GROWTH OF THE SHOOT IN *ASPARAGUS RACEMOSUS* WILLD

LINEAR growth of the shoot can be observed in a few plants without the aid of an Auxanometer or a horizontal microscope. In the Cucurbitaceæ the rate of growth is rapid but the elongation of the stem is accompanied by the growth and the increase in size of the leaves, axillary shoots and flowers. Kraus[1] and Smith[6] have recorded daily increase in growth in *Bambusa* which is quite rapid. The total elongation in *Bambusa*, however, is the result of the activity of several growth zones and a younger internode might start growing after the older has entirely ceased to grow. There is thus a periodic rise and fall in the net growth-increase or elongation.

In *Asparagus racemosus* Willd., the shoot in the beginning elongates at a very rapid rate and the growth is linear till the axillary shoots appear, as the leaves are reduced to scales. The growth of axillary shoots is delayed till the main shoot has attained some length. The axillary shoots also grow very rapidly but then the main shoot grows very slowly. Till the axillary shoots begin to grow rapidly, the growth of the main shoot is appreciably great and can be directly measured by means of a scale without the help of an Auxanometer or a horizontal microscope. The writer[2, 3] has already recorded the 12-hourly rate of growth of a number of shoots in *Asparagus racemosus* and *Asparagus sprengrii.*

It was also observed that the rate of growth for the day is 25 per cent. higher than at night. Periodicity in this matter—higher rate of growth during day than at night—was observed in the case of shoots of both the species. Further observations were made to elucidate this point. A number of shoots are given out by *Asparagus* during spring. They grow rapidly till they attain a definite height, without producing axillarly shoots. The height attained by different shoots of the same plant was 114·5 cms., 116·5 cms., 127·0 cms., and 78 cms. This plant was four years old and was growing in field-conditions in a 12-inch flower-pot. Older plants in the ground grow more than 350 cms. before the axillary shoots are formed.

The growth-rate is slow in the beginning, then it becomes rapid, attains maximum rate after which it gradually falls off. The figures in the second row begin with slow rate of growth—·8 cm., ·4 cm. for 12 hours and later on, growth was uniformly higher for some days having reached a maximum of 6·7 cms. for 12 hours after which it fell off quickly when the axillary shoots appeared. This is also true in the other three cases.

The record of the 12-hourly rate of increase in centimeters of the shoot of *Aspearagus racemosus* is noted in Table I.

The maximum increase in the four cases was:—

	Per 12 hours	Per minute
I	8·5 cms.	·12mm.
II	6·7 cms.	·09mm.
III	9·9 cms.	·13mm.
IV	8·9 cms.	·12mm.

Kraus[1] noted an increase of 0·4 mm. per minute in the stem of *Bambusa* and Smith, A.M.[6] observed elongation at a rate of nearly 0·4 mm. per minute. These varying results in *Bambusa* may be due to various causes.

TABLE I

(Observations were made at 8 a.m. and 8 p.m. each day) D = Day, N = Night

	16th April	17th April		18th April		19th April		20th April		21st April		22nd April		23rd April		24th April		25th April		26th April		27th April
Shoot	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D
I	6·6	6·4	7·0	5·5	6·0	4·0	**8·5**	5·0	7·0	5·5	5·0	3·5	4·8	2·7									
II	·8	·4	3·0	**3·2**	5·4	3·5	4·9	6·0	6·5	6·5	6·2	5·1	**6·7**	6·0	5·5	1·0	0·5	0·5					
III					2·0	2·5	5·4	5·0	6·0	7·5	5·5	8·0	6·7	8·5	**9·1**	6·5	8·7	5·0	6·5		**13 0**	4·5	**4·5**
IV													4·5	7·0	7·5	6·0	7·0	4·1	7·9	**8·9**	1·2	6·4	
	Sl	ow			R	ap	id			M	ax	im	um								S	lo	w

TABLE II

	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D
I	6·4	7·0	5·5	6·0	4·0	8·5	5·0	7·0	5·5	5·0	3·5	4·8	2·7					
II		3·0	3·2	5·4	3·5	4·9	6·0	6·5	6·5	6·2	5·1	6·7						
III					2·5	5·4	5·0	6·0	7·5	5·5	8·0	6·7	8·5	*9·1*	6·5	8·7	5·0	6·5
IV													7·0	7·5	6·0	7 0	4·1	7·9

D—Day. N—Night.

Moller, A.,[5] observed an increase of 5 mm. per minute in the fruitification of *Dictyophora*.

There is periodicity in the day and night rates of elongation. Generally the increase in the day time is higher than in the night and the periodicity is almost regular except in shoots I and III on 21st April. The suggestive figures of elongation are given in Table II.

Thus elongation during the day is generally higher than in the night. This has been observed earlier by the writer[3] and further observations were made to elucidate this point. This may be due to the fact that the plant is adding new material continuously during the day time as suggested by Blackman,[4] or there is more rapid translocations of the food materials from the tubers during the day than at night.

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January 18, 1945.

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ELECTRIC POTENTIAL OF THE EARTH'S SURFACE

It has been commonly assumed that the electric potential of the earth's surface is a fixed quantity, and that its magnitude is zero. It should be worthwhile, however, to see whether this concept is correct from the standpoint of modern theory.

According to geophysics the central portion of the earth's interior is a spherical core of a hot, ionised, liquid metallic mass of radius 3,500 km.[1] rotating round the terrestrial magnetic axis,[2] and that the earth's magnetism requires that it be negatively charged. It has also been computed that there emerges at the surface of this spherical core a strong electric field varying between 10^6 volts per cm.[3] and 10^8 volts per cm.[4] Around this hot core is the comparatively cold earth's crust, made up of crystalline rock, which is 2,900 km. thick, and which extends to the earth's surface.

During the process of cooling through the ages, there is a considerable thermo-electric current passing between the surface of the core and the underside of the crust.[5] There is also a negative charge on the earth's surface which is indicated by the presence of the atmospheric electric field which at sea level varies from 100 to 500 volts per metre, and approaches a zero value at the uppermost layers of the atmosphere, that is to say, it varies from one to five times its basic value. There is also considerable flow of an air-earth electric current from the upper air to the earth's surface. Around the earth, further, there is the outer shell of the upper atmosphere, which is known to bear a positive charge, and the whole system is enveloped in the corpuscular radiation which the sun is continuously sending out into the space surrounding it.

Since we know by induction that there must be a positive "surface" charge on the underside of the earth's crust; that there is a negative surface charge on the earth's surface; that thermo-electrons continually enter the underside of the crust; that air-earth current electrons leave at the earth's surface; that the strength of the core's field is of the order of 10^6 volts per cm. and that the electric fiel which emerges at the earth's surface is merely a few volts per cm., we must infer that there exists an exceedingly steep difference of potential between the under and the upper surfaces of the crust, and that the electric potential of the earth's surface with respect to the core must thus be of a very high order of magnitude, and not zero as has been commonly assumed.

We further know that corpuscular radiation from the sun so affects the positively charged shell of the outermost upper atmosphere and consequently, the earth's total charge, that the terrestrial electric field has been found to vary in direct proportion.[6]

We are unfortunately not in possession of adequate data on the exact nature of variation of the terrestrial electric field within the earth's crust, but it must obviously satisfy the relationship $y = f(Q, x)$ in which y is the field strength and Q, the earth's charge, and that the electric potential P, of the earth's surface must be given by $P=2900\,\text{km}.\, f(Q)\,dx$, x being height of a point on the earth's surface measured from core's surface. Since, however, Q is a quantity which we found, varied directly as the terrestrial electric field, which we know changes from time to time, it is obvious that the electric potential of the earth's surface with respect to the core is not a fixed quantity as is commonly assumed but that it varies over a wide range of values, and that it does so in direct proportion to the magnitude of the field as registered by an electrograph at the earth's surface at a given instant of time.

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January 25, 1945.

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