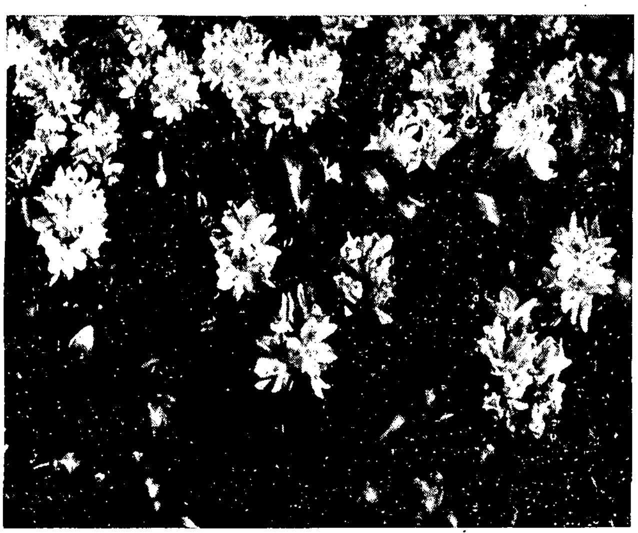
AN ITEM IN CONSERVATION

By G. C. DYMOND.

The principles of conservation are at long last on the move. Conservation of the land, conservation of our water supplies and conservation of fertility are all interwoven subjects that have passed the propaganda stage and are now becoming practical politics, backed by the laws of the land. The literature of the past ten years amply covers the perils of erosion and the land conservation necessary to combat it. The conservation of our water supplies follows, and experts have recently stated that: "South Africa's scarcity of water will limit, within thirty years, its industrial expansion and the number of people it can support, unless the rivers are completely nationalised and the riparian principle of water usage is abolished" (see *Sunday Times*, 16th March, 1947).

The third conservation is that of fertility. Flood waters wash away the land and the rivers take away vast stores of fertile elements to the sea. This aspect was well covered by J. P. J. van Vuren.[4]

In this paper I intend dealing with a possible method of trapping part of this lost fertility by means of water plants.



Water Hyacinth in flower

Of all the aquatic plants, the water hyacinth is the most prolific and spectacular. It was first brought to the United States from Venezuela for the New Orleans Cotton Exposition in 1884. Garden-lovers sought this botanical curiosity and set them in pools and ponds. Very soon the plants escaped their garden bounds and infested the streams and bayous, with the result that for the past forty years many thousands of pounds have been spent in trying to keep in bounds this navigational nuisance. The water hyacinth, *Eichornia crassipes*, propagates from tiny root fragments, which break off from the large plants and quickly develop leaf stalks and broad green leaves. The stalks swell to form bulbous pontoons which keep the plants afloat.

The literature has little good to say of this curse of the waterways. Evart,[1] writing about the weeds of Victoria, says: "The water hyacinth has been used as a manure but is very bulky and rots quickly, so that it only has a slight and temporary value in adding humus to the soil."

In Bengal,[2] farmers are persuaded to turn the water hyacinth into a composted manure. Analyses of random samples of the compost show a percentage of nitrogen on a dry basis of 1.12 per cent.

The suggestion that watercress in England, and the water hyacinth in tropical countries, be used as a means of trapping the fertility at present lost in sewage effluent, was given in a paper recently delivered at the Institute of Sewage Purification in London.[3]

Incidence in Natal.

The short Enseleni River in Zululand and the series of small lakes running into Richards Bay are choked with water hyacinth. Last year a planter commenced raking out the plants and placing them on the land. Other than this, the plant is still a curiosity devoted to sunken gardens and glass jars, and only recently has it been deproclaimed as a noxious weed.

Hyacinth blocking the river

Its Value as a Soil Improver.

Like seaweed, river grasses, watercress, etc., the water hyacinth has a high water content, which ranges from 93 to 95 per cent., so that the collection and transport of the wet material is uneconomical. A simpler and less costly method is to drag it on to the banks of the river or lake and allow it to dry out partially before using it in a compost bed.

Its analysis varies considerably with the composition of the water in which it grows. When there is a scarcity of fertilizer elements the plant becomes diminutive, but with plenty of food the growth becomes luxurious with a deep green colour.

The following analyses show the extremes of composition. The samples were taken from a garden pool poor in plant-food and from the Enseleni River.

	Water content per cent.	Dry matter per cent.	Ash per cent. dry substance.	Nitrogen per cent. dry substance.
No. 1	93.0	7.0	23.17	1.33
No. 2	93.4	6.6	23.90	2.01

Percentage analysis of the ash :—

	Total silica.	Chlorine.	Iron and alumina.	Sulphates.	Lime.	Magnesia.	Phosphoric oxide.	Potash.	Undetermined.
No. 1	58.02	3.55	19.35	2.40	6.75	2.20	0.86	4.81	2.06
No. 2	39.40	9.23	17.00	2.57	8.50	5.61	4.00	11.20	2.49

In order to check the cause of this considerable variation, sets of plants were grown for two weeks, one series in river water and the other with additional nutrients. The results were :—

	Water content per cent.	Dry matter per cent.	Ash per cent. dry substance.	Nitrogen per cent. dry substance.
No. 1	94.1	5.9	34.00	1.42
No. 2	95.5	4.5	29.30	2.23

Percentage analysis of the ash :—

	Total silica.	Chlorine.	Iron alumina.	Sulphates.	Lime.	Magnesia.	Phosphoric oxide.	Potash.	Undetermined.
No. 1	44.74	6.04	23.00	2.46	6.80	4.64	2.00	7.36	2.96
No. 2	23.92	9.58	30.40	2.81	8.00	5.06	8.00	11.62	0.61

In the short period of two weeks, the nitrogen rose from 1.42 per cent. to 2.23 per cent., the silica dropped from 44.2 per cent. to 23.6 per cent., the phosphoric oxide rose from 2.0 per cent. to 8.0 per cent., and the potash from 7.36 per cent. to 11.62 per cent.

Now, in a well-filled area there are approximately 96 tons of plants per acre. (Calculation based on weight of plants per square foot after air-drying for half an hour.) The rate of cover or reproduction (summer months) is 100 per cent. per month minimum. Assuming this rate throughout the year, one acre will yield a maximum of 6.7 tons and a minimum of 4.3 tons of dry matter per month, or 80.4 tons and 51.6 tons per acre per year. For calculation purposes, an average of 66 tons of dry matter per acre per annum is taken.

Applying the maximum and minimum percentages of nitrogen, phosphoric oxide and potash obtained in the previous series we get :—

	Maximum.	Minimum.	Average.
Per cent. of nitrogen ...	2.23	1.33	1.78
Lbs. of nitrogen per acre per annum	3,075.6	1,755.6	2,415.6
Ash per cent. dry matter .	33.17	29.30	31.24
Per cent. of phosphoric oxide	8.00	0.86	4.43
Lbs. phorphoric oxide per acre per annum	3,502.8	332.6	1,917.7
Per cent. of potash	11.62	4.81	8.22
Lbs. potash per acre per annum	4,494.0	2,106.0	3,300.0

Evaluation in Terms of Unit Values:

Unit Values.

	Per unit.	per lb.
Organic nitrogen	£1 9 5	17.65d.
Phosphoric oxide	8 0	4.8 d
Potash	7 2	4.3.d

Crop Values:
On Acre per Annum.

	Pounds weight.			Value.		
	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.
Nitrogen ...	3,075.6	1,755.6	2,415.6	£226.2	£129.1	£177.6
Phosphoric oxide ...	3,502.8	332.6	1,917.7	£70.0	£6.6	£38.4
Potash... ...	4,494.0	2,106.0	3,300.0	£80.5	£37.7	£59.1
Total ...				£376.7	£173.4	£275.1

These calculations take no account of humus values or of lime and other salts present in the plant. However, at its minimum valuation and with its specialised ability to float and grow on water, the water hyacinth may prove to be a useful trapper of fertility from effluents which are normally lost in the sea.

Other grasses and aquatic plants which live in and choke our non-navigable rivers not only impede scour, but are a potential source of raw material for compost or green manuring. Thus a sorghum similar to *Sorghum verticilliflorum* Stampf. but which has a compact interflorescence, and was first collected on the banks of the Tugela River, near Weenen, has now almost covered the Nonoti lower reaches below Darnall. An analysis of this grass showed the following :—

	Water content per cent.	Dry matter per cent.	Ash per cent. dry substance.	Nitrogen per cent. dry substance.
Sorghum... ...	83.5	16.5	13.80	2.10

	Phosphoric Oxide per cent. Ash	Phosphoric Oxide per cent. Dry substance	Potash per cent. Ash	Potash per cent. Dry substance
Sorghum... ...	2.25	0.31	5.15	0.71

The general interest in all forms of conservation is becoming world-wide. The foregoing is a small contribution to a vast subject, yet in its specialised way and for special conditions, the water hyacinth is unique and may yet prove the only practical method of recovering some of the vast quantities of fertility which are to-day being wasted and lost.

References.

[1] Evart, —. (1941): Horticultural Abstracts. **11,** 26.

[2] H., A. (1945): Some Suggestions for the Utilization of Auckland Wastes. News-Letter on Compost No. 13, 68.

[3] Howard, Sir Albert (1946): Activated and Digested Sewage Sludge in Agriculture and Horticulture. Institute of Sewage Purification, 118 Victoria Street, Westminster, London, S.W.1.

[4] Van Vuren, J. P. J. (1944): Utilization of Urban Wastes. Proc. S.A. Sugar Tech. Assoc., **18,** 71.

Mr. Palairet said that Mr. Dymond had given a lead in pointing out yet another direction in which we could economically increase the fertility of our soils. He wanted to know, however, the maximum speed of water which would allow the hyacinth to grow and the minimum speed to avoid choking his irrigation furrows.

Mr. Dymond, in reply, stated that the hyacinth did not anchor itself to anything, but lived entirely on the water and the nutrients therein. It would not, however, grow in absolutely stagnant water. It must have a certain amount of running water. Experiments conducted on effluents showed that the hyacinth would grow for a few days, but unless there was fresh water coming in it would then wilt and die. The amount of fresh water required was a subject for further experimentation.

Mr. Moberly said Mr. Dymond explained in his paper how the hyacinth was introduced into the United States, but he had heard a somewhat different theory. It was said that a small fish, the Barbados Millions, was introduced to control the mosquito larva and the hyacinth was subsequently obtained to provide shade for the fish. Whatever the reason might have been, the hyacinth had now got such a hold on the bayous of Louisiana that attempts to clear them had been abandoned in many cases. It was known that the hyacinth grew very well in our coastal estuaries, particularly further north where it was warmer, but apparently it did not grow above a certain altitude and no hyacinths were found at Kloof, 1,800 feet above sea-level.

Dr. McMartin wanted to know what was meant by "the rate of reproduction is 100 per cent. per month minimum," and how it could be assumed that such a rate would be maintained throughout the year. He thought that the rate of reproduction, expressed as a percentage of the original area, would be governed by the initial area under hyacinth.

It had been calculated that if all the sewage sludge in Great Britain were composted, the amount available for farmers would be about 70 lbs. per acre per annum for arable land. The cost of distribution would, however, be most uneconomic, and he doubted it very much whether any authority would give up water-borne sewage with the possible danger of epidemics.

Mr. Dymond, in reply, stated that his experiments were conducted in summer, and he had found that in a large tank the area under hyacinth doubled itself in somewhat less than a month. The rate of reproduction was therefore at least a 100 per cent. per month during that period, and he had assumed this basic rate for other months for the sake of calculations; but they would have to be checked on a larger scale. He did not suggest the use of hyacinth in place of water-borne sewage, but only to make use of the salts in activated sludge effluent.

He had seen the hyacinth grow at an elevation of 1,700 feet but they were very poor, which he thought due to the fact that the plants grew on a Table Mountain Sandstone formation, and water from this formation was deficient in nutrient salts. This might be the reason for the poor growth rather than the actual altitude.