REVIEW

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Physician's guide to popular low-carbohydrate weight-loss diets

ABSTRACT

Low-carbohydrate weight-loss diets are very popular, but the recommendations of many of these diets are diametrically opposed to those put forth by the US Department of Agriculture, the American Heart Association, and other national organizations. Their focus on foods high in protein, fat, and cholesterol has potentially serious health implications. Physicians need to be knowledgeable about the efficacy of these programs and to talk to overweight patients about weight loss.

KEY POINTS

Low-carbohydrate diets fail because, like all fad diets, they do not deal with the underlying issues of being overweight, nor do they teach better lifelong eating habits.

An important first step in advising patients who are already on a low-carbohydrate diet is to assess their readiness to question the merits of such diets.

Questions remain about the possible association of low-carbohydrate diets with the risk of colon cancer, heart disease, diabetes, and hypertriglyceridemia.

Each pound of body fat contains 3,500 kcal; therefore, a person who consumes 500 kcal less than he or she expends per day can lose only 1 lb of fat in 1 week. Any higher initial weight loss with ketogenic diets is therefore due to more severe caloric restriction or water loss rather than to fat loss.

PATIENT INFORMATION
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POPULAR LOW-CARBOHYDRATE diets such as those described in such best-selling books as *The Zone* and *Dr. Atkins' New Diet Revolution* can turn weight loss into a double-edged sword. These plans produce fast results relatively easily, without restricting intake of proteins and fats, but they can jeopardize health in a variety of ways.

Physicians treating patients for obesity-related conditions have a unique opportunity to influence patients' food choices by providing reliable, objective information about the safety and efficacy of low-carbohydrate diets.

See related commentary, pages 777-781.

This paper addresses common claims made by proponents of low-carbohydrate diets and discusses what to tell patients who are already on such a diet or may be thinking of trying one.

THE 'SUPER-SIZING' OF AMERICA

In 1980, 46% of US adults age 20 and older were overweight or obese; by 1999, the number had increased to 60%.[1] This dramatic increase has coincided with several trends:

- Higher energy intake from larger portions at home and at restaurants ("super-sizing")
- Greater consumption of high-fat foods
- Widespread availability of low-cost, good-tasting, energy-dense foods
- Decreased physical activity at work, at home, and during leisure time.

A growing national preoccupation with weight loss has accompanied these trends. At any given time, 44% of women and 29% of men are dieting,[2] and Americans spend $33 billion a year on weight-loss products, programs, and pills.[3]

Books on low-carbohydrate diets far outsell others books on weight loss.[3] The two books already mentioned seem to be the most popular; others include *Sugar Busters*, *Protein Power*, *Suzanne Somers' Get Skinny on Fabulous Food*, *The Doctor's Quick Weight Loss Diet* (aka the "Stillman diet"), and *The Carbohydrate Addict's Diet*.[3]

FALSE CLAIMS OF LOW-CARBOHYDRATE DIETS

CLAIM 1
The main cause of obesity is the shift from foods that contain fat to processed foods that replace fat with sugar

Proponents of low-carbohydrate diets claim that the main cause of accelerated weight gain in the United States is the shift from foods that contain fat to foods that replace fat with sugar (ie, processed foods), a substitution they say leads to high insulin levels and fat accumulation.[3] Not so: excessive energy intake—not diet composition—is the cause of weight gain.[4]

Low-carbohydrate diets restrict carbohydrate intake to anywhere from 20 g/day in the Atkins Induction Diet to 170 g/day in the Zone diet (TABLE 1). This is in stark contrast to the American Heart Association's recommendation that carbohydrates should account for 55% to 60% of total daily caloric intake: 275 g/day for a diet of 2,000 kcal and 300 g/day for a diet of 2,500 kcal.[5]

60% of adult Americans are overweight or obese

CLAIM 2
A state of perpetual ketosis causes weight loss, regardless of calories consumed

Low-carbohydrate, high-protein diets are called "ketogenic" because they cause the body to eventually burn fat for energy. Ketosis is the accumulation in the blood of ketones, byproducts of fat oxidation, and it represents the body's adaptation to fasting or starvation. The theory behind low-carbohydrate diets is that inducing perpetual ketosis causes the person to lose weight (fat) regardless of how many calories from protein and fat are consumed.

However, weight loss can occur only if caloric expenditure exceeds caloric intake. Furthermore, the level of carbohydrates needed to maintain ketosis is much less than either the 275 g/day consumed by Americans on

average[4] or the American Heart Association's recommended 220 g/day (TABLE 1). The Ongoing Weight Loss Stage of the Atkins diet, for instance, limits carbohydrate intake to 20 to 40 g/day while allowing unlimited amounts of meat, cheese, poultry, fish, eggs, salt, and fats, a recommendation that overlooks the total (or almost total) inability of the human body to convert fatty acids to glucose, the primary source of energy for the human brain.[6]

CLAIM 3
Low-carbohydrate diets are new

Most low-carbohydrate diets are touted as new, but they are not. English surgeon William Harvey prescribed such diets for the treatment of obesity in 1872.[7]

CLAIM 4
Ketogenic diets are safe

Ketosis from prolonged fasting in healthy people increases insulin resistance and glucose intolerance.[8] Insulin resistance—a state in which a given concentration of insulin is less effective both at stimulating glucose uptake by skeletal muscle and at restraining hepatic glucose production—plays a central role in many disease states (eg, insulin resistance/metabolic syndrome, type 2 diabetes, hypertension, cardiovascular disease, atherosclerotic cardiovascular disease) and is a major risk factor for the development of coronary artery disease, the chief cause of morbidity and mortality in patients with type 2 diabetes. Glucose intolerance has been linked to hypertension and dyslipidemia.[5,9]

Key sources of protein in low-carbohydrate diets usually contain fat

CLAIM 5
Eating carbohydrates leads to overeating

Promoters of low-carbohydrate diets maintain that carbohydrates raise insulin levels more than other foods do, thereby causing the overeating that leads to obesity. In fact, insulin is secreted in reaction to all foods, not only those containing carbohydrates. However, some responses are physiologic while others are pathologic; overeating contributes to the latter by causing exaggerated hyperinsulinemia and glucose intolerance.

The glycemic index—a measure of the rise in blood glucose over a specified period of time (usually 2 hours) vs the response to an equal amount of carbohydrate in a standard food (often white bread)—is a more pertinent way to assess how much insulin the body secretes in response to various foods.[10–12]

CLAIM 6
Low-carbohydrate diets have specific cardiovascular benefits

Dr. Atkins claims that those who follow his regimen appear to have lower cardiovascular risk, lower blood pressure, and significantly lower triglyceride levels.[13,14] No long-term studies substantiate this claim. In fact, any clinically significant weight loss (5% to 10% of initial body weight) can have these effects.

Furthermore, animal and dairy products, the main sources of protein in low-carbohydrate diets, usually contain fat. Even though some of the fat can be removed, as with skim milk, low-carbohydrate diets tend to be high in fat overall. The intake of fat with low-carbohydrate diets, particularly saturated fat, increases to 56% to 66% of total calories—twice the 30% or less recommended in current national dietary guidelines. Excessive intake of dietary cholesterol and, to a greater extent, saturated fat increases levels of low-density lipoprotein (LDL) cholesterol and the risk of heart disease and some types of cancer.[15] Consumption of large amounts of meat may also contribute to cardiovascular disease.[16]

CLAIM 7
Low-carbohydrate diets are high in protein and therefore are healthier

Low-carbohydrate diets are not necessarily high in protein, as claimed. A comparison of dietary intake among persons who consumed a low-carbohydrate diet vs those who consumed a typical American diet[4] found scant difference in protein intake (91 g/day vs 83 g/day). The low-carbohydrate group, however, consumed only about two thirds as many calories as the group eating a typical American

diet (1,450 kcal vs 2,200 kcal), indicating that weight loss was due to reduced caloric intake, not to high protein consumption.[4]

On the other hand, no direct link has yet been found between consumption of animal protein and chronic disease. Though critics of high-protein ketogenic diets claim that the diets increase the risk of gout, osteoporosis, and renal disease, they have no evidence to back those claims.[17] In fact, obese persons with diabetes may benefit from high-protein, low-calorie diets. In a study that compared the effects of high-carbohydrate (low-protein) vs high-protein (low-carbohydrate) low-calorie diets for hyperinsulinemic obese patients, high-protein diets proved more effective at lowering insulin levels and body weight.[18]

COMPOSITION OF STANDARD VS LOW-CARBOHYDRATE DIETS

Compared with national guidelines for healthy eating and weight loss, low-carbohydrate diets contain excessive amounts of cholesterol, saturated fat, and animal protein. The Atkins and Protein Power diets are particularly high in fat. TABLE 1 shows how the macronutrient composition of the leading low-carbohydrate diets differs from the American Diabetes Association recommendations and the American Heart Association's dietary guidelines for the year 2000.[5]

Obesity-related conditions improve with a weight loss of only 5% to 10%

Nutrients missing from low-carbohydrate diets

Micronutrients. Cutting back on entire food groups or restricting variety can lead to deficiencies in vitamins, minerals, and other essential micronutrients.[3] Carbohydrate-rich foods can be excellent sources of fiber, vitamins (B, C, and E), carotenoids, and other beneficial phytochemicals. They also provide calcium, potassium, and the majority of trace minerals. Supplements can replace some but not all of these.

Fiber. Low intake of fiber can cause constipation and may contribute to the development of hemorrhoids, diverticulosis, polyps, colon cancer, heart disease, diabetes, and obesity. The health benefits of phytochemicals (eg, carotenoids, lycopenes, flavonoids, phytic acid, indoles, isothiocyanates)[19] and fiber, for example, can only be obtained from foods. Due to poor intake of high-fiber breads, cereals, and vegetables, dieters need to take fiber supplements or eat fiber-fortified foods to avoid constipation and concentration of bile salts and chemicals that cause colon and breast cancer.

Complex carbohydrates. Carbohydrates are generally classified as simple (sugars) or complex (starches). Simple carbohydrates either occur naturally or are refined and added to foods during or after processing. Foods high in complex carbohydrates (whole grains, vegetables, beans, fruits) are rich in fiber and other nutrients and are relatively low in calories. Processed foods based on refined starch and simple sugars (sugar, soft drinks, cookies, donuts, cakes, sweetened cereals, white bread, pretzels) are generally high in calories and low in fiber and other nutrients.

Diets deficient in complex carbohydrates are likely to be nutrient-poor. Weight-loss plans that restrict high-carbohydrate foods can lead to cravings for foods that are high in sugar and fat.[13] Diets high in simple carbohydrates can lead to hypertriglyceridemia.[20]

POTENTIAL ADVERSE EFFECTS OF KETOGENIC DIETS

Ketogenesis may cause the following conditions:

- Mild dehydration, which can cause dizziness, headaches, confusion, nausea, fatigue, sleep problems, irritability, bad breath, and worsening of gout symptoms and existing kidney problems
- Poor athletic performance from the depletion of stored glycogen: insulin is required for protein synthesis, and without insulin, muscle protein synthesis after exercise is impaired[7]
- Increased risk of osteoporosis from calcium loss if protein intake remains high and calcium intake is low[21]; a high ratio of animal to vegetable protein intake may increase bone loss and the risk of hip fracture in elderly women[22]
- Nausea may at first suppress the appetite, but the effect might not be long-term[23]

- Inability to maintain weight loss due to cravings and boredom with the lack of variety of foods; if the dieter "cheats," a surge of insulin can cause sodium and water retention and subsequent weight gain
- Rising blood pressure with age due to the deficit of high-carbohydrate, high-fiber foods that protect against high blood pressure[24]
- Orthostatic hypotension due to rapid weight loss[25]; this can put older patients who are already at risk for falls at an increased risk of injury.

WHAT ACCOUNTS FOR THE WEIGHT LOSS IN KETOGENIC DIETS?

Weight loss can occur only if caloric expenditure exceeds caloric intake. Caloric intake is reduced only by limiting the intake of one or more of the macronutrients (protein, carbohydrates, fat, and alcohol).[26]

Low-carbohydrate diets provide an average of 1,450 kcal/day.[4] Experts agree that the safest minimum caloric intake for people on medically unsupervised diets is 1,500 kcal/day for men and 1,200 kcal/day for women.[5,9] Since each pound of body fat represents 3,500 kcal, a man who takes in 500 kcal less per day than he expends can lose only 1 lb in a week. A man who weighs 200 lb requires approximately 3,000 kcal/day to maintain his current weight, assuming a caloric intake requirement of 15 kcal per lb of body weight. If a man with moderate physical activity who weighs 200 lbs were to eat absolutely nothing for a week, the most weight that he could lose from fat would be 6 lbs.

The initial, rapid weight loss experienced on low-carbohydrate diets, therefore, cannot come from fat alone. Instead, it comes from the loss of water and electrolytes produced by natriuresis (not by ketosis), which results from a decline in insulin. Water loss also results from the breakdown of liver glycogen (stored carbohydrates).[27] In the absence of dietary carbohydrates, glycogen is converted to glucose to maintain blood sugar levels. Glycogen contains a large number of water molecules, and water that is the byproduct of the conversion of glycogen to glucose is excreted in quantities sufficient to contribute to the high initial weight loss.

If the average intake for an obese person who weighs 300 lbs is about 4,500 kcal/day,[28] cutting back to anything below 2,000 kcal/day is a severe restriction (semi-starvation, in fact) and is very hard to maintain. A low-carbohydrate diet may actually help control hunger in this situation, owing to its high protein content, induced ketosis, or both.

Dr. Atkins claims that caloric intake is not important for weight loss or weight gain, and that a "high insulin level directly lowers energy needs."[14] His theory that calories are unimportant and that "you can, in fact, sneak them out of your body unused, or dissipated as heat" has not been proven.[14] Studies have shown that there is indeed a greater weight loss on a ketogenic diet than with a mixed (balanced) diet, but that the loss was almost entirely due to fluid, not fat.[29–34]

In subsequent weeks of a ketogenic diet, most of the weight loss is from body fat and averages 1 to 2 lbs per week. This weekly average, however, is similar to other types of low-calorie diets. Caloric intake drops because most of the high-carbohydrate foods eliminated are also very high in calories: cake, cookies, bread, chips, fries, sweetened cereal, candy. In other words, low-carbohydrate diets work because overall caloric intake is decreased, and perhaps also because high fat intake or ketosis depresses the appetite.[30] Nausea, however, may accompany ketogenic appetite suppression.[28]

MONITORING FOR ADVERSE EFFECTS OF LOW-CARBOHYDRATE DIETS

Patients on a low-carbohydrate diet should be monitored for orthostatic hypotension (supine blood pressure vs standing blood pressure), dizziness, headaches, fatigue, irritability, gout, and kidney failure. Laboratory work includes routine blood tests (glucose, blood urea nitrogen, sodium, potassium, chloride, and bicarbonate), urinalysis (specific gravity, pH, protein, and acetone), and a lipid profile.

Vital signs and the rate of weight loss should be monitored at least monthly during a low-carbohydrate weight-loss program. Dosages of medications being taken for obesity-related comorbidities (hypertension, diabetes, coagulopathies, gout) may need to be adjusted.

Monitor vital signs and weight at least monthly in patients on low-carbohydrate diets

WHAT TO TELL PATIENTS ON A LOW-CARBOHYDRATE DIET

Follow-up visits are a good opportunity for physicians and dietitians to educate patients about realistic weight management and safe and unsafe dietary practices. Have brochures and charts (eg, the USDA Food Guide Pyramid) on hand to give to patients. More information on how to advise patients who are ready to try a safer and more effective weight-loss program can be found in "How to help your patient lose weight" in the *Cleveland Clinic Journal of Medicine*.[26] (Also, see the Patient Information page at the end of this article: "What you should know about low-carbohydrate diets," page 775.)

An important first step in advising patients is to assess their readiness to question the merits of low-carbohydrate diets. When discussing low-carbohydrate diets with patients, stress these points:

- Initial "fast" weight lost is water, not fat
- These diets are deficient in nutrients that cannot be replaced by supplements and are excessive in nutrients that may increase the risk of mortality and chronic disease
- These diets are difficult to adhere to because they lack variety and increase the desire to consume high-carbohydrate, high-fat foods. It is very difficult to stay on a diet that includes less than 100 g of carbohydrate per day in the long term, considering that the typical American diet contains about 275 g/day
- Ketogenic diets are associated with adverse effects
- A diet low in fruits, vegetables, and whole grains increases the risk of heart disease, cancer, and stroke
- Adherence to official dietary guidelines, such as those of the American Heart Association,[5] provides a basis for healthy living and weight loss
- Obesity-related conditions improve with a weight loss of only 5% to 10%, even though a weight loss of 30% may be needed to reach the ideal body weight. A 5% reduction in weight maintained for 1 year is considered successful long-term weight loss.[9]

Encourage patients to see permanent weight loss as their goal.

NATIONAL NUTRITION SURVEYS

A common perception is that the diets that get the most press coverage are the most popular. But national nutrition surveys such as the National Health and Nutrition Examination Survey (NHANES) and the USDA's Continuing Survey of Food Intakes by Individuals (CSFSII) indicate that, if we define "most popular" as most widely liked and most prevalent, then the most popular diets are in fact balanced diets.

It appears that a combination of a low-fat, low-energy diet along with increased energy expenditure is the most successful method for maintaining weight loss in the long term. The National Weight Control Registry (NWCR), which tracks people who lose weight successfully (loss of 30 lbs or more, maintained for at least 1 year), echoes this finding. The participants lost weight and maintained their weight loss by voluntarily consuming a high-fiber, low-fat diet and by exercising regularly. Walking was the most frequently cited physical activity.

A study of initial enrollees in the NWCR revealed that the average caloric intake was about 1,400 kcal/day, with 24% of calories from fat and 56% from carbohydrates.[31] The foods consumed by these dieters are the same as those in the 2000 American Heart Association dietary guidelines.[5] There are no reports of such success with low-carbohydrate diets.[31]

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CONCLUSIONS AND RECOMMENDATIONS

There is no evidence that low-carbohydrate diets are effective for long-term weight management, and their long-term safety is questionable and unproven. Long-term compliance also needs to be investigated; humans desire a variety of foods, and therefore diets that restrict variety are destined to fail.

Low-carbohydrate diets fail because, like all fad diets, they do not deal with the underlying issues of being overweight, nor do they teach better lifelong habits. As Denise Bruner, MD, stated at the USDA debate on nutrition, in February 2000, "Weight reduction must focus on the whole life-style—not solely the

diet."[35] Ultimately, there is no escaping the fact that weight loss boils down to eating less and moving more.

Given these facts, we recommend referring patients to a registered dietitian who can provide guidance in accordance with the American Heart Association dietary guidelines and an individualized plan that takes the patient's food preferences into consideration.

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REFERENCES

1. **Centers for Disease Control, National Center for Health Statistics.** Overweight Prevalence Statistics, 1999.
2. **Serdula MK, Mokdad AH, Williamson DF, Galuska DA, Mendlein JM, Heath GW.** Prevalence of attempting weight loss and strategies for controlling weight. JAMA 1999; 282:1353–1358.
3. **Stein K.** High-protein, low-carbohydrate diets: do they work? J Am Diet Assoc 2000; 100:760–761.
4. **Freedman M, King J, Kennedy E.** Popular diets: a scientific review. Obesity Rev 2001; 9 (Suppl 1):1–40.
5. **Krauss RM, Eckel RH, Howard B, et al.** AHA scientific statement: AHA dietary guidelines: revision 2000: a statement for healthcare professionals from the Nutrition Committee of the American Heart Association. Circulation 2000; 102:2284–2299.
6. **Cahill GF, Jr.** Survival in starvation. Am J Clin Nutr 1998; 68:12–34.
7. **Kenney JJ.** Are low-carbohydrate ketogenic diets the key to weight control? Weston, FL: Food and Health Communications Inc; 2000:1–37.
8. **Horton TJ, Hill JO.** Prolonged fasting significantly changes nutrient oxidation and glucose tolerance after a normalized meal. J Appl Physiol 2001; 90:155–163.
9. **National Institutes of Health, National Heart, Lung, and Blood Institute.** The practical guide: identification, evaluation, and treatment of overweight and obesity in adults. Available from **www.nhlbi.nih.gov/guidelines/obesity/ practgde.htm**. Last accessed May 15, 2001.
10. **Spieth LE, Harnish JD, Lenders CM, et al.** A low glycemic index diet in the treatment of pediatric obesity. Arch Pediatr Adolesc Med 2000; 154:947–951.
11. **Ludwig DS.** Dietary glycemic index and obesity. J Nutr 2000; 130 (Suppl 2):280–283.
12. **Ludwig DS, Peterson KE, Gortmaker SL.** Relation between consumption of sugar-sweetened drinks and childhood obesity: a prospective, observational analysis. Lancet 2001; 357:505–508.
13. **Rock C.** A view on high-protein, low-carbohydrate diets (letter). J Am Diet Assoc 2000; 100:1300–1301.
14. **Atkins RC.** Dr. Atkins' new diet revolution. New York: Avon Books, 1992.
15. **Beecher GR.** Phytonutrients' role in metabolism: effects on resistance to degenerative processes. Nutr Rev 1999; 57 (Suppl 1):3–6.
16. **Sullivan JL.** Iron and the genetics of cardiovascular disease. Circulation 1999; 1000:1260–1263.
17. **Anderson JW, Konz EC, Jenkins A.** Health advantages and disadvantages of weight-reducing diets: a computer analysis and critical review. J Am Col Nutr 2000; 19:578–590.
18. **Baba NH, Sawaya S, Torbay N, Habbal Z, Azar S, Hashim SA.** High protein vs. high carbohydrate hypoenergetic diet for the treatment for obese hyperinsulinemic subjects. Int J Obes Relat Metab Disord 1999; 23:1202–1206.
19. **Mazza G, editor.** Functional foods: biochemical and processing aspects. Lancaster, PA: Technomic Publishing, 1998.
20. **Baschetti R.** Concentrations of sugars in high-carbohydrate diets. Am J Clin Nutr 2001; 73:129–130.
21. **Heaney RP, Dowell MS, Rafferty K, Bierman J.** Reply to B Teucher and SJ Fairweather-Trait. Am J Clin Nutr 2001; 73:128–129.
22. **Sellmeyer DE, Stone KL, Sebastian A, Cummings SR.** A high ratio of dietary animal to vegetable protein increases the rate of bone loss and the risk of fracture in postmenopausal women. Am J Clin Nutr 2001; 73:118–122.
23. **Rosen JC, Gross J, Loew D, Sims EAH.** Mood and appetite during minimal-carbohydrate and carbohydrate-supplemented hypocaloric diets. Am J Clin Nutr 1985; 42:371–379.
24. **Sacks FM, Svetkey LP, Vollmer WM, et al.** Effects on blood pressure of reduced dietary sodium and the Dietary Approaches to Stop Hypertension (DASH) Diet. N Engl J Med 2001; 344:3.
25. **Bloom WL, Azar G.** Similarities of carbohydrate deficiency and fasting. Arch Intern Med 1965; 112:333–337.
26. **Weiss D.** How to help your patients lose weight: current therapy for obesity. Cleve Clin J Med 2000; 67:739–754.
27. **Fisler JS, Drenick EJ, Wexler H, DeLucia L, Finegold SM.** Starvation and semistarvation diets in the management of obesity. Annu Rev Nutr 1987; 7:465–484.
28. **Pennington AW.** Treatment of obesity with calorically unrestricted diets. Am J Clin Nutr 1953; 1:343–348.
29. **Yang M-U, Van Itallie TB.** Composition of weight lost during short-term weight reduction. J Clin Invest 1976; 58:722–730.
30. **Harris JK, French SA, Jeffery RW, McGovern PG, Wing RR.** Dietary and physical activity correlates of long-term weight loss. Obes Res 1994; 2:307–313.
31. **Shick SM, Wing RR, Klem ML, McGuire MT, Hill JO, Seagle HM.** Persons successful at long-term weight loss and maintenance continue to consume a low-energy, low-fat diet. J Am Diet Assoc 1998; 98:408–413.
32. **Golay A.** Similar weight loss with low or high carbohydrate diet? Int J Obes Relat Metab Disord 1996; 20:1067–1072.
33. **Yang M-U.** Composition of weight loss during short-term weight reduction. J Clin Invest 1976; 58:722–730.
34. **Van Itallie TB.** Dietary approaches to obesity. In: Howard A, editor. Recent advances in obesity research. Westport, CT: Technomic Publishing, 1975:256–269.
35. **US Department of Agriculture.** Millennium lecture series symposium on the great nutrition debate. Washington, DC, February 24, 2000. Available from **www.usda.gov/cnpp/Seminars/GND/Proceedings.txt**, pp. 73–74. Last accessed June 1, 2001.

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