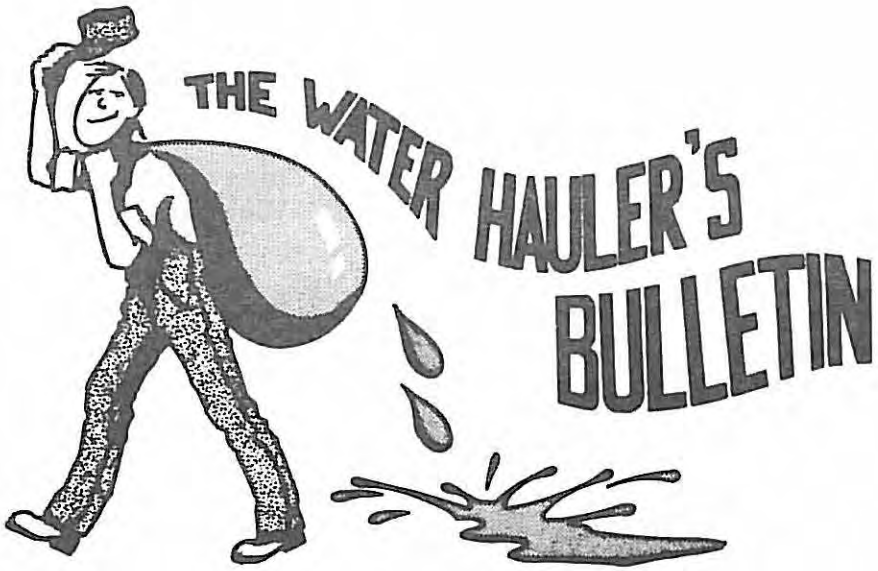


VOLUME 3, APRIL 1981

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## HAZARD - PHOTOCOPYING MACHINES

Health Effects and Prevention:

Most photocopiers emit ozone gas. Ozone irritates the eyes, nose, throat, and lungs. Ozone may also cause damage to chromosomes. A chemical used in Xerox brand toner called nitropyrene may be a potential cancer causing agent. Photocopiers should be located in well ventilated areas. If necessary, ventilation ducts should be attached directly to the copier. Ozone levels should be checked and maintained below the OSHA standard level (0.1 parts per million of air). Clerical workers should know what chemicals are in the toners presently being used, and make sure they do not contain nitropyrene. When handling toners, plastic gloves, a smock and a respiratory filter mask should be used.

(This warning from Alberta Union of Provincial Employees; source - Labor Occupational Health Program, University of California.)

* * *

KEEP YOUR TRENCHING OPERATIONS SAFE

The following is the text of a statement by W. H. Rozel, P. Eng., Executive Director - Work Site Services of Workers' Health, Safety and Compensation, directed to all firms involved in trenching: Re: Violations of Safety Regulations.

"The regulations concerning worker safety in trenches and excavations are contained in Sections 415 - 456 inclusive, of Alberta Regulation 271/76 made under The Occupational Health and Safety Act. Other regulations under the Act, as well as the Act itself, stipulate the responsibility of employers for the safety of their employees. Copies of the Act and its Regulations are available from the Queen's Printer at: 11510 Kingsway Avenue, Edmonton, Alberta.

The requirements of the regulations have been widely publicized and, I believe, are generally known and understood throughout your industry. Despite this we continue to have accidents and fatalities ... resulting from blatant disregard of the elementary safety precautions included in the regulations.

Effective immediately, all Occupational Health and Safety Officers have been directed to take the following action when they observe failures to provide the shoring or cutbacks required by the regulations:

1. Immediately stop all work until corrective action is completed.
2. Initiate a recommendation for prosecution under The Occupational Health and Safety Act."

The Irrigation Division recommends that the irrigation industry adheres to all safety regulations. The importance of workers' safety cannot be over-emphasized.

*Unstable soil and deep trench conditions are a breeding ground for accidents. The ladder provides a ready exit, but obviously, this trench could not be considered "safe".*

* * *

## THE SCREW PUMP FOR LOW LIFT APPLICATION

Originally designed by the famous Greek mathematician and physicist in the 3rd Century BC, the Screw Pump has come a long way from the "Archimedian Screw" which was a hand operated spiralled tube on an incline. It appeared and disappeared several times in history but the modern day screw pump dates back to the 1920's when it was used primarily for drainage in the Netherlands. Today the screw pump is a highly efficient variable capacity low lift pump consuming less power than the centrifugal or mixed flow pump for the same static lift.

A recent Engineering Digest (Sept. 1980) article stated that the screw pump's rise in popularity as a low lift pump in municipal and industrial application is due mainly to the spiralling energy cost. Most of what we say here is based on this article and subsequent discussion with the representative of the Gray Engineering Group - the Ontario firm responsible for the design and manufacture of the first screw pump in Canada.

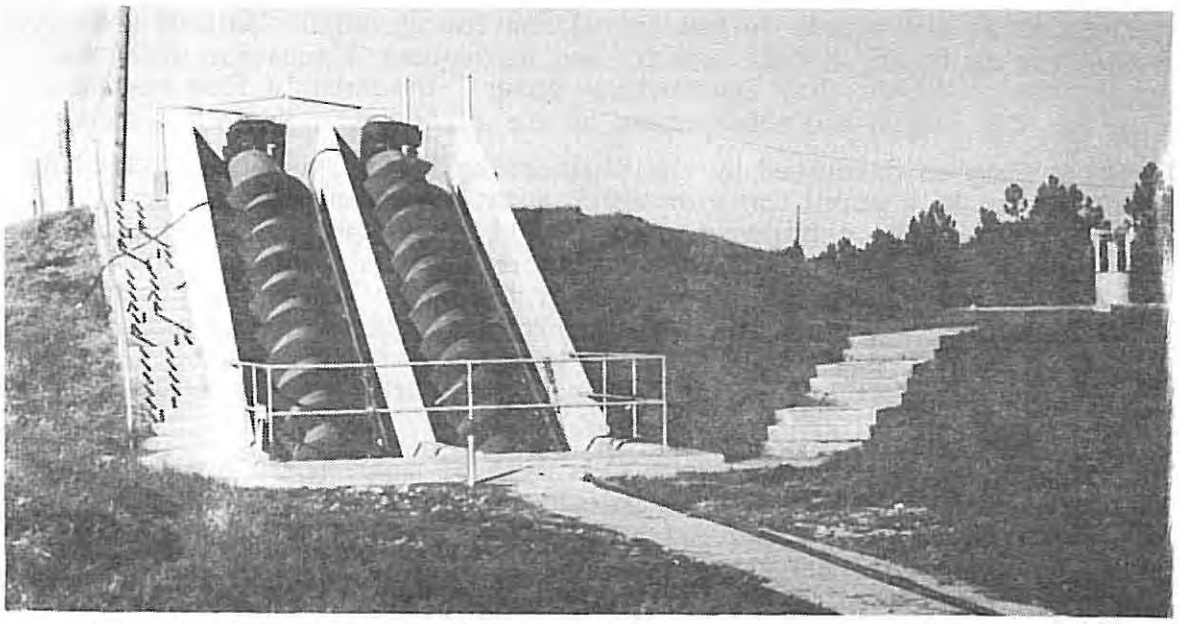
The Screw Pump as described by the Engineering Digest, is essentially an auger similar to a screw conveyor which rotates within a stationary unlined trough, semi circular in cross section (see photo). As liquid is being introduced to the lower or inlet end of the screw, it is carried upward by the flights and discharged over the upper lip of the trough. The flights are supported on a center drive or "torque" tube which, in turn, is carried by a submerged radial bearing system at the lower or idle end and a thrust and radial bearing system at the upper or drive end.

We have no first hand knowledge of this type of pump, but a paper by William L. Berk (1976) gives some interesting features that are advantageous compared to the centrifugal pump. In a nutshell some of the pump's features are: (a) capable of pumping grit, rocks, wood, tin cans, plastic and other foreign objects because of the wide clearance between the flights. (b) does not need a deep wet well, suction and delivery pipes, valves and fittings. Because of this, the total lift is less so power requirement is less. (c) can operate at over 70% efficiency through a range from 100% to 33% of the design capacity. This high efficiency means less power requirement. (d) operates at a slow speed so wear is less and abrasion due to solids in the liquid is less. (e) is self compensating to automatically pump the quantity of liquid that comes to it from zero to its maximum rated capacity with no change of speed (a variable discharge pump at no extra cost).

With beneficial features like these, it seems that we should be considering the screw pump for low lift high volume application. For reasons not clear to us, screw pumps are being used mainly in handling of storm drainage and raw sewage. Today, there are two units in Whitecourt, Alberta. Each unit has a capacity of 260 L/s (3500 gpm) and static lift of approximately 7 metres. In Okotoks another unit is being installed to handle raw sewage. It has a capacity of 177 L/s (2800 US gpm) and a lift of 8 metres.

We believe there are applications for the screw pumps inside the Southern Alberta Irrigation Districts. An application that could have had a screw pump installed is the low lift pump on Horsefly Reservoir in the Taber Irrigation District. This pump lifts water from Horsefly Reservoir into the Taber Main Canal to supplement its flow. Still another application for this type of pump may be on the proposed Bow River Irrigation District's Badger Lake Reservoir where again water will be pumped from the Reservoir into Lateral H to supplement flow.

As more information and literature becomes available on the screw pump, we will endeavor to keep our readers posted.



*This 66" diameter twin screw pump is 55' long and has a capacity of 10,000 U.S. gallons per minute (38,000 litres per minute). It is located in Louisiana. (Photo courtesy of Brian Clarke.)*

* * *

## BARNWELL SEALANT TEST PLOT

The concrete canal lining sealant test plot established just west of Barnwell in the Fall of 1980 is being monitored by our Research Unit. The only information that is apparent at this time, is that there has been considerable movement in the existing cracks which has dislodged or ruptured some of the sealants. There is also evidence of several new cracks in close proximity to the old ones. No evaluation of the individual products has yet been made.

* * *

## IRRIGATION SCHEDULING

### Introduction

Irrigation scheduling is a program for water management on the farm in which all the plant-water-soil relationships are considered. It is a systematic approach which enables the farmer to optimize production by effectively managing available irrigation water and equipment.

Crop yields on irrigated land are increased when soil moisture is kept at sufficiently high levels to encourage optimum plant growth. Lack of water for even short periods of time may in some cases drastically reduce yields. Soil moisture can sometimes be used so quickly that drought conditions rapidly result unless the soil reservoir is replenished at regular intervals.

Irrigation scheduling is a valuable tool in determining when, where and how much water to apply during irrigation. Scheduling takes into consideration all the factors which affect production, the crop grown, weather conditions during that particular season, etc. From this and soil moisture, the present use of soil water is calculated and a forecast is made as to future water needs.

### Advantages Of Irrigation Scheduling

Irrigation scheduling should permit farmers to (1) increase crop yield, (2) improve water use efficiency, (3) make the best use of available equipment and help in planning new equipment purchases, (4) help plan which fields or crops to irrigate when conditions limit irrigation.

Not every farmer will use scheduling for all these purposes.

### How Do Farmers Schedule Irrigation

Most farmers use a systematic method of deciding when to irrigate. Some schedule irrigation by checking the soil moisture by the appearance and feel of the soil. This is done by digging a hole with a shovel or auger and examining the soil in the top three quarters of the root zone. Others follow "irrigation scheduling" programs offered either by Alberta Agriculture or private companies. These programs are scientifically planned and can maintain optimum crop growing conditions if followed.

Many farmers follow a very subjective approach and irrigate in a fixed pattern. Since natural rain in Southern Alberta provides 1/3 to 1/2 of the moisture required by the common crops, many farmers depend on this moisture. They normally plan to irrigate alfalfa following the first and second cut and grain during the boot to heading stages. Often the timing of these events coincides and results in the peak July demands noted in most irrigation districts.

Proper irrigation scheduling could help to reduce this peak water demand but will not eliminate it. If all water users followed a scheduling program total water use would increase since average crop water use appears to be about 75 to 80% of that necessary to produce the best level of production. Good irrigation scheduling could also reduce risk of crop loss from interruption in water deliveries.

Figure 1 shows the optimum level of crop water demand for County 26 if the irrigated acreage is 40% forages, 50% grains and 10% specialty crops. The difference between the upper and lower curves indicates the amount of the crop requirement supplied by precipitation. The irrigation requirement in May will on the average year be eliminated by soil moisture stored between growing seasons. The actual pattern of crop requirement will vary annually as soil moisture storage and precipitation change. The pattern of crop requirements is also similar in shape to actual district deliveries of water.

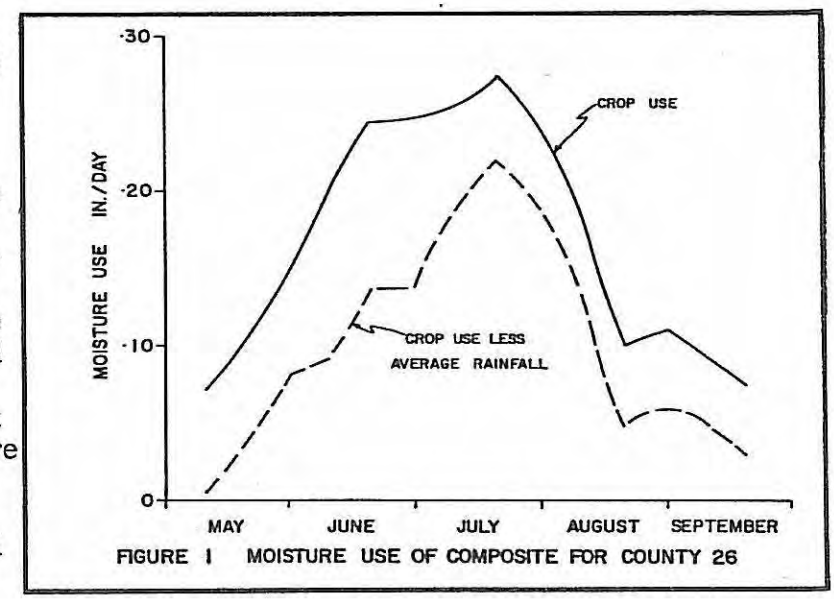


FIGURE 1 MOISTURE USE OF COMPOSITE FOR COUNTY 26

## The Irrigation District Role In Irrigation Scheduling

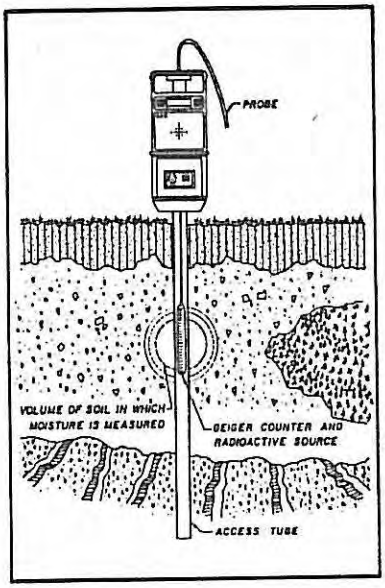
From the foregoing discussion the district role in irrigation scheduling appears to be one of passively providing water when the farmer orders it. This should not be so. It is physically impossible for most districts to meet the absolute peak demands possible during mid-July without assistance from precipitation or previously stored soil moisture. Using scheduling to reduce peak irrigation requirement could be helpful.

In the Lower Colorado River Basin many of the irrigation districts are becoming actively involved in irrigation scheduling to assist in arranging water deliveries and to eliminate water spills. The availability of water is so limited that the only way these districts will be able to develop their designated acreages is to efficiently manage water at all levels. To these districts irrigation scheduling appears to be an important tool to do this. At least one district is providing their ditchriders with projected demands from a field scheduling program to assist in sizing deliveries.

## Irrigation Scheduling In 1981

If precipitation continues as it has to date in 1981, scheduling of irrigation water deliveries both at the farm and district levels could provide problems. Alberta Environment has projected that both the Bow and Oldman River systems will yield only 75% of their normal runoff. They correctly stated that spring precipitation can significantly affect this water yield. This applies equally well to the available moisture levels on irrigated land.

It is possible to make some generalization about irrigation scheduling in 1981. If average to below average rainfall occurs, irrigation will be started earlier than normal by many operators. If possible in some districts where diversions depend on river flows, water users will try to irrigate early to ensure crops can withstand drought in case water is not available later.




SOIL MOISTURE MEASUREMENT BY NEUTRON PROBE

If Southern Alberta is fortunate and receives the type of heavy precipitation received last May in the Lethbridge area, water managements will not be greatly different from those experienced last year.

The Farm Irrigation Services Branch of the Irrigation Division will continue to offer the "Irrigation Scheduling Program" to interested farmers. This program involves monitoring soil moisture weekly and recommending irrigation dates and water needs. Further information is available from Dick Heywood, Soil & Water Specialist, Farm Irrigation Services Branch at 329-5154.

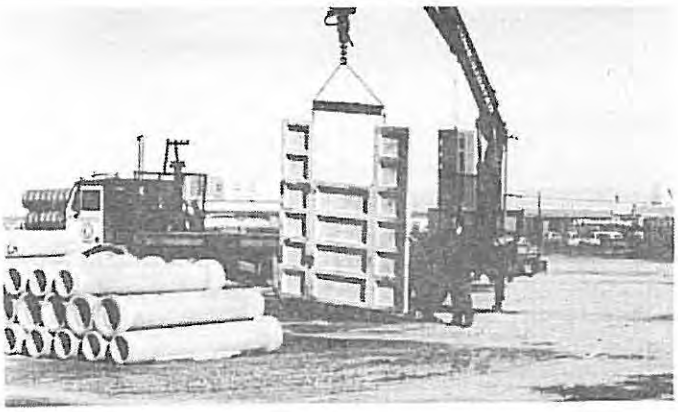
* * *

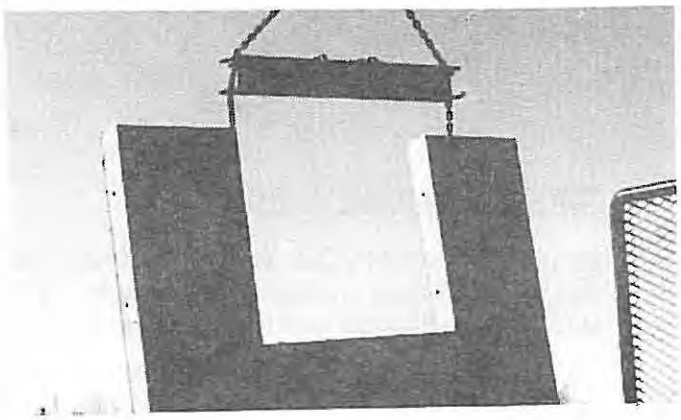
## CONSOLIDATED CONCRETE UNVEILS NEW PRECAST PANEL

Most people in the irrigation business are familiar with Consolidated Concrete's precast irrigation structure panels which were designed by Alberta Agriculture, Irrigation Division. Requests from the Irrigation Districts have resulted in the design and production of a new, larger center panel to cut installation time by reducing the number of panels required for a given structure.

The new panel has a maximum size of 2500 mm by 3600 mm. It has a 1200 mm wide by 1000 mm or 1500 mm deep opening which can be placed along either dimension of the panel. The length of the panel can be decreased in 500 mm increments to 2100 mm. It is also available without the opening and gates or pipe stubs can be cast into it on special order. The 2500 mm x 3600 mm solid panel weighs 2015 kg. Deduct 365 kg for the 1200 mm x 1500 mm opening, 240 kg for 1200 mm x 1000 mm opening, and 275 kg for each 500 mm decrease in length of the panel.

When lifting the panel, Consolidated Concrete recommends using the lifting eyes provided and the use of a spreader bar if the panel contains an opening.





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## WIND PUMP DEVELOPMENT FOR FARM DRAINAGE

The Drainage Branch of the Irrigation Division is studying the possibility of using wind machines to pump the effluent from subsurface drainage systems in areas where suitable gravity outlets are not available. A new windmill design that permits locating the actual windmill in an area where the most wind blows, not necessarily on top of the well, could revive an energy source that has not been used for many years.

The two metre windmill propeller drives an air compressor mounted on the head. This unit pumps air through flexible tubing up to 300 metres away to a pump situated at a 30% submersion drop in the well. Water is lifted by air injection to a discharge point. More than one windmill can service the same pump to increase capacity.

The pump has no moving parts and will operate dry, accepting sand and silt with no harm to the mechanism. It is under 2 metres in length and requires a minimum submergence of 10 metres inside a minimum 65 millimetre diameter casing.

The basic unit will pump up to 23 litres per minute. The package consists of propeller, mast, compressor and pump. Flexible air and water lines, and a tower, if needed, are extra. Larger models are available.

The compressor is designed to perform in winds from 16 kilometres/hour to gale force, and the windmill is designed to kick out in high winds and continue functioning at half speed.

In cooperation with the St. Mary River Irrigation District, two models of this type of windmill will be installed by the Irrigation Division in 1981 to monitor and evaluate their effectiveness. The site chosen is on a tile drain project near Bow Island. One model is shown in accompanying photo.

Further information can be obtained from Brent Paterson, Head, Drainage Branch, 329-5515.

* * *

*THE WATER HAULER'S BULLETIN*

*Designed to provide the operation and management personnel of Irrigation Districts with items of interest in their line of work. Comments are welcome. Please contact Roger Knibbs at 329-5164, Lethbridge.*

*Published quarterly by the Evaluation and Management Unit, Project Planning Branch, Irrigation Division, Alberta Agriculture, Agriculture Center, Lethbridge, Alberta T1J 4C7.*

WATER HAULER BULLETIN SUPPLEMENT - APRIL 1981

Alberta Agriculture, Irrigation Division recommends ...

# AVOID IRRIGATION IRRITATION

BY: DONNA BATYCKI*

..... check for Eurasian watermilfoil

Eurasian watermilfoil, Myriophyllum spicatum L., the scourge of the Tennessee Valley Authority, B.C.'s 'alien invader'---call it what you will, it's a super-weed. Introduced to North America from across the pond during the late 1800's, this aquatic weed has spread throughout our continent, rapidly and without mercy, taking over lakes and ponds, reservoirs and sloughs, and irrigation canals.

In southern Alberta, where annual precipitation reaches an average of only 17 inches, irrigation systems are the life-lines to the agricultural industry. Aquatic weeds are already a problem, feeding off the fertilizers and pesticides that seep into the water. Eurasian watermilfoil, should it extend its grasp into the lakes and irrigation waters of Alberta, could cause the expenditure of millions of dollars in control or eradication measures.

Eurasian watermilfoil roots in the hydrosoil, its long flexible stems reaching the surface of waters up to 7 m deep. This weed prefers slow-moving or still waters and can function at nutrient levels far lower than many other aquatic plants. It has a competitive advantage over floating plants in that it takes its nutrients from the sediment. Forming dense, branched mats on the surface of the water, this weed keeps light from reaching plants that grow below. Eurasian watermilfoil is extremely adaptive and, once established, it merely adjusts its rate of growth to the prevailing environmental conditions. For example, it has even been reported as growing under ice cover.

Eurasian watermilfoil produces seeds, but its most rapid and effective means of propagation is by fragmentation. Autofragmentation, or abscission, occurs after each of the two annual flowering periods. Inadvertent or accidental fragmentation from wave action or boating activity can happen at any time. Fragments become waterlogged, sink to the substrate, and take root. Growth is rapid and one successful fragment can grow 4 m or more in a single season.

The nuisance potential of Eurasian watermilfoil is extremely high. This is seen in the example of the invasion of the Okanagan lake system. Eurasian watermilfoil was first observed around 1970 in the Vernon Arm of that area, where it had affected less than 20 hectares of lake surface. By 1979, it covered almost 1000 hectares, infesting most mainstem lakes and over 40 ponds and lakes in B.C.'s lower mainland. In the summer of 1980, a specimen, later confirmed as Eurasian watermilfoil, was collected in the Champion Lakes near Trail. Despite government quarantine efforts, the super-weed was spreading its boundaries.

Although aquatic plants do play a beneficial role in the ecosystem, over-abundance only results in a negative impact. Eurasian watermilfoil, because of its ability to spread rapidly and form dense populations, has literally destroyed recreational activity in many areas and will continue to do so until permanent control measures can be levied.

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*Donna Batycki is a consultant to Alberta Environment, Pollution Control Division, Pesticide Chemicals Branch in Lethbridge.

Thus far, control measures, such as mechanical removal (dredging and harvesting) and herbicide application, are being implemented. Harvesting is expensive and time-consuming. It removes only the upper portions of the plants and, therefore, meets with only temporary success.

Rotovating and dredging, either by machine or by diver-operated suction hoses, remove the roots and are somewhat more successful in thinning the population. Plant pieces must be removed from the water after cutting takes place or they will spread the infestation even more. Disposal of harvested or dredged material presents additional problems; utilization of weed is still undergoing study and as yet is not economically feasible.

Chemical control methods also manifest difficulties. The use of 2,4-D must be carefully supervised. Although the application of granular, slow-release 2,4-D BEE allows a relatively high degree of selectivity, the remaining aquatic community may still be subject to effects of the chemical for a short period of time. A 100% kill-rate is also hard to attain with dense populations, and application must be repeated seasonally. The use of any chemical in potable water will meet with some dissention and the case of 2,4-D is no different. The B.C. government has had to deal with private environmentalist groups, such as the South Okanagan Environmentalist Coalition, in efforts to justify the use of this chemical.

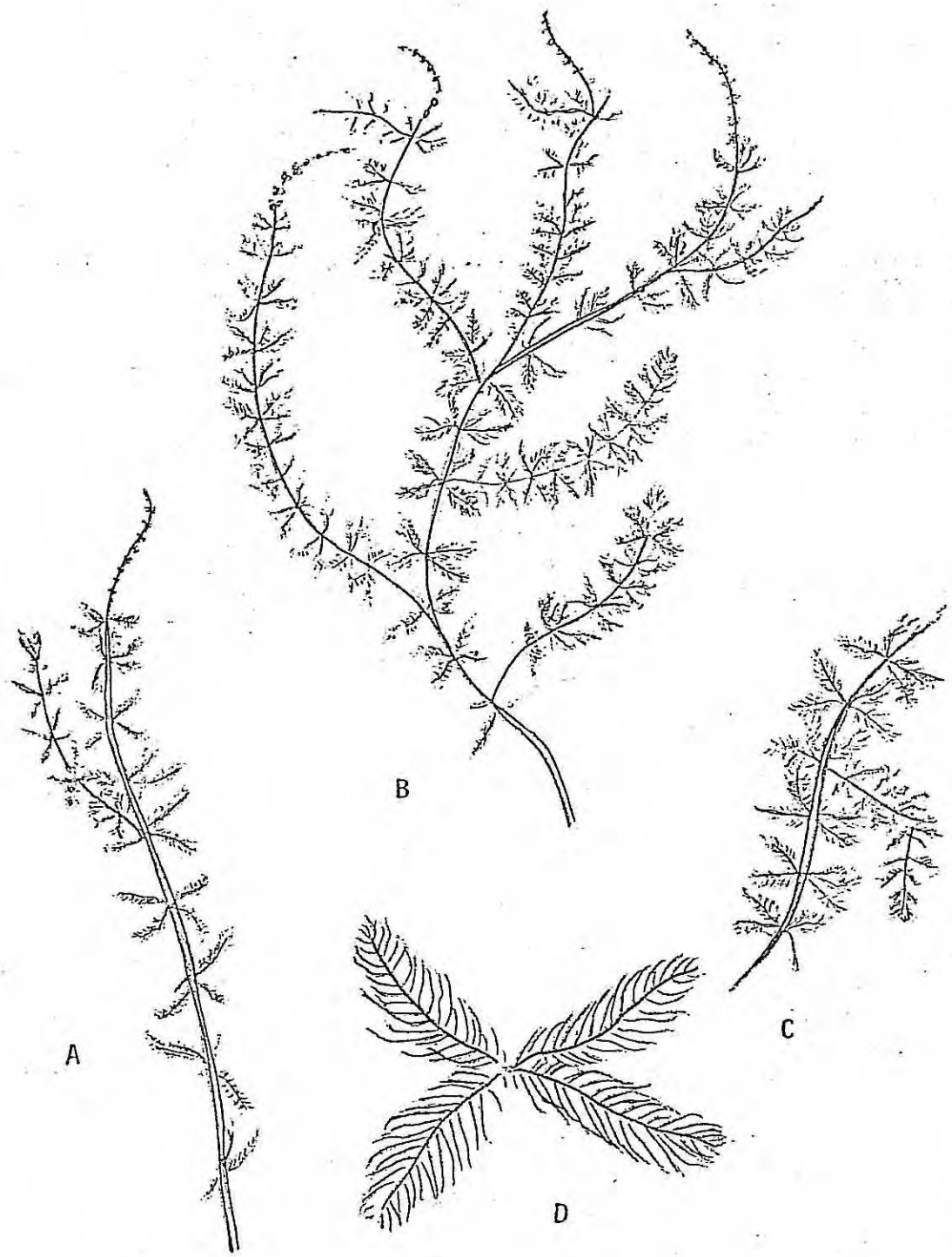
Biological control (the introduction of insects, fish or bacteria that would limit the growth of Eurasian watermilfoil) is another method under study. This method has the singular disadvantage of introducing another external biological factor which may in turn get out of control.

Control by nutrient limitation is another long-term consideration. Theoretically, if we can determine how and why Eurasian watermilfoil uses certain nutrients, we can manipulate its growth pattern and perhaps control its distribution and abundance. Many researchers feel this method is not feasible while others advocate it whole-heartedly.

Alberta has not yet had to face a Eurasian watermilfoil infestation, but Myriophyllum exalbescens, a close relative to this alien species, grows in several areas of our province. The two species, virtually indistinguishable except by experts, have a great deal in common, although the native species does not seem to present the same catastrophic results. Studies of the ecology and the physiology of Eurasian watermilfoil offer no substantial reasons why this plant could not survive, and proliferate, in Alberta's climate.

The B.C. government has spent millions of dollars on control and quarantine projects in hopes that populations of this weed can be limited to certain areas and thereby controlled with greater ease. As boaters and aquarists are implicated in the transport of Eurasian watermilfoil over the province, or even the continent, the government has set up boat check-stops and a public awareness program to inform people of the dangers of carrying viable weed fragments from one site to another. Control methods are useless if the spread of the weed can not be checked.

Albertans should be aware of what Eurasian watermilfoil look like. If it is found in any slough, lake, pond or irrigation ditch, it should be reported immediately to the proper Alberta Environment authorities. Alberta has a limited number of recreational lakes and an extensive irrigation network. Such valuable resources should not be lost to carelessness or negligence.

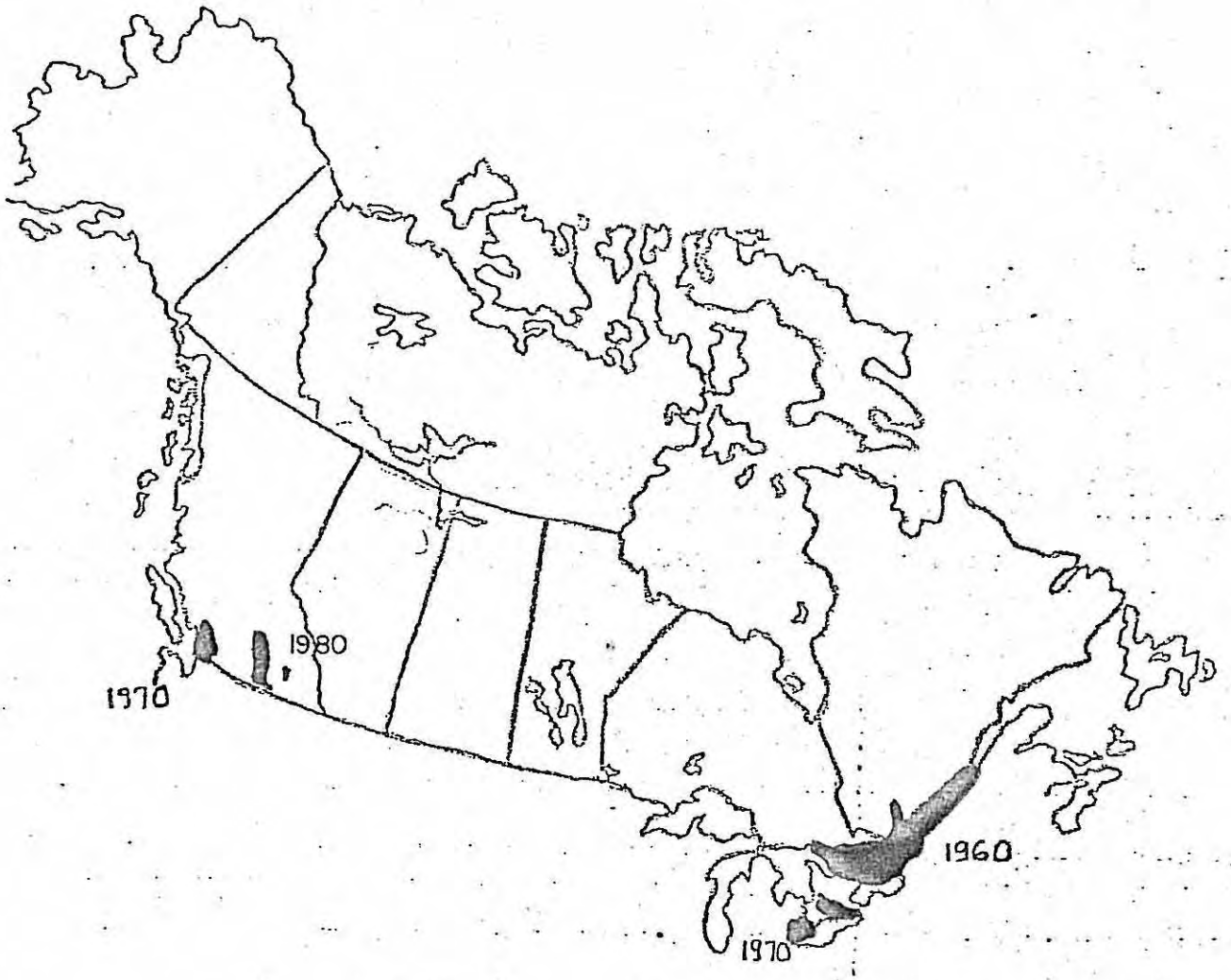



A and B Eurasian watermilfoil showing spikes

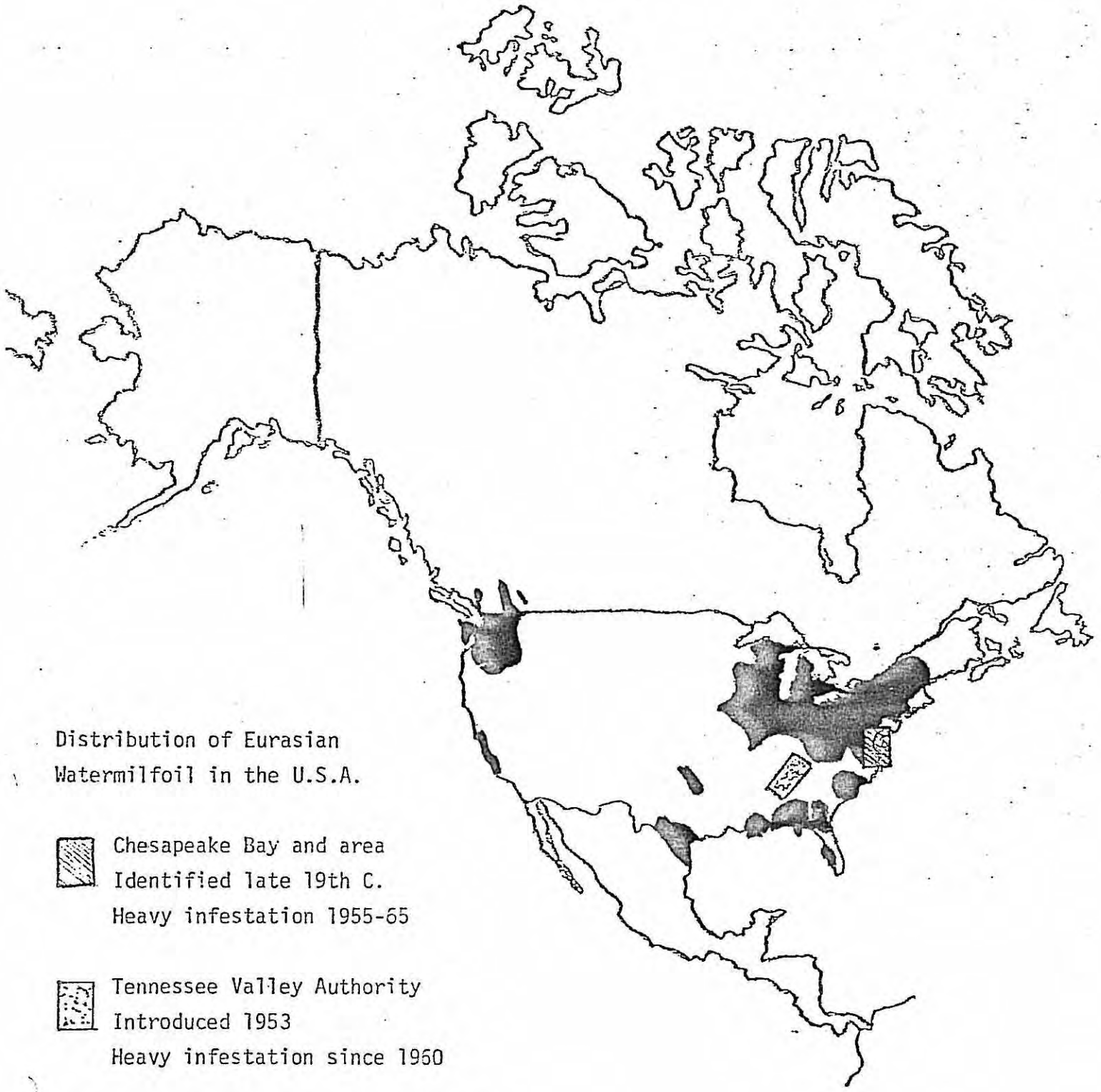
C Eurasian watermilfoil branch

D Eurasian watermilfoil whorl of 4 leaves

(Reed, 1977)




Distribution of Eurasian Watermilfoil in Canada and approximate dates of its identification



Distribution of Eurasian
Watermilfoil in the U.S.A.

Chesapeake Bay and area
Identified late 19th C.
Heavy infestation 1955-65

Tennessee Valley Authority
Introduced 1953
Heavy infestation since 1960

Areas that Eurasian watermilfoil
has invaded since 1960