffalo, NY 14240	800-263-7233	SS
The Thyme Garden	20546-H Alsea Hwy; Alsea, OR 97324	541-487-8671	TG
Twilley Seed Co	POB 65; Trevose, PA 19053	800-622-7333	TS
W.A. Burpee Seed Co.	300 Park Ave; Warminster, PA 18991	800-487-5530	WB

Appendix B. Perennial herb species, common names, and seed sources.

Latin binomial	Common name	Named variety	Year planted - Sources
Achillea millefolium	yarrow	Summer pastel	98 – FB, TS
		Cerise Queen	98 - PS, PG
		Colorado mix	98 – WB
Echinacea purpurea	purple coneflower	Starlight	96 – SG
		no name	96 - CP, GC, HS, JS, NG, PT, TG
Hyssopus officinalis	hyssop	no name	96 - CP, CF, GC, HS, JS, NG, PT, TG
Levisticum officinale	lovage	no name	98 - FB, JS, PS, WB
Marrubium vulgare	horehound	White	96 - CF, TG
		no name	96 - CP, GC, HS, JS, NG
Melissa officinalis	lemon balm	no name	96 - CP, CF, HS, JS, PT, SG, TG
Mentha species	mint	Common mint	96 – PT
		Peppermint	96 – CF, TG
M. x Spicata	spearmint	Spearmint	96 – NG
Monarda didyma	bee balm,	no name	96 – GC, HS, NG, TG
	bergamot	Panorama mix	96 – JS
Nepeta cataria	catnip	no name	96 – CF, GC, HS, JS, NG, PT, SG, TG
Salvia officinalis	sage	Broadleaf	98 – FB
		Extrakta	98 – JS
		no name	98 – PS
Tanacetum parthenium	feverfew	White wonder	96 – SG
		Double flowered	96 – GC
		Single	96 – TG
		Golden ball	96 - PT
		no name	96 - CP, HS, JS
Thymus vulgaris	thyme	German winter	98 - JS
		English	98 -PS
		Common	98 - TS, WB
Valerania officinalis	valerian	no name	96 - HS, JS, NG, TG

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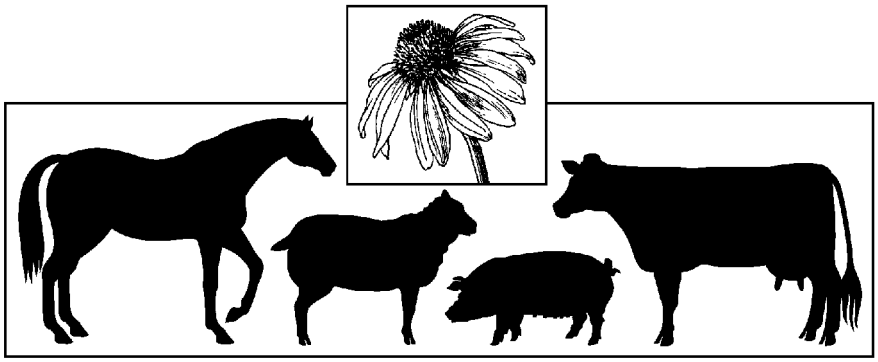

Herbal Monograph
Index

Herbal Monograph

Common Name
Aconate (Monkshood)

Scientific Name
Aconitum napellus

Aconitum napellus
Drawn from plate in Woodville's Medical Botany (1790)

Source
Derived from whole plant with root when plant begins to flower. All parts contain aconitine, the action alkaloid[1] meloid used in medical practice of homeopathy. Remedy administered in minute, incomprehensibly small doses.[2] It is important to recognize that many plants contain toxic components that may have therapeutic as well as poisonous outcomes depending upon the dose of the toxins consumed.[3]

Uses
Early stages of all feverish states, shock, operation, exposure to cold winds or dry heat[1]. Use remedy in dramatic conditions, especially of these symptoms tend to create panic in the patient.[4]

Contradictions

Powerful alkaloid use in minute homeopathic remedy purposes.[3]

Dosage

6X one every half-hour for six doses. (Macleod 1983)

Homeopathy Regulations

Homeopathic medicines are regulated as drugs by inclusion in the Food, Drug and Cosmetic Act. Like all drugs in the United States are also regulated as prescription and non-prescription. Homeopathic medicines are regulated as drugs, in order to prescribe or dispense homeopathic medicines, you must have a license to prescribe medicine.[3]

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[5]Is Homeopathy Regulated. 1995 Standard Homeopathic Company, Los Angeles, CT 90061.

Herbal Monograph

Common Name
Arnica

Scientific Name
Arnica montana L.

Arnica montana L.

Source
Fresh or dried inflorescence (flower).

Uses
External Use (ointment) in injury and for consequences of accidents, e.g. hematoma, dislocations, contusions, edema due to fracture, rheumatic muscle and joint problems.[1]

Internal Use - extracts of arnica exhibit a toxic action on heart, large increase in blood pressure. This is not recommended.[2]

Applied locally to produce superficial inflammation to reduce pain.[4]

Contradictions

Prolonged external use may cause dermatitis. Long use can also give rise to eczema.[1] Ointments with not more than 15% 'Arnica Oil'.[1]

References

[1]Blumenthal, et.al. The Complete German Commission E Monograph English Translation. 1998. American Botanical Council. Austin, TX.

[2]V.E. Tyler. The Honest Herbal, Third Edition 1993, Pharmaceutical Press.

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[4]T.S.C. Li, Ph.D. Medicinal Plants Culture, Utilization and Phytoparmacology Agriculture and Agri Food Canola Technomic Publishing Company, Inc, 851 New Holland Avenue, Box 3535, Lancaster, PA 17604.

Herbal Monograph

Common Name
Calendula

Scientific Name
Calendula officinalis L.

Calendula officinalis L.

Source
Dried flower heads or the dried ligulate flowers (ray florets) of Calendula officinalis L..[1]
The drug contains triterpeae glycosiden and aglycones, as well as carotenoids and essential oils.[1]

Uses
Internal and topical use: Inflammation of the oral and pharyngeal mucosa.[1]
External: Poorly healing wounds.[1]

Contradictions
None found[1]

Dosage
2-5 g crude drug in 100 g ointment.[1]

Actions
Anti-inflammatory and granulatory action in topical application.[1]
Bed sores, ulcers, and skin rashes.[4]

References

[1]The Complete German E Monographs. English translation. 1998. American Botanical Council. Austin, TX.

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Herbal Monograph

Common Name
Cat's Claw "Una de gato"

Scientific Name
Uncaria tomentosa

Uncaria tomentosa
Lee Robert Nausbaum
Illustrator/Threshold Enterprises, Ltd.

Source

Bark, roots and leaves of vine grown in Peru. The most frequent used form is from bark.[1]

**Preparation: 20-30 g of bark chopped and boiled in liter of water 20-30 minutes 'low flame'. Liquid cooled and ingested 3 times a day, every eight hours and at meal times if possible (one liter per day).[1]*

Uses

Gastrointestinal complaints and arthritis[1]; anti-inflammatory properties.[2] Studies showed Cat's Claw protects cells against oxidation stress[2] stimulating immunologic system, antiviral, anti-inflammatory and antitumor.[3]

Contradictions

Enormous confusion in Peruvian and other Latin American territory by the use of popular term “Una de gato”. Then are species that can be toxic to humans known under popular name. Important to know scientific name (*Uncaria tomentosa*).[1]

Dosage

References

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[3]T.S.C. Li, Ph.D. Medicinal Plants Culture, Utilization and Phytoparmacology Technomic Publishing Company, Lancaster, PA.

Herbal Monograph

Common Name
Cayenne Pepper (Paprika)

Scientific Name
Capsicum frutescens

Capsicum frutescens
Courtesy of TROPILAB INC.

Source
Paprika consists of dried fruits of various capsaicin - rich Capsicum species. Cayenne pepper consists of the dried, ripe fruits of Capsicum frutescens L..[1]

Uses
Painful muscle spasm.[1] Improves the flow of blood to the skin and mucosa, treat rheumatism, sciatic and pleurisy[2], Pharyngitis and septic throats.[3]

Contradictions

Application on injured skin are allergies to paprika preparations.[1] In rare cases hypersensitivity reaction can occur[1] or injured skin or near eyes.[2]

Dosage

Internally, this herb can be safely consumed when used appropriately[2]. In semi - 1 grid preparations containing 0.02-0.05% capsaicinoids in liquid preparations 0.005-0/01% capsaicinoids, in poultices containing 10-40 g capsaicinoids per cm^2.[1]

Duration of Administration

Not longer than 2 days; 14 day must pass before new application can be used in same location. Longer use can cause damage to sensitive nerves.[1] Preparations irritate mucous membranes, contact with eyes must be avoided.[1]

References

[1]The Complete German E Monographs. English translation. 1998. American Botanical Council. Austin, TX.

[2]T.S.C. Li, Ph.D. Medicinal Plants Agriculture and Agric. Food Canada Technomic Publishing Company, Inc., 851 New Holland Avenue, Box 3535, Lancaster, PA, 17604, USA.

[2]C. Macleod, MRCUS, DVSM, Vet FF Hom A Veterinary Materia Medica and Clinical Repertory. C.W. Daniel Company Ltd, Church Path. Saffron Welden, Essex, England.

Herbal Monograph

Common Name
Echinacea, Purple Cornflower

Scientific Name
Echinacea purpureae

Echinacea purpureae

Source
Purple cornflower herb consists of fresh, above-ground parts, harvested at flowering time[1] roots during plant dormancy.

Uses
Internal - supportive therapy for colds and chronic infection of the respiratory tract and lower urinary tract[1]

External - poorly healing wounds and chronic ulceration[1]

Immune modulator activity and antimicrobal[2]

Contradictions

External - None

Internal - No parenteral administration in case of tendencies to allergies, especially allergies to composite family.

Dosage

Most scientific chemical studies on Echinacea have been carried out in Germany.[3] In the United States most readily available in hydroalcoholic extract and powdered administered orally in form of capsules. Hydroalcoholic extract stimulate lymphatic tissue in the mouth, thereby initiating an immune response.[3] Powdered Echinacea in form of capsules would probably be relatively inactive.[4]

Actions

In human and/or animal experiments Echinacea preparation given internally or parenterally have produced immune effects.[1]

References

[1]Blumenthal, et.al. The Complete German Commission E Monograph English Translation. 1998. American Botanical Council. Austin, TX.

[2]T.S.C. Li, Ph.D. Medicinal Plants Culture, Utilization and Phytoparmacology Agriculture and Agri Food Canola Technomic Publishing Company, Inc, 851 New Holland Avenue, Box 3535, Lancaster, PA 17604.

[3]V.E. Tyler. The Honest Herbal, Third Edition 1993, Pharmaceutical Press.

[4]C. Hobbs. The Echinacea Handbook Eclectic Medical Publication, Portland, OR, 1989. 118 pp.

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Common Name
Dandelion

Scientific Name
Taraxacum officinale

Taraxacum officinale

Source
Fresh or dried above ground parts. The leaf contains better principles.[1]

Uses
Loss of appetite and feelings of fullness and flatulena[1] extracts of leaves have exhibited a pronounced diuretic action.[2] Liver damage remedy.[4]

Contradictions
Essentially free of significant toxicity or side effects.[3]

Dosage

4-10 g of herb 3 X daily
4-10 ml liquid extract
1:1 m 25% alcohol 3 X daily

References

[1]Blumenthal, et.al. The Complete German Commission E Monograph English Translation. 1998. American Botanical Council. Austin, TX.

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[3]V.E. Tyler. The Honest Herbal, Third Edition 1993, Pharmaceutical Press.

[4]C. Day. The Homeopathic Treatment of Beef and Dairy Cattle. 1995. pp 44. Beaconsfield Publishers.

Herbal Monograph

Common Name
Garlic

Scientific Name
Allium sativum

Allium sativum

Source
Fresh or carefully dried bulbs that consist of the main bulb with several secondary bulbs (cloves) .[1]

Uses
Garlic contains alliin and sulfur containing essential oil.[1] The most frequent use of garlic in recent times has been in treating atherosclerosis and high blood pressure.[2] A prominent secondary application is to provide relief from various stomach and intestinal ailments[3] antioxidant value.[4]

Contradictions
None

Dosage
Minced bulb and preparations thereof for internal use.[1] The best way to assure the effectiveness of garlic for any of the conditions in which it may be helpful is to eat it raw in relatively large quantifies.[5]

References
[1]Blumenthal, et.al. The Complete German Commission E Monograph English Translation. 1998. American Botanical Council. Austin, TX.

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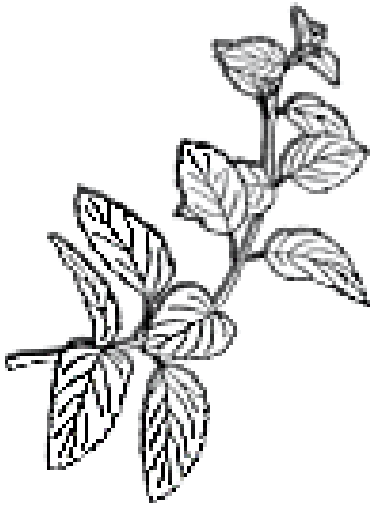
[5]H.P. Koch. Deutsche Apotheker Zeitung 129:1991-1997, 1989.

Herbal Monograph

Common Name
Peppermint

Scientific Name
Mentha piperita L.



Mentha piperita L.

Source

Fresh or dried leaf. Herbs contains at least 1-2 percent essential oil.[1]

Uses

Spastic complaints of the gastrointestinal tract as well as gall bladder and bile duct .[1] In Europe the herb is incorporated in many tea mixtures intended to alleviate various ailments of the stomach.[2] German health authorities have found peppermint to be effective spasmolytic, antibacterial agents and promoters of gastric secretions[3]. Carminative, mild antispasmodic and local anesthetic properties.[4]

Contradictions

Not given to infants or very young children, since they may often experience a choking sensation form the contained menthol.[2]

Dosage

Human: 3-6 g of leaf daily - 5-15 g of tincture daily[1]
Livestock: No known recommendations

Presenters

Karreman and Holden use or know of its use in livestock health care.

References

[1]Blumenthal, et.al. The Complete German Commission E Monograph English Translation. 1998. American Botanical Council. Austin, TX.

[2]V.E. Tyler. The Honest Herbal, Third Edition 1993, Pharmaceutical Press.

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[4]T.S.C. Li, Ph.D. Medicinal Plants Culture, Utilization and Phytoparmacology Technomic Publishing Company, Lancaster, PA.

Herbal Monograph

Common Name
Stinging Nettle

Scientific Name
Urtica dioica

Urtica dioica

Source
Fresh or dried above ground parts. Gathered during growing season[1] considered a pesky lowly weed.

Uses
Nettle leaf contains mineral salts, mainly calcium and potassium and silicic acid.[1] Young shoots contain the same amount of carotene (provitamin A) and vitamin C as spinach[2]. The diuretic properties of nettle have long been recognized.[2] It helps restore normal milk flow, particularly in the sow, helps promote normal urination.[3]

Contradictions
None known.

Dosage
Human: 9-12 g f drug daily
Livestock: No known recommendations
1:1 m 25% alcohol 3 X daily

References

[1]Blumenthal, et.al. The Complete German Commission E Monograph English Translation. 1998. American Botanical Council. Austin, TX.

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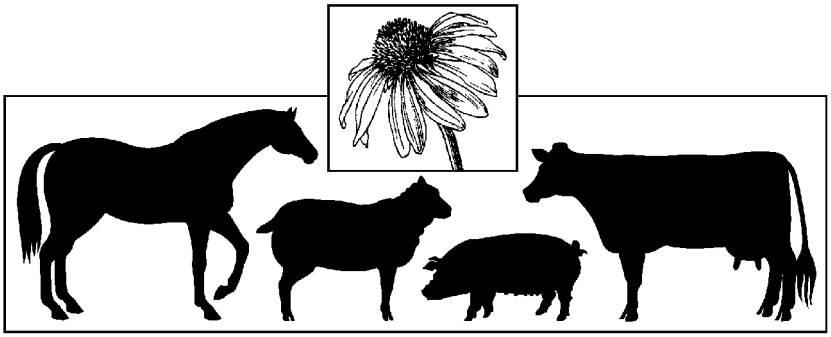

Organic Livestock & Grazing Resources

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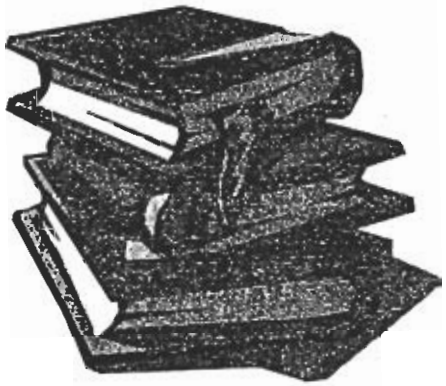

Compiled by:

The Northeast Organic Farming Association of Vermont's Dairy Technical Assistance Program.

NOFA would like to thank the UVM Center for Sustainable Agriculture's Vermont Pasture Network Program for contributing to this resource listing

Organic Livestock and Grazing Resources

These resources have been put together by the Northeast Organic Farming Association's Dairy Technical Assistance Program.. Enclosed you should be able to find numerous alternative animal health products, organic mineral packages, organic fertilizers, organic grain, animal health consultants and other useful tools for your organic operation, as well as resources for grazing systems management. If you have any questions about organic agriculture or production methods you can contact the NOFA-VT office at 802-434-4122 or email them at info@nofavt.org.

Table of Contents:

1) Herbs, Vitamins, Mineral Packages, and Supplements

Agri-Dynamics (Jerry Brunetti)
PO Box 735, Easton, PA 18044, 'An Alternative Product Line for Farm Livestock'
Phone (610) 250-9280, Fax (610) 250-7840
(herbal based products, essential oils, vitamins, colostrum whey products, trace mineral supplements, etc)

Bio-AG Consultants and Distributors, Inc. (Murray Bast)
RR3, Wellesley, Ontario NOB 2TO
Phone (800) 363-5278, Fax (519) 656-2534
(mineral mixes, kelp meal, culbac, trace mineral salt)

Brookfield Ag Service, (Charlie Taplin)
Box 314A, Brookfield, VT 05036
Phone (802) 276-3762
(homeopathic kits, vitamins, natural salts, organic fertilizers, seeds, organic pesticides, macro and micro minerals, kelp meal, probiotics, colostrum based products, other animal health products, soil testing services)

The FERTRELL Company
Box 265, Bainbridge, PA 17502
Phone (717) 367-1566
(Colostrum products, organic mineral packages: custom mix to the needs of your animals, other animal health products)

Flora-Stim
924 Milnor Rd, PO Box 128, Green Castle, PA 17255
Phone (800) 659-3325, Fax (717) 597-2123,
Website: www.flora-stim.com
(Organic and Natural For Feed and Soil)

Helfter Feeds, Inc
301 Main Street, PO Box 27, Osco, IL 61274
Phone: (800) 373-5971, Fax:: (309) 522-5570
(vitamin, mineral and nutritional supplements for the production of drug and hormone free meat and milk)

Homestead Organics
1 Union St, PO Box 39, Berwick, Ontario KOC 1GO
Phone (613) 984-0480, Fax (613) 984-0481
(Organic Grain and Mineral Company)

Midwestern Bio-Ag (William and Gary Zimmer)
HWY ID, Box 160, Blue Mounds, WI 53517
Phone (800) 327-6012

Nature's Way, Inc
1374 Horned Owl Rd, Horton, KS 66439
Phone (785) 486-3302, Fax (785)486-3990
(organic enzyme feed product)

North Country Organics (Paul Sachs)
RR1 Box 2232, Bradford, VT 05033
Phone (802) 222-4277
(diatomaceous earth, organic fertilizers and soil amendments, organic mineral packages for livestock and dairy, organic pest controls, Soil Food Web Tests and Solvita Tests for on-farm use).

Thorvin Kelp, USA
220 Race St, PO Box 458,
New Castle, VA 24127
Phone: (800)464-0417, Fax: (540)864-5161
Website: www.thorvin.com,
email: sales@thorvin.com
(kelp OMRI listed as " allowed for organic production" for both livestock and plants)

2) Soil Testing Services and Fertility Recommendations

Agri-Dynamics (Jerry Brunetti)
PO Box 735, Easton, PA 18044, 'An Alternative Product Line for Farm Livestock'
Phone (610) 250-9280, Fax (610) 250-7840
(herbal based products, essential oils, vitamins, colostrum whey products, trace mineral supplements, etc)

Brookfield Ag Services, (Charlie Taplin)
Box 314A, Brookfield, VT 05036
Phone (802) 276-3762
(homeopathic kits, vitamins, natural salts, organic fertilizers, seeds, organic pesticides, macro and micro minerals, kelp meal, probiotics, colostrum based products, other animal health products, sail testing services)

The FERTRELL Company (Dave Mattocks)
Box 265, Bainbridge, PA 17502
Phone (717) 367-1566, 800-347-1566

Midwestern Bio-Ag (William and Gary Zimmer)
HWY ID, Box 160, Blue Mounds, WI 53517
Phone (800) 327-6012

North Country Organics (Paul Sachs)
RR1 Box 2232, Bradford, VT 05033
Phone (802) 222-4277
(diatomaceous earth, organic fertilizers and soil amendments, organic mineral packages for livestock and dairy, organic pest controls, Soil Food Web Tests and Solvita Tests for on-farm use)

Woods End Research Laboratory (Will Brinton)
PO Box 297, Mt Vernon, ME 04352
Phone (207) 293-2457, Fax (207) 293-2488,
website: www.maine.com/woodsend
(Agricultural and Environmental Research and Consulting, Soil quality testing, soil life and compost maturity test kits)

3) Sources of Organic Fertilizers

Brookfield Ag Service, (Charlie Taplin)
Box 314A, Brookfield, VT 05036
Phone (802) 276-3762
(homeopathic kits, vitamins, natural salts, organic fertilizers, seeds, organic pesticides, macro and micro minerals, kelp meal, probiotics, colostrum based products, other animal health products, sail testing services)

The FERTRELL Company (Dave Mattocks)
Box 265, Bainbridge, PA 17502
Phone (717) 367-1566, 800-347-1566
(Colostrum products, organic mineral packages: custom mix to the needs of your animals, other animal health products, soil testing services)

North Country Organics (Paul Sachs)
RR1 Box 2232, Bradford, VT 05033

Phone (802) 222-4277
(diatomaceous earth, organic fertilizers and soil amendments, organic mineral packages for livestock and dairy, organic pest controls, Soil Food Web Tests and Solvita Tests for on-farm use)

Parametric Associates, Inc
10934 Lin-Valle Drive, St Louis, MO 631213
Phone (800) 747-1601, (314) 892-1662
(*Nutrapathic Livestock Restore* for parasite control, *Nutrapathic Soil Conditioner and Soil Restore*)

4) Sources of Organic Grains and Forages

Cold Springs Farm (Sumner Watson)
Sharon Springs, NY
Phone: 518-234-8320
Email: cffarm@capital.net
(organic grain and seed)

Depot Farm Supply
Rick Dutil
Whiting, VT
Phone: 802-247-6700

Field Farm (Andy Davis)
PO Box 82, Ferrisburg, VT 05456
Phone: 802-877-6323

Golburn Valley Oil Mill
Box 2168, Tisdale, SK S0E 1T0
Phone:306-873-5547, Fax: 306-873-4579

Great Lakes Organic (Ike & Beatrice Enter)
RR2 Parkhill, Ontario NON 2K0,
Phone: 519-232-9458
Website: www.greatlakesorganic.com

Homestead Organics (Tom Manley)
1 Union Street, PO Box 39, Berwick, Ontario K0C1G0
Phone:613-984-0480, Fax: 613-984-0481

Lakeview Organic Grain (Klaas and Mary-Howell Martens)
1443 Ridge Rd, Penn Yan, NY 14527
Phone: 315-531-1038 (Daniel Hoover = Manager)

McGeary Organics (Dave Farmer & Dave Poorbaugh)
PO Box 299, Lancaster, PA 17608-0299
Phone: 800-624-3279 Email: sales@mcgearygrain.com ,
Website: www.mcgearygrain.com

Morrison's Custom Feeds (Les Morrison)
Barnet, VT
Phone: 802-633-4387

NC + Organics (Maury Johnson)
3820 North 56th Street, PO box 4739, Lincoln, NE 68504
Phone: 800-279-7999, Website: www.ncorganics.com , Em
organics@nc.plus.com (organic seed)

Robert Mosher Transport, inc. (Kevin & Barbara Mosher)
1736, Rte 225, Noyan (Quebec), Canada J0J 1B0
Phone: 450-294-2757, fax:450-294-2813

5) Fly Control Products and Services

Agri-Dynamics (Jerry Brunetti)
PO Box 735, Easton, PA 18044, 'An Alternative Product Line for Farm Livestock'
Phone (610) 250-9280, Fax (610) 250-7840
(herbal based products, essential oils, vitamins, colostrum whey products, trace mineral supplements, etc)

Brookfield Ag Service, (Charlie Taplin)
Box 314A, Brookfield, VT 05036
Phone (802) 276-3762
(homeopathic kits, vitamins, natural salts, organic fertilizers, seeds, organic pesticides, macro and micro minerals, kelp meal, probiotics, colostrum based products, other animal health products, soil testing services)

Crystal Creek Services
A Division of Leiterman & Associates, Inc
N9466 Lakeside Road, Trego, WI 54888
Phone (888) 376-6777, Fax (715) 466-5042
(natural, effective, environmentally safe livestock health products formulated with the needs of the organic and conscientious producer in mind, No-Fly Fly Repellent)

The FERTRELL Company (Dave Mattocks)
Box 265, Bainbridge, PA 17502
Phone (717) 367-1566, 800-347-1566
(Colostrum products, organic mineral packages: custom mix to the needs of your animals, Orange Guard Fly Control,other animal health products, soil testing services)

Spalding Laboratories
760 Printz Road, Arroyo Grande, California 93420
Phone (800) 845-2847
(fly predators)

2000 IPM Laboratories, Inc.
Locke, NY 13092-0300
Phone (315) 497-2063, Fax (315) 497-3129
Email: ipmlabs@ipmlabs.com
(fly predators)

6) Homeopathic remedies, herbs, & other animal health products: where to find them

Agri-Dynamics (Jerry Brunetti)
PO Box 735, Easton, PA 18044,
Phone (610) 250-9280, Fax (610) 250-7840
(herbal based products, essential oils, vitamins, colostrum whey products, trace mineral supplements, etc)

Arrowroot Standard Direct
83 East Lancaster Avenue, Paoli, PA 19301
(single remedies, combination remedies, herbs, tinctures, books)
Phone (800) 234-8879,
Website: www.arrowroot.com

Brookfield Ag Services
Box 314A, Brookfield, VT 05036
Phone (802) 276-3762, 888-293-1200
(homeopathic kits, vitamins, natural salts, organic fertilizers, seeds, organic pesticides, macro and micro minerals, kelp meal, probiotics, colostrum based products, other animal health products, soil testing services)

Clark Veterinary Clinic (Dr. Sheaffer)
PO Box 353, Palmyra, PA 17078
Phone (717) 838-9563, Fax (717) 838-0377
(homeopathic kits, remedies, phone consultations)

Crossgates Farm Homeopathic Products, Ltd
Crossgates Farm, Banknewton, Gargrave,
R Skipton, North Yorkshire BD23 3NT
Phone/Fax 01756 748585
Website: www.crossgatesfarm.co.uk
(homeopathic remedies and kits -in spray bottles, laminated treatment cards, homeopathic pills for oral dispensing, & books)

Crystal Creek Services
A Division of Leiterman & Associates, Inc
N9466 Lakeside Road, Trego, WI 54888
Phone (888) 376-6777, Fax (715) 466-5042
(natural, effective, environmentally safe livestock health products formulated with the needs of the organic and conscientious producer in mind)

The FERTRELL Company
Box 265, Bainbridge, PA 17502
Phone (717) 367-1566
(Colostrum products, organic mineral packages: custom mix to the needs of your animals, other animal health products)

Hux, Inc (Ron Hux)
Route 1 Box 19A
Picton, TX 75471
Phone (800) 663-9727, Fax(903)866-0432
Website: www.huxinc.com
(*Hoofmate* - a botanical product used for the treatment of hairy heel warts and other hoof problems

Immunodynamics
Box 544, Perry, Iowa 50220
Phone (800) 634-5229, website
www.colostrum.com
(biological serum from first milk colostrum)

IMPRO Products
Dr. Richard Holliday, DVM, Marketing and Technical Services
3 Allamakee St, Waukon, Iowa 52172
Phone (800) 626-5536, Fax(319) 568-4259
(probiotics, vitamin and mineral supplements, colostrum based products)

National Homeopathic Products,CELLETECH LTD
518 Tasman St., Madison, WI 53714
Phone (800) 888-4066
(Cell-Ag product line for cattle and calves, combination remedies

Nutrapathic Agricultural Products
Parametric, Inc.
10934 Lin-Valle Drive, St Louis, MO 63123
Phone (800) 747-1601, Fax (314) 892-1602
(homeopathic/herbal combination remedy *Livestock Restore*)

Parametric Associates, Inc
10934 Lin-Valle Drive, St Louis, MO 631213
Phone (800) 747-1601, (314) 892-1662
(*Nutrapathic Livestock Restore* for parasite control, *Nutrapathic Soil Conditioner and Soil Restore*)

Standard Homeopathic
210 West 31st St, PO Box 61067, Los Angeles, CA 90061
Phone (800) 624-9659, Fax (310) 516-8579
(books, kits, remedies)

Washinton Homeopathic Products, Inc.
4914 Del Ray Avenue, Bethesda, MD 20814
Phone (800) 336-1695, Website:
www.homeopathyworks.com
(homeopathic kits, remedies, tinctures, ointments, books)

7) Alternative Animal Health Care Professionals

Beaufait, Henrietta E., DVM
RR2 Box 640, Bog road, Albion, ME 04910
Phone (207) 437-2133
(homeopathic veterinarian, phone consults)

Crystal Creek Services
A Division of Leiterman & Associates, Inc
N9466 Lakeside Road, Trego, WI 54888
Phone (888) 376-6777, Fax (715) 466-5042
(natural, effective, environmentally safe livestock health products formulated with the needs of the organic and conscientious producer in mind)

Engel, Marta, DVM
RR1 Box 1198, Soldiers Grove, WI 54655
Phone (608) 734-3273
(homeopathic veterinarion, phone consults)

Hoke, David, VMD
7069 Chester A. Arthur Rd, Enosburg falls, VT 05450
Phone (802) 933-6651
(livestock veterinarian, farm consulting, teacher, workshops)

Potkewitz, Lisa, VMD, Saratoga Mobil Vet
Phone (518) 584-3872
(consults with organic and biodynamic farms, uses western herbs,
nutritional therapy and other approaches)

Sheaffer, Edgar, VMD, Clark Veterinary Clinic
PO Box 353, Palmyra, PA 17078
Phone (717) 838-9563, Fax (717) 838-0377
(homeopathic kits, remedies, phone consultations)

Skilling, Heather, VMD
4731 west Berkshire Rd, Enosburg Falls, VT 05450
Phone (802) 933-8303, email:
healingvt@together.net
(homeopathic veterinarian, phone consults)

Treat, Robert, DVM
Green Mountain Veterinary Hospital
:R1 Box 1030, Manchester, VT 05255
Phone (802) 362-2620
(homeopathic veterinarian, phone consults)

Woodard, Stephen, DVM
Woodard Veterinary Clinic
Loomis Hill Road, Waterbury Center, VT 05677
Phone (802) 244-5452
(homeopathic veterinarian, remedies, phone consults)

8) Other Resources

Acres USA
PO Box 8800, Metairie, LA 70011
Phone: (800) 355-5313, Fax: (504) 889-2777
(Monthly publication, books, tapes, conferences)

"Appropriate Technology Transfer for Rural Areas" (ATTRA)
PO Box 3657, Fayetteville, Arkansas 72702
Phone: (800) 346-9140, Website: www.attra.org
(Free resource packets on sustainable dairy, beef, chicken, hog production & much more)

Bio-Dynamic Farming & Gardening Association, Inc.
Building 1002B, Thoreau Center, The Presidio, PO Box 29135, San Francisco, CA 94129
Phone: (415) 561-7797, Fax: (415) 561-7796, Website: www.biodynamics.com
(Books, monthly publication, conferences, workshops)

ıamplain Valley Compost Company, Products and Services
Steve Wisbaum, 245 Ten Stones Circle, Charlotte, VT 05445
Phone/Fax: (802) 425-5556

Graze Magazine
PO Box 48, Belleville, WI 53508
Phone: (608) 455-3311, E-Mail: graze@mhtc.net

The Josephine Porter Institute for Applied Bio-Dynamics, Inc.
PO Box 133, Woolwine, VA 24185-0133
Phone: (540) 930-2463
(Bio-Dynamic publications, BD preparations)

Northeast Organic Farming Association of Vermont (NOFA-VT)
PO Box 697, Richmond, VT 05477
Phone (802) 434-4122, Fax (802) 434-4154
Email: info@nofavt.org , vof@nofavt.org, Website: www.nofavt.org

Northeast Organic Dairy Producers Alliance (NODPA)
C/o NOFA-VT, PO Box 697, Richmond, VT 05477
Phone: 802-434-4122
(To enable organic family dairy farmers, situated across an extensive area, to have informed discussion ıut matters critical to the well being of the organic dairy industry as a whole. Contact the NOFA-VT otfice for a copy of the NODPA Overview, past newsletters or to contact a NODPA Farmer Board Member.

Organic Materials Review Institute (OMRI)
Box 11558, Eugene, OR 97440
541-343-8971
www.omri.org

Organic Trade Association (OTA)
74 Fairview St, PO Box 547, Greenfield, MA 01302
413-774-6432, www.ota.com

The Stockman Grassfarmer
PO Box 9607, Jackson, MS 39826-9607
Phone: (800) 748-9808, Fax: (601) 981-8558

Vermont Grass Farmers Association (VGFA)
UVM Center for Sustainable Agriculture, 590 Main Street, Burlington, VT 05405
Phone: (802) 656-3834 , email: gharris@zoo.uvm.edu
("To promote, manage and oversee grazing outreach and education programs in Vermont", Discussion groups, quarterly newsletter, pasture activities calendar, annual grazing conference)

Vermont Sheep Breeders Association (VSBA)
20832 East Main Street, Richmond, VT 05477

Vermont Beef Producers Association (VBPA)
RR 1 Box 34, Woodstock, VT 05091
Phone: 802-457-1520
Website: www.state.vt.us/agric/vbpa/memapp.htm

Vermont Organic Milk Producers Association (VOMPA)
31 Pearl Street, Montpelier, VT 05602
website: http://vompafreeservers.com , email: vompa@yahoo.com

Wise Traditions in Food, Farming and the Healing Arts - A Quarterly publication for The Weston A Price Foundation.
PMB 106-380, 4200 Wisconsin Avenue, NW, Washington, DC 20016
Phone: 202-333-HEAL
Website: www.westonaprice.org, email: WestonAPrice@msn.com

9) Pasture Management Consulting

1) **Baker, Alan,** 3111 VT Route 7A, Shaftsbury, VT 05262
   Phone: (802) 442-3504; 'Whole farm planning specializing in grazing strategies and nutrient management'

2) **Flack, Sarah,** 2063 Duffy Hill Rd, Enosburg Falls, VT 05450
   Phone: (802) 933-6965, email: sarahflackfarm@hotmail.com

3) **Ghia, Mike,** Ewetopia Sheep Dairy, Putney, VT
   Phone: (802) 387-5017

4) **Hoke, Dave,** (livestock veterinarian), 7069 Chester A Arthur Rd, Enosburg Falls, VT 05450, Phone: (802) 933-6651

5) **McCrory, Lisa,** 848 North Randolph Rd, Randolph Ctr, VT 05061
Phone: (802) 728-4416, email: lmccrory@together.net

10) Websites for grazing, livestock, organic ag, & alternative animal health

www.omri.org - website for the Organic Materials Review Institute.

www.ota.org - website for Organic Trade Association.

www.amu.usda.gov/nop - Information on the National Organic Standards.

www.altvetmed.com - Complementary and Alternative Veterinary Medicine.

http://grassfarmer.com - info on grass based & seasonal dairying, milking parlor designs, and much more.

www.eatwild.com - information on grass fed meat and dairy products.

www.westonaprice.org - Weston A Price Foundation promoting wise traditions in food, farming and the healing arts. The Foundation is dedicated to restoring nutrient-dense foods to the American diet through education, research and activism.

www.glgn.org - information on grazing publications from Wisconsin.

ww.jdmfg.com/jd_agri/milking.html - information on flat barn parlor equipment.

http://pss.uvm.edu/vtcrops/Pasture.html#TOP - Vermont pasture and grazing management page.

www.fullcirclefarm.net/ - information on high CLA cheese from grass fed cows.

www.mistyridgefarm.com/ - information on custom heifer grazing and grass fed dairy beef.

www.nhq.nrcs.usda.gov/BCS/graze/nonfed.html - NRCS site with information on the environmental benefits of grazing.

www.sheepusa.org/ - American sheep industry association site.

www.lionsgrip.com/pastured.html - information on pastured poultry.

www.agritech.org.nz./grassprofit.htm - information on New Zealand agriculture.

www.sarep.ucdavis.edu/grants/reports/nader/Intro.HTM - marketing grass fed beef

www.bmts.com/~beggs/pasture.htm#pasture - information on sheep pasture management

www.sheepandgoat.com/ - Maryland sheep and goat web site

www.caf.wvu.edu/~forage/Tutorial/forindx.htm - An online forage plant identification tutorial.

www.forages.css.orst.edu/Topics/Pastures/index.html - Oregon State University interactive online forages information page.

/w.wisc.edu/dairy-profit/ - The University of Wisconsin Center for Dairy Profitability develops, coordinates and conducts effective interdisciplinary educational and applied research programs, emphasizing

business management, human resource management, production systems, finance and marketing systems that enhance dairy profitability.

www.caf.wvu.edu/~forage/ - This site provides links to Fact Sheets, Tutorials, "Ye Olde Forage Library ", and Other WWW sites, having information relevant to forage-livestock systems. Our goal is to provide practical information that farmers can use to develop new or improve established forage-livestock systems.

www.ibiblio.org/farming-connection/grazing/home.htm - Grazing resources page from the Sustainable Farming Connection, including links to other sites, articles, publications information, on-line discussion groups, and much more.

www.glci.org/ - Home page for the Grazing Lands Conservation Initiative.

www.ncg.nrcs.usda.gov/glti/homepage.html - Home page for the USDA Grazing Lands Technology Institute.

11) Vermont Pasture Network E-Mail Discussion List: How To Join

The Vermont Pasturelands Network (VPN) is an informal group of farmers, extension and agency personnel, VGFA members, and others interested in promoting pasture-based farming. The goal of VPN is to gather, exchange information, and plan research and outreach projects together on issues related to pasture based farming systems.

The UVM Center for Sustainable Agriculture created an email discussion list to continue and build upon the work of the Vermont Pasturelands Network (VPN). If you have access to email, we hope you will consider subscribing to this list to share your ideas about grazing; to keep folks aware of upcoming events; and to support other list members in their enthusiasm for pasture-based farming in Vermont and beyond.

To join the vpn list, send an e-mail message to:

listserv@list.uvm.edu

Put the subscribe command as the first line of your message along with the list name and your first and last name. Some examples:

sub vpn Henry Somebody
sub vpn Joan A. R. Person

Once you are on, you may send a message to everyone on the list by sending e-mail to:

vpn@list.uvm.edu

If you have questions about the list, please contact us.

DAIRY TECHNICAL ASSISTANCE PROGRAM'S

NOFA-VT Book Order Form

Author	Title	Price
Albrecht	Albrecht Papers, Vol 1, *Foundation Principles*	$30.00
Albrecht	Albrecht Papers, Vol 2, *Soil Fert. & An. Health*	$20.00
Albrecht	Albrecht Papers, Vol 3, *Eco-Agriculture III*	$20.00
Albrecht	Albrecht Papers, Vol. 4, *Enter Without Knocking*	$20.00
Anderson	Life & Energy in Agriculture	$20.00
Ashworth	Seed to Seed	$20.00
Beck	The Secret Life of Compost	$19.00
Belanger	Raising Milk Goats the Modern Way	$12.95
Biddis	Homeopathy in Veterinary Practice	$12.00
Carroll	Cheesemaking Made Easy	$14.95
Chitkara	Relationships of Homeopathic Remedies	$ 5.00
Damerow	Chicken Health Handbook	$19.95
Day	Homeopathic Treatment of beef and Dairy	$29.95
de Bairacli Levy	The Complete Herbal Handbook for Farm and Stable	$23.00
Duval	Treating Mastitis Without Antibiotics	$ 5.50
Duval	The Control of Internal Parasites in Cattle and Sheep	$ 5.50
Ekarius	Small-Scale Livestock Farming	$18.95
Fallon	Nourishing Traditions	$25.00
Groh	Farms of Tomorrow Revisited	$17.50
Grubinger	Sustainable Vegetable Production from Start-up to Market	$42.00
Hansford	The Herdsmans Guide to Homeopathy	$10.50
Haynes	Keeping Livestock Healthy	$19.95
Leon W. Hess	The Treatment of Cattle by Homeopathy	$15.00
Dave Hoke	A New Trouble Shooters Guide to Dairy Cows	$12.00
Jain	Poultry Doctor	$ 4.00
Kickapoo.O.R.N.	Organic Dairy Farming	$ 7.50
Kinsey	Hands-on Agronomy	$19.00
Koepf	The Biodynamic Farm	$16.95
Lee	Chicken Tractors	$19.95
Lovell	A Biodynamic Farm...	$15.00
Macher	Making Your Small Farm Profitable	$19.95
George Macleod	Treatment of Cattle by Homeopathy	$17.95
George Macleod	A Veterinary Materia Medica...	$17.95
Mercia	Raising Poultry the Modern Way	$12.95
Mercia	Raising Your Own Turkeys	$12.95
Mettler	Basic Butchering of Livestock and Game	$14.95
Murphy	Greener Pastures on Your Side of the Fence	$30.00
Pfeiffer	Weeds and What They Tell	$ 7.50
Podolinsky	Biodynamic Agriculture, Vol 1	$14.95
Podolinsky	Biodynamic Agriculture, Vol 2	$14.95
Proctor	Grasp the Nettle	$24.95
Pfeiffer	Laws of Life in Agriculture	$12.95
Robinson	Why Grassfed is Best!	$ 7.50
Ruddock	Veterinary Medicine	$ 5.00
Rush	Veterinary Homeopathy	$ 5.00
Salatin	Pastured Poultry Profits	$35.00

Salatin	Salad Bar Beef	$35.00
Salatin	You Can Farm	$35.00
Schwenke	Successful Small Scale Farming: An Organic Approach	$14.95
Simmons	Raising Sheep the Modern Way	$12.95
Sheaffer	Materia Medica for Livestock Homeopathy kit (Laminated)	$15.90
Smith	The Real Dirt	$13.95
Steiner	Agriculture	$17.50
Steiner	Rudolf Steiner o Nutrition and Stimulants	$13.00
Turner	Fertility Pastures and Cover Crops	$25.00
Turner	Seed Sowing and Saving	$19.95
van Loon	The Family Cow	$12.95
Voisin	Soil, Grass & Cancer	$30.00
Walters,	Eco-Farm: An ACRES-USA Primer	$25.00
Zimmer	The Biological Farmer	$25.00

Proceedings for 1997 Alternatives in Animal Health Conference	$ 6.25
Farmer to Farmer Proceedings (apples, sweet corn, greenhouse, livestock, strawberries)	$ 3.95 each

PLEASE NOTE: NOFA MEMBERS get a 10% DISCOUNT on ALL BOOKS EXCEPT *The Farmer to Farmer Proceedings*

Please ADD shipping/handling for books as follows: (based on total sales of books)

0-$20	add $2.00
$20-$30	add $2.50
$30-$50	add $3.50
$50 +	add $4.50

NOFA ORDER FORM

Name:_____

Address: _____

Phone: _____

Please mail to NOFA-VT, PO Box 697, Richmond, VT 05477
Books will be mailed out 2-3 weeks of ordering.

Book Title	# copies	price	shipping/handling	Total