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THE TILLERS OF THE PEARL MILLET—*PENNISETUM TYPHOIDEUM* (RICH)

By G. N. RANGASWAMI AYYANGAR, B. A., I. A. S.,
Millets Specialist, Agricultural Research Institute,
and
P. V. HARIHARAN, B. Sc., (Hons.),
Assistant, Millets Breeding Station, Coimbatore.

Pennisetum Typhoideum, the pearl millet, is the second important millet in India. This millet is primarily the cereal of light loams in areas of low rainfall. Whereas *Sorghum* is mainly single-stalked and single-headed, the pearl millet is the very opposite of sorghum in being many-stalked and many-headed. In addition to this the plant is protogynous.

The details of the tillering habit of this plant were studied especially with a view to assay the economic aspect of this equipment. The study was made in two years and four seasons, two of them rainfed and two irrigated. The system of branching and the order of flowering were observed in 46 plants, both rainfed and irrigated. The yield of the various kinds of tiller heads was taken in a total population of 278 plants, 78 of which were of the dry land type and 200 of the irrigated—all chosen at random from some of the typical local varieties.

The first subject of study was the internodal lengths of the main stalk of the plant. This stalk is the one that grows right from the seed. The number of internodes above the ground level on this main stalk varies from 6 to 12, nine being the commonest. The next frequent are those with 8 and 10. These exclude the group of very closely disposed internodes which are underground and which give rise to the Primary Tillers. On this main stalk, measurements of the internodes were made in the 9 internoded plants and the trend of the internodal lengths could be expressed graphically by the following numbers representing segments in a thousand—unit length from base upward :— 30, 70, 95, 115, 120, 125, 120, 110 and 215 (Fig. ix). It will be noticed that the bottom-most internode is the shortest in length. The next upper one is a little over twice the first. The third, fourth, fifth and sixth internodes show a progressive increase in length, the seventh and eighth ones a slight decrease, and the ninth and final one, viz., the peduncle, is the longest, being about a fifth of the stalk. In odd instances the fifth or the sixth internode may be shorter in length than the ones immediately below and above it.

The main stalk gives rise to one or more primary tillers arising at or below ground level. These tillers may be a little more or less in height than the main stalk. In internodal lengths they conform

Fig. 1

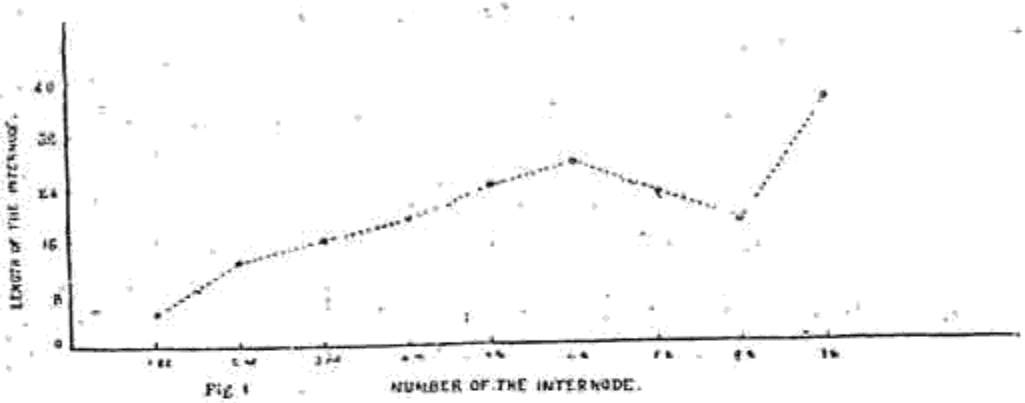

Fig. 2

THE PEARL MILLET—A TYPICAL PLANT

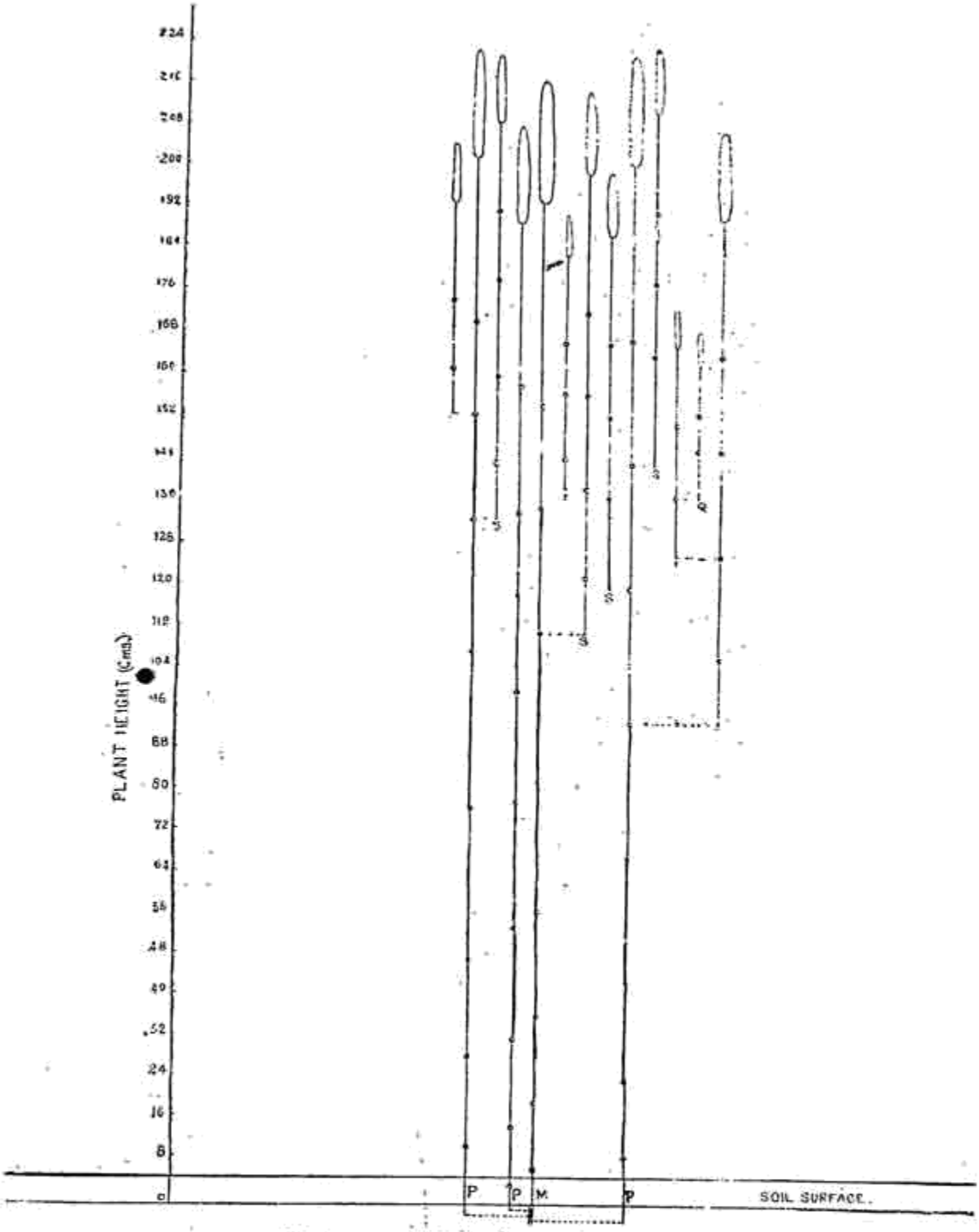

Fig. 3. BRANCHES OF A TYPICAL PLANT IN PENNISETUM TYPHOIDEUM (RICH) — THE PEARL MILLET.

M = main stalk. P = primary tiller.
S = secondary branch, T = tertiary branch & Q = quaternary branch.

to the general trend indicated for the main stalk. This general resemblance to the main stalk makes the group of principal heads, both the main and the primary, the chief source of grain yield in this millet.

Arising both from the main stalk and the primary tillers are the secondary branches. These branches are found to arise from the nodes (leaf axils) in the aerial portions of the main stalk or of the primary tillers. Usually they arise from about half the height of these main and primary shoots (Fig. 2). These secondary tillers are 3 to 5 noded (leaved). Their internodal lengths, when five, tend to a distribution similar to that noted in the main stalk and primary tillers. This repetition on the part of the secondary tiller, the progenitor of another earhead, is very interesting. The secondary earheads are naturally smaller than those of the first group but tend to shoot up and keep more or less the same heading zone.

In abnormal seasons or untimely opulence the secondary branches may make a feeble effort at producing branches. These tertiary branches produce very small heads and are borne on thin stalks which are 3 to 4 noded (leaved). In the 4 noded of these, the general tendency for a shorter internode to intervene between the peduncle and the longer internode below, is indicated. The contribution of these tertiary branch heads to the total grain yield of a plant is negligible. They are merely in the nature of an outlet for untimely facilities for growth. Tertiary branches may occasionally give rise to a feeble quaternary branch. This endeavour at the production of such late and weak branches on the part of the secondary and tertiary branches, is the unavoidable sequence of the stimulation of axillary buds so very necessary for the production of secondary branches, whose contribution to grain yield, especially in times of adversity in which there is a diminution in the due output of grain on the part of the main or primary heads, is appreciable.

In figure 2 is sketched a typical *Bajri* plant with its various classes of tillers described above. In figure 3 is given a graphic presentation of the same plant teased up to a parallel disposition of the component parts. It will be noticed that the main stalk is not alone but that there is an endeavour at producing more than one tiller from the ground level. Each of these stalks arising from the ground produces a branch or branches with earheads that are in the nature of a reserve in case of adversity.

This pearl millet is primarily the cereal for areas of precarious rainfall and of sandy soils with poor retentiveness of moisture. Big leaves are unsuited to such conditions. Many small leaves are a necessity. A one-stalked effort may end in disaster as the plant lacks the reserve moisture present in soils suited to the sorghums. Therefore

a first output of primary tillers, and a second gush of secondary branches with their earheads of decreasing size (with an average surface area of 115, 90, 50 and 20 sq. cm. per main, primary, secondary and tertiary head), ensure a many noded, and therefore many leaved condition, (usually up to 60, with a range of about 35 to 90), and serves admirably the needs imposed by its habitat.

The demands of protogyny are met by a compacting of the earhead zone. The branches contribute to this object by an undue elongation of their peduncles which in these are about a fourth to a third of their length as against the fifth of the peduncle length in stalks arising from the ground.

The observations recorded above apply generally to both rainfed and irrigated varieties. There is this difference however between them, viz., a comparatively less incidence of secondary branches and a total absence of tertiaries in the irrigated (see table below).

This difference in the tillering habit between the rainfed and irrigated varieties is reflected in the duration of their flowering. In irrigated varieties the first flush of anthesis is finished in a week. After this, heads from the branches may open their flowers and linger on up to a maximum of three weeks after the first flush. In rainfed varieties the duration of the main flush of flowering is spread out over a period of about 12 days and the last of the tertiaries may be found to have its anthers extruded well after the seeds in the preceding group of heads have set and the crop is ready for harvest.

The order of flowering in a plant was also studied in all the classes of earheads and it could be set down broadly to be as follows:- The head of the main stalk flowers first. Next to it is that of the primary tiller from the lowest node among the ones underground. Next in order is the one arising from the node immediately above it and so on until the primaries finish. (In the case of the secondary branch heads the order is generally reversed. Should there be more than one secondary head on the main stalk or any of the primary tillers, the one above flowers earlier than the one below. Similarly in the case of the tertiary branch heads.

The number, surface area and grain yield of these earheads were evaluated by taking counts, head measurements and grain weights on the 78 type plants belonging to the rainfed group and the 200 of the irrigated group. The very late and immature quaternary heads were founded to be negligible both in number and yield and are omitted. Keeping one hundred as the unit, the centages in number, surface area of the major kinds of earheads and of yield per plant were arrived at and are given in the table below.

Season and population.	Number of Earheads.				Surface area of Earheads.				Grain Yield.			
	1 Main stalk head.	2 Primary tiller heads.	3 Secondary branch heads.	4 Tertiary branch heads.	1	2	3	4	1	2	3	4
Main. (Rainfed) 78 plants.	7	32	55	6	20	40	35	5	10	35	50	5
Summer. (Irrigated) 200 plants.	20	60	20	–	25	65	10	–	30	55	15	–

The substantial contribution of the heads from the secondary branches in rainfed varieties and the marked contribution of both the main and primary heads in irrigated varieties is prominently brought out.

Germination tests made on seeds gathered from the various classes of earheads did not show any appreciable differences in their sprouting energy. On an average 90 to 100 per cent. of the seeds from the main stalk and primary tiller heads and 88 to 95 per cent. of the secondary and tertiary branch-head seeds germinated.

It was also noticed that the size of the seed showed a progressive decline with the lateness of the earhead. An estimate of the size of the various classes of seeds was made by counting the number of seeds required to weigh two grammes. About fifty such readings were made in each kind of seed and it was observed that those from the main stalk head numbered from 300 to 400, those from the primary tiller heads 400 to 460, those from the secondary branch heads 500 to 680 and those from the tertiary branch heads 800 to 1500.

These studies reveal how eminently the tillering habit, the flowering sequence of the tiller and branch heads and the general organization of the vegetative and the reproductive phases fit the pearl millet for its role among the cereals.

THE SUGAR INDUSTRY OF AUSTRALIA.

The world congress of sugar-cane technologists that met at Brisbane in Australia towards the end of August this year was the fifth of its kind. The above Society meets once in three years and alternately in the Western and Eastern hemispheres. The last or the fourth session met at Porto Rico in 1932 and the next one is programmed to meet at Lousiana in the United States of America in 1938.

The Indian delegates to the above congress who reached back to India between the middle and the third week of last month consisted of Seth Lalchand Hirachand—owner of a sugar factory and plantation