

and bowel problems.<sup>40</sup> In Colombia, the mucilaginous fruits are used for cough. Elsewhere it is used for arthritis, boils, cancer, dysuria, fever, gravel, and scurvy.<sup>32</sup> Chinese consider their alfalfa deobstruent, depurative, diuretic, and stomachic, using it to treat the five viscera and, especially, intestinal and renal disorders.<sup>16</sup>

Tender shoots of alfalfa are reported to contain, per 100 g, 52 calories, 82.7% moisture, 6 g protein, 0.4 g fat, 9.5 g total carbohydrate, 3.1 g fiber, 1.4 g ash, 12 mg Ca, 51 mg P, 5.4 mg Fe, 3410 IU vitamin A, 0.13 mg thiamine, 0.14 mg riboflavin, 0.5 mg niacin, and 162 mg ascorbic acid. Green forage of *M. sativa* is reported to contain, per 100 g 80.0% moisture, 5.2 g protein, 0.9 g fat, 3.5 g fiber, and 2.4 g ash. Silages contain, per 100 g, 69.5% moisture, 5.7 g protein, 1.0 g fat, 8.8 g fiber, and 2.4 g ash. Alfalfa whole meal and leaf meal are reported to contain, per 100 g, 66 and 77 calories, 7.5 and 8.0% moisture, 16.0 and 20.4 g protein, 2.5 and 2.6 g fat, 27.3 and 17.1 g fiber, 9.1 and 11.5 g ash, respectively. Many other details will be found in the references.<sup>29-33,40</sup> The "betaine fraction" of alfalfa contains: 0.785% stachydrine, 0.063% choline, 0.0069 trimethylamine, and 0.0052% betaine. The following purines have been identified: adenine, guanine, xanthine, and hypoxanthine; the pyrimidines, isocytosine; and the ribosides adenosine, guanosine, inosine, and cytidine. These factors stimulate the growth of *Bacillus subtilis*. The three most abundant compounds in alfalfa juice were adenine (0.17%), adenosine (0.25%), and guanosine (0.36%). One study cites 5.1 g arginine/16 g N; 3.1 g cystine and methionine, 1.5 g histidine, 4.6 g isoleucine, 7.2 g leucine, 5.6 g lysine, 4.6 g phenylalanine, 4.1 g threonine, 1.5 g tryptophane, and 4.6 g valine for alfalfa hay. Alfalfa is a valuable source of vitamins A and E; it contains beta-carotene 6.24, thiamine 0.15, riboflavin 0.46, niacin 1.81, and alpha-tocopherol, 15.23 mg/100 g; pantothenic acid, biotin, folic acid, choline, inositol, pyridoxine, vitamin B<sub>12</sub>, and vitamin K are also present. One report gives total crude lipids as 5.2% of total dry weight, with 11% fatty acids, 10% digalactolipids, 16% monogalactolipids, 8% phospholipids, 44% neutral lipids, and 12% others. In the chloroplasts, linoleic, linolenic, and palmitic acids are the predominant acids, whereas stearic and oleic are low. The triglyceride fraction of alfalfa meal contains 16.9% linoleic acid, 32.2% linolenic acid, 31.0% oleic acid, and 19.9% saturated fatty acids. The phospholipid fraction (0.24% dry alfalfa meal) contained 35.2% linolenic acid, 36.8% oleic acid, 14.7% linoleic acid and 13.3% saturated acids. Good alfalfa hay contains 138 to 198 mg choline per 100 g hay. Alfalfa meal contains 21 mg A-spinasterol/100 g. Five xanthophylls comprise 99% of the xanthophyll fraction of fresh alfalfa, viz., 40% lutein, 34% violaxanthin, 19% neoxanthin, 4% cryptoxanthin, and 2% zeaxanthin. Alfalfa volatiles include acetone, butanone, propanal, pentanal, 2-methyl-propanal, and 3-methylbutanal.<sup>40</sup> Alfalfa honey gave the following average values: water 16.56, invert sugar 76.90, sucrose 4.42, dextrin 0.34, protein 0.11, acid (as formic) 0.08, and ash 0.07%. Alfalfa seeds contained: moisture 11.7, protein 33.2, fat 10.6, N-free extract 32.0, fiber 8.1, and mineral matter 4.4%.

**Toxicity** — Nitrate concentrations greater than 0.2% can harm livestock. Heavy N fertilization may increase nitrates to 1.0%. Tannin concentrations between 2.7 and 2.8% have been reported. Several coumestans occur in alfalfa, 4'-*O*-methylcoumestrol, 3'-methoxycoumestrol, lucernol, medicagol, sativol, trifoliol, and 11,12-dimethoxy-7-hydroxycoumestan. Four isoflavones are reported in alfalfa (daidzein, formononetin, genistein, and biochanin A) and they, like coumestrol, produce an estrogenlike response, possibly contributing to reproductive disturbances of cattle. Seeds are reported to contain trypsin inhibitors. Some people are allergic to the dust generated when alfalfa is milled. Medicagol has fungicidal properties. Some alfalfa saponins exhibit hypocholesterolemic activity.<sup>42</sup> Tricin(e) inhibits the smooth muscles and has antioxidant and estrogenic activity<sup>33</sup> (GRAS § 182.10 and 182.20).<sup>29</sup>