Using Sea Water for Agriculture

Aim: marking a text structure, using graphics in note-taking.

1. Pre-reading:
   Discussion on water supplies, fresh and sea water, arid areas in the world.

2. Scan the text *'Using Sea Water for agriculture'* and label the margin brackets with the expressions at the bottom.

3. Compare your margin notes with 'simple graphics'

4. Read the article step by step:

   Paragraph 1,2 (focus on vocabulary)
   Match the given expressions with their definitions
   In the text, find the words that have the same meaning as the expressions on the handout

   Paragraph 3:
   Label the diagram *'Cheapest method of evaporation'* and describe it to your neighbour.

   Paragraph 4:
   'Arizona method' - flowchart
   To show how the process continues, use the arrows .

5. Complete the spidergram with the key points

6. Recapitulation: types of note-taking

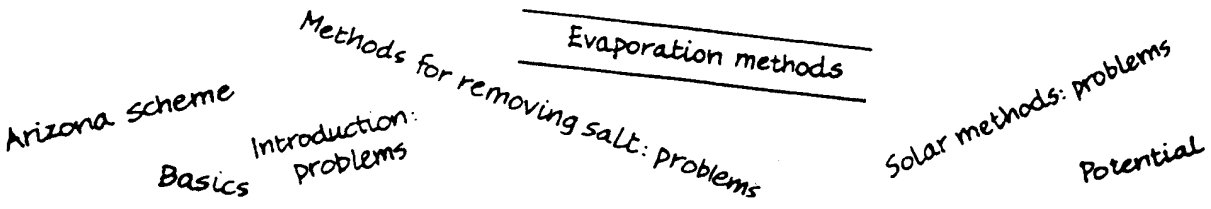
Control of evaporation. and particularly of transpiration of water through plants, is obviously of crucial importance in all regions of the world where water is scarce. It is being investigated most thoroughly in connection with the use of sea water for agriculture. Sea water can actually be used as such for watering certain plants, on certain soils.[2()] But it seems unlikely that it can be at all widely used for growing plants useful for food. and it is not at all certain how long it can be carried on before the accumulation of salt in the lower parts of the soil makes it unusable.

Most attempts to use sea water for agriculture depend on first removing the excess salt. There are two basic methods of desalination. One depends on using a membrane which will allow the water to pass, but will hold back the salts (reversed osmosis). The other is distillation. that is to say water vapour or steam is produced and this. which does not contain salts. forms fresh water when it is condensed. The production of steam can be done by actually boiling the sea water or. more gently, by encouraging evaporation from the surface of sea water which is warmed but not raised to boiling point. Both the membrane-filtering techniques and the boiling technique require large amounts of concentrated energy. They are essentially industrial processes of a very energy-consuming kind. The evaporation methods are much less demanding. and I will discuss them first.

The cheapest way of evaporating sea water is to use the heat of the sun. The sea water is run into shallow tanks of concrete or plastic. preferably with a black bottom which absorbs the sun's heat. The tanks. which are usually built long and narrow. are covered with a transparent roof with curved or sloping sides. The water in the tanks is warmed, evaporates, and the water vapour condenses again on the cooler glass roof and runs down the sides to be collected in a trough at the bottom. Installations of this kind are already in use in many arid regions near the sea, from the coasts of Chile to the Aegean islands. It is a very satisfactory process provided one does not want too much water. It has mostly been used to provide drinking water. The quantities required for agricultural irrigation would require enormous areas of tanks.

A much more sophisticated low temperature evaporation scheme is being developed in Arizona.[21] The scheme involves using cold sea water which is pumped into the installation to aid the condensation of the water vapour which has been produced by hot sea water. Originally solar energy was used to heat the sea water. but since any place that wanted to run such a scheme would certainly be generating its own electricity. probably with a diesel engine. use was later made of the 'waste heat' in the cooling water of the engine.

They also introduced another improvement which is of very general application. The fresh water was used on plants grown in plastic greenhouses. A large sheet of plastic is attached to a low brick or stone wall. and a small pump keeps the air pressure inside the plastic at about half a pound per square foot. above the air pressure outside. so the plastic is inflated, in the form of a long low sausage. The plastic is transparent to the sunlight which the plants need. while the water, led to the plant roots and transpired through their leaves. is trapped inside and not allowed to escape back into the general atmosphere; it can be used again and again. Experimental plants of this kind are working in Arizona and Mexico. and a quite big one, planned to provide food for a sizeable population, is being built in the oil-rich Persian Gulf state of Abu Dhabi. There are quite a large number of areas in the world in which arid deserts come near enough to the sea coast for developments of this kind to make important contributions to the world's food supply.



ad paragraphs 1 and 2

Match the given expressions with their definitions:

transpiration	the separation of a liquid from a solid or another liquid by vaporization followed by condensation
reverse osmosis	a change of state from liquid to vapour which can occur at any temperature up to the boiling point
distillation	the evaporation of water vapour from plant leaves via tiny pores
excess	gradual increase in amount until there is a large quantity in one place
accumulation	a larger amount of something than is allowed or needed
desalination	the salt removed from sea water so that it can be used in homes and factories
investigation	separation of solute from a solution by causing the solvent to flow through a membrane at pressures higher than the normal osmotic pressure
evaporation	an (official) attempt to find out the reasons for something such as a scientific problem

In the text find the words that have the same meaning as the expressions below:

extremely important

there is not enough of it available

the top layer of the earth in which plants grow

continue doing something

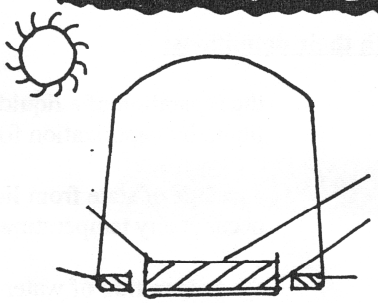
have something inside or have something as a part

takes a lot of energy

needing a lot of ability, effort or skill

ad paragraph 3

Cheapest method of evaporation



ad paragraph 4

'Arizona method'

irrigates plants in closed plastic greenhouses (inflated bags)

fresh water evaporates

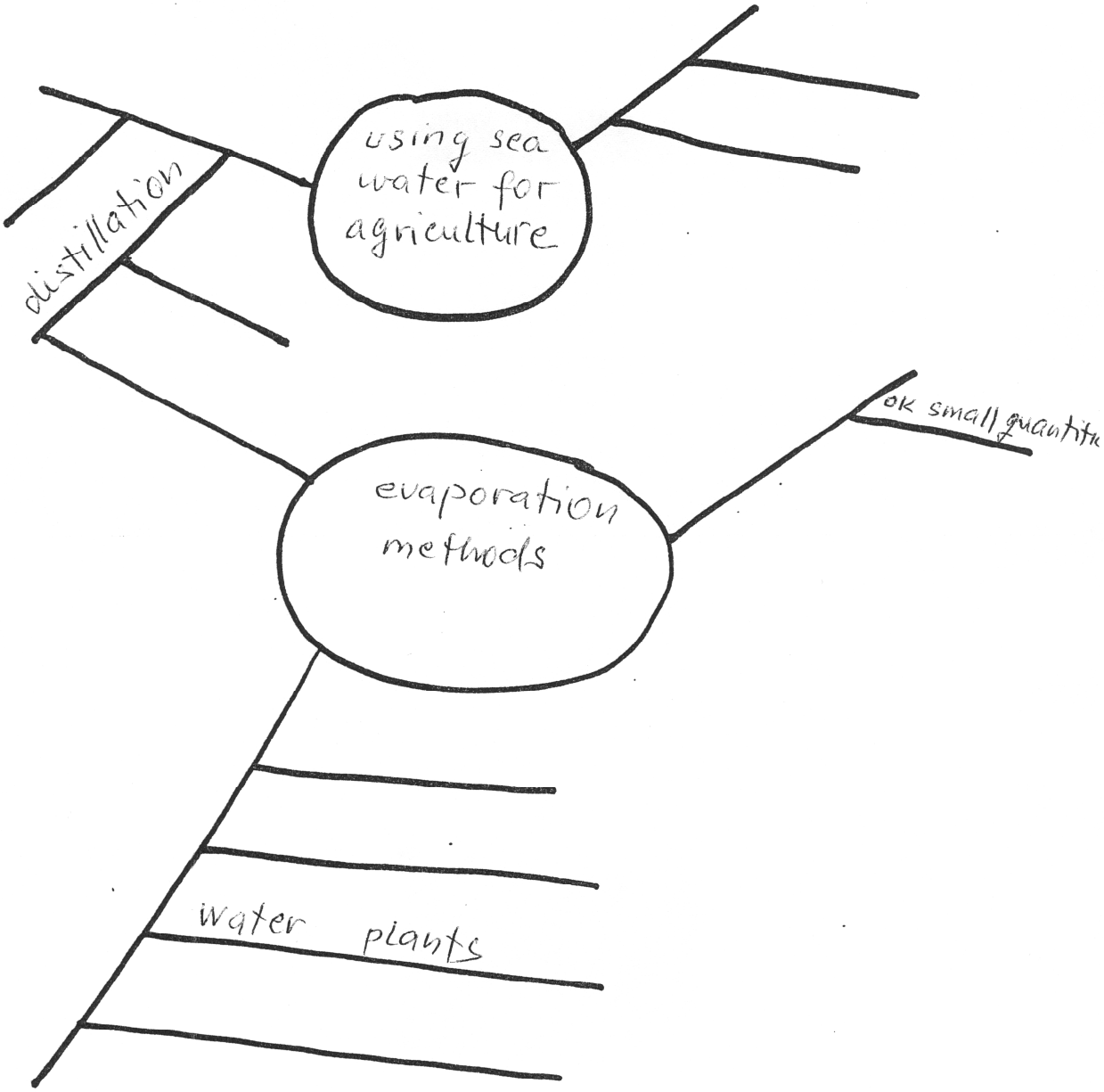
transpired water trapped and recycled

warmed by sun or 'waste heat' from diesel generator

condenses because cooled by cold sea water

sea water pumped to installation

Spider notes



(2)

TEXT EXPLORATION

simple graphics

Discourse study: Marking text structure

Simple graphics can be used to show how a text is structured. This can be useful in two ways:

1. in marking parts of the text for later revision and reference
2. in note-taking

The text on page 78 has this structure:

Text topic: Using sea water in agriculture

Introduction: problems	*Para. 1*
Methods for removing salt: problems	*Para. 2*
Evaporation methods:	
Solar methods: problems	*Para. 3*
Arizona scheme:	
Basics	*Para. 4*
Potential	*Para. 5*

We can also show this structure by using margin brackets and labels. Note how the text on page 78 has been marked. Do this only if the text belongs to you!

using sea water for agriculture

desalination methods

osmosis

distillation

evaporation

boiling

problems

not for food crops

salt accumulation

evaporation methods

solar tanks

OK small quantities

condensed by cold sea water

water plants

condensate collected and recycled

warmed by waste heat

Arizona scheme