Evaluation Of Some Common Aquatic Weeds As Possible Feedstuffs

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Eradication of aquatic weeds from many natural and impounded waters is probably not only impossible, but detrimental to the environment. Elimination of a particular species releases nutrients and space for the growth of other species which may be more obnoxious than the original offender. Vegetation management designed to maintain certain species at desirable population sizes without serious alteration of the habitat should be developed. Limited chemical and biological control would undoubtedly be very important in this type of management, but in some instances weed removal might be the most effective method. Plant harvest would be particularly suited for lakes suffering from artificial enrichment, since large quantities of nutrients would be removed in the plants. Harvested plants could possibly be utilized as feeds to offset the cost of removal. In developing tropical countries exploitation of aquatic weeds for food might be practical even when not done in conjunction with weed control operations since conventional forages are in short supply.

Chemical analyses have been made of one or two samples of many aquatic plants, but comprehensive data on a large number of samples are available for only a few species. A review of these data (2) revealed that on a dry weight basis many aquatic plants contained as much or more crude protein, crude fat, and mineral matter than many conventional forage crops. Fiber values for aquatic plants were usually lower than those for forage species.

The present study was initiated to obtain information on the crude protein content of a variety of common aquatic plants. Since preliminary observations had revealed that some species of water weeds contained large quantities of tannin which decreases the digestibility of protein, tannin analyses were made on all samples.

MATERIALS AND METHODS

Samples of 43 species of aquatic plants were obtained from various areas in Alabama and Florida. Whenever possible, each species was collected from several different stands. All samples were obtained from lush green stands. Plants were harvested at random from several places within the stand and the materials were combined and stored on ice during transit to the laboratory. Plants were washed free of debris, drained of adherent water, and dried at 60° C for moisture determination. Samples were pulverized in a Wiley Mill. Crude protein was determined from dried samples as Kjeldahl nitrogen x 6.25 (1). The crude protein content of the fresh materials was calculated on the basis of moisture content. Tannin analyses were made according to Rosenblatt and Peluso (4).

RESULTS AND DISCUSSION

Crude protein data from the dried samples are presented in Table 1. Values above 18% were considered excellent, those from 12 to 18% good, and those below 12% poor. Plants containing more than 6% tannin were considered of

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[2]This research was supported by Rockefeller Foundation Grant No. RF-65061 to Auburn University. Manuscript preparation was aided by Contract AT (38-1)-310 between the University of Georgia and the U. S. Atomic Energy Commission.

TABLE 1. SUMMARY OF CRUDE PROTEIN AND TANNIN ANALYSES OF AQUATIC PLANTS.

Crude protein content (% of dry weight)		
>18	12 to 18	<12
Orontium aquaticum	*Alternanthera philoxeroides*	*Myriophyllum heterophyllum*
Jussiaea decurrens	*Potamogeton diversifolius*	*Potamogeton crispus*[1]
Elodea densa	*Eichhornia crassipes*	*Potamogeton nodosus*
Ceratophyllum demersum	*Sagittaria latifolia*	*Hydrotrida caroliniana*[1]
Najas guadalupensis	*Vallisneria americana*	*Polygonium hydropiperoides*[1]
Justicia americana	*Nymphaea odorata*[1]	*Polygonium sagittatum*
Sparganium americanium	*Myriophyllum brasiliense*[1]	*Polygonium pensylvanium*[1]
Nuphar advena	*Myriophyllum spicatum*	*Jussiaea peruviana*[1]
Rhizoclonium sp.	*Cabomba caroliniana*	*J. diffusa*[1]
Hydrodictyon reticulatum	*Eleocharis acicularis*	*Typha latifolia*
Lyngbya	*Brasenia schreberi*[1]	*Nymphoides aquaticum*
	Saururus cernuus[1]	*Hydrolea quadrivalvis*
	Nelumbo lutea[1]	*Hydrochloa carolienensis*
	Spirogyra sp.	*Pista stratiotes*
	Pithophora sp.	
	Chara sp.	
	Oedogonium sp.	
	Nitella sp.	

[1]Contained more than 6% tannin.

TABLE 2. Crude Protein Content (Wet Weight Basis) of Aquatic Plants.

Species	Crude protein	Species	Crude protein
	%		%
Justicia americana	3.4	*Myriophyllum spicatum*	1.3
Sagittaria latifolia	2.6	*Ceratophyllum demersum*	1.1
Sparganium americanium	2.5	*Cabomba caroliniana*	0.9
Orontium aquaticum	2.6	*Vallisneria americana*	0.8
Nuphar advena	2.5	*Eichhornia crassipes*	1.1
Alternanthera philoxeroides	2.5	*Pithophora* sp.	2.5
Jussiaea decurrens	2.3	*Chara* sp.	1.5
Elodea canadensis	2.3	*Rhizoclonium* sp.	1.1
Najas guadalupensis	1.7	*Hydrodictyon reticulatum*	0.9
Potamogeton diversifolius	2.2	*Spirogyra* sp.	0.8
Eleocharis acicularis	1.7	*Nitella* sp.	0.7

little nutritive value.[3] As previously indicated, these data were for relatively young plants. The crude protein content declines rapidly with maturity and aquatic plants for use as feedstuffs should be harvested at the time of maximum harvestable crude protein rather than at the time of maximum yield of plant material.

Crude protein values for water weeds were similar to those reported for high quality forages (3) when the comparisons were made on a dry weight basis. Aquatic plants contained much more moisture than forage crops. The crude protein content of fresh high quality forages usually ranges from 3 to 5% (3). Few aquatic plants fell within this range (Table 2). Almost all species would have to be at least partially dehydrated prior to utilization.

These findings and data from the literature (2) indicate that if dried, many aquatic plants contain large percentages of crude protein. The actual biological values for aquatic plants must be determined in feeding trials. The present data should be valuable in selecting species for more detailed nutrition evaluation.

Aquatic plants present certain unique problems of harvesting and processing. Quite different approaches could be taken in developing tropical nations as opposed to technologically advanced societies. Most tropical areas have cheap manual labor and the plants could be harvested by hand. If the plants are to be used as forage, most species must be at least partially dried. During much of the year drying conditions in the tropics are poor; however, with proper precautions a short period of air drying should reduce the moisture content of most plants enough for use as a green roughage. Transportation is poor in the tropics and aquatic plants would not likely become an article of commerce, but many local populaces located near weed infested waters could benefit greatly if the plants were used as food. Aquatic plants could temporarily help alleviate food shortages until lasting agricultural and social solutions are found.

If water weeds are to be harvested commercially in the United States, then the product must be competitive in quality and cost with conventional forages. Labor is expensive and the plants would have to be harvested mechanically. Mechanical harvesters require considerable capital outlay and are costly to operate. In most areas weather conditions are too unstable to permit air drying, so mechanical driers would have to be developed. Most aquatic plants contain 2 to 4 times less dry matter than forages, so drying would be very expensive. For example, in order to obtain 1 ton of dry *Elodea canadensis* or *Eichhornia crassipes,* 14 and 20 tons of wet materials, respectively, would have to be processed. This excessive moisture content would prohibit transportation to a central processing plant, so drying would have to be done on a barge or by a portable unit located on the shore. An operation as outlined above would have to be in almost continuous operation and only very large plant stands could be exploited. Based on a simple assessment of the problems of harvesting and drying, it appears very doubtful that aquatic plants have direct commercial possibilities.

Nutrient pollution is presently accelerating eutrophication in many lakes. No practical method has been developed for removing nutrients once they have been discharged into a body of water. The harvest of aquatic vegetation is a promising method of nutrient removal. By harvesting enough plants to balance the nutrient inflow and outflow, the process of eutrophication would be stopped and the lake would revert to a steady state with regards to nutrients. The fertility level of a lake could be reduced by removing plant bound nutrients at a rate greater than nutrient inflow.

If water weed harvest is used as a management technique, the plants could be processed into a feed provided the cost of drying would not exceed the value of the feed. The practicality of such an operation appears feasible, but pilot studies must be conducted.

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